

ENVIRONMENTAL & OCEAN SCIENCES (EOSC)

EOSC 500 | CORE SEMINAR I

Units: 2 Repeatability: No

An introduction to the infrastructure of the Environmental and Ocean Sciences graduate program and to those critical skills useful in graduate studies. Students will be exposed to a range of research areas through a series of seminars presented by the Environmental and Ocean Sciences graduate faculty, affiliated university faculty in other departments and scientists from other institutions. Students also will choose a thesis committee chair and develop a written preliminary plan for their own research in pursuit of the master's degree.

EOSC 501 | CORE SEMINAR II

Units: 2 Repeatability: No

During this seminar, students will learn how to develop questions that can be tested scientifically, design experiments that are amenable to statistical analysis and collect data that are interpretable. Students will write a formal thesis proposal, which includes a review of pertinent literature and present it orally to the assembled Environmental and Ocean Sciences faculty. They also will form their thesis committees. Successful completion of this seminar is a prerequisite for advancement to candidacy.

EOSC 511 | STATISTICS

Units: 3 Repeatability: No

This course is intended to build on a basic understanding of statistical analysis gained at the undergraduate level. The course will review methods of hypothesis testing and the statistical tests most commonly used in environmental and ocean sciences. It will introduce multivariate techniques and modern nonparametric methods. The main emphasis will be experimental design and choosing the most appropriate methods of statistical analysis to answer specific questions. Students will learn how to use the statistical software package R and will have the opportunity to work with their own data, if applicable. Three hours per week.

EOSC 514 | INTRODUCTION TO MAPS AND SPATIAL DATA ANALYSIS

Units: 4 Repeatability: No

Use of maps as an analytical tool. Topics include: map reading; the use of maps as a medium for describing and analyzing various types of spatially-distributed data; stereoscopic interpretation and cartographic representation of landforms, vegetation, and land use. Laboratory exercises will use ArcGIS software. Two hours of lecture and one laboratory per week. Fall semester.

EOSC 515 | GEOGRAPHIC INFORMATION SYSTEMS

Units: 4 Repeatability: No

Theory and practice of Geographic Information Systems (GIS) as a tool for the display and manipulation of spatial data. Applications include: urban planning; land use classification; biomass analysis; crop monitoring; forest resource assessment and management; and disaster assessment, management, and recovery. Laboratory exercises will use ArcGIS software. Two hours of lecture and one laboratory per week. Spring semester.

EOSC 520 | INTRODUCTION TO REMOTE SENSING

Units: 4 Repeatability: No

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 530 | HUMAN IMPACTS ON THE COASTAL ENVIRONMENT WITH LAB

Units: 4 Repeatability: No

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 EOSC 530 and EOSC 430 or EOSC 431 or EOSC 531.

EOSC 531 | HUMAN IMPACTS ON THE COASTAL ENVIRONMENT

Units: 3 Repeatability: No

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 EOSC 531 and EOSC 430 or EOSC 431 or EOSC 530.

EOSC 533 | PLANKTON ECOLOGY

Units: 4 Repeatability: No

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 534 | WETLANDS ECOLOGY WITH LAB

Units: 4 Repeatability: No

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 534 and EOSC 535.

EOSC 535 | WETLANDS ECOLOGY

Units: 3 Repeatability: No

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 534 and EOSC 535.

EOSC 536 | MARINE COMMUNITY ECOLOGY WITH LAB

Units: 4 Repeatability: No

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 EOSC 536 and EOSC 436 or EOSC 437 or EOSC 537.

EOSC 537 | MARINE COMMUNITY ECOLOGY**Units: 3 Repeatability: No**

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 EOSC 537 and EOSC 436 or EOSC 437 or EOSC 536.

EOSC 538 | ANIMAL BEHAVIORAL ECOLOGY WITH LAB**Units: 4 Repeatability: No**

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 538 and EOSC 539 or for taking both EOSC 538 and PSYC 344.

EOSC 539 | ANIMAL BEHAVIORAL ECOLOGY**Units: 3 Repeatability: No**

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 539 and EOSC 538.

EOSC 540 | MATHEMATICAL MODELING IN ECOLOGY**Units: 4 Repeatability: No**

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 540 and MATH 440.

EOSC 550 | GEOLOGICAL OCEANOGRAPHY**Units: 4 Repeatability: No**

The origin and geologic history of the ocean basins, with a detailed investigation of the theory of plate tectonics, ocean sedimentation and paleoceanography. Examination of how geological processes affect physical, chemical and biological processes in the ocean will be emphasized. Students will present and discuss primary literature pertinent to the topics covered in the course. Three lectures and one laboratory per week. One cruise and one additional weekend field trip may be required. A course in introductory geology, with laboratory, is recommended.

EOSC 551 | BIOLOGICAL OCEANOGRAPHY**Units: 4 Repeatability: No**

Biological oceanography is covered from an integrated, functional perspective. Unifying themes will be factors that affect marine ecosystems and the relationship between environmental characteristics and biological communities. Nearshore, open ocean and deep sea environments will be covered. Ecological, behavioral, physiological and biochemical adaptations of marine organisms also will be considered. Primary literature, scientific writing and experimental design will be emphasized. Three lectures and one laboratory per week. One cruise and additional fieldwork may be required. As well as one year of general biology, with laboratory.

EOSC 552 | ENVIRONMENTAL AND OCEAN GEOCHEMISTRY**Units: 4 Repeatability: No**

What makes the oceans salty? Why do plankton need dust to survive? Why is arsenic in groundwater considered the worst mass poisoning in human history? Is Fiji Water really pristine? In this course you'll learn how water – oceans, rivers, groundwater – differ in composition and the processes that control their chemistry. We'll trace the journey of water from rain, to rivers, into groundwater, and how water-rock interaction contributes to ocean salinity. What happens when these waters are contaminated? We'll investigate basic soil and water contamination processes caused by environmental processes such as mining, refining ores, and disposal of waste into landfill. The course will focus on metal contamination, both naturally occurring in rocks (mines in San Diego) and anthropogenically influenced (metals in Mission Bay). We'll determine how much contamination is too much, for both organisms and humans, and the possible health effects of exposure to these contaminants.

EOSC 561 | INVERTEBRATE ZOOLOGY**Units: 4 Repeatability: No**

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 562 | BIOLOGY OF FISHES**Units: 4 Repeatability: No**

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 565 | MARINE MAMMALS**Units: 3 Repeatability: No**

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. Three hours of lecture per week.

EOSC 573 | CLIMATOLOGY**Units: 4 Repeatability: No**

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

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 EOSC 574 and EOSC 474 or EOSC 475 or EOSC 575.

EOSC 575 | HISTORY OF THE EARTH AND CLIMATE**Units: 3 Repeatability: No**

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 EOSC 575 and EOSC 474 or EOSC 475 or EOSC 574.

EOSC 581 | NATURAL RESOURCES OF DEATH VALLEY**Units: 3 Repeatability: No**

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 585 | ENVIRONMENTAL GEOLOGY**Units: 4 Repeatability: No**

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 587 | SURFACE WATER HYDROLOGY**Units: 4 Repeatability: No**

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 588 | GEOMORPHOLOGY**Units: 4 Repeatability: No**

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

Topics of special interest or unique opportunity. Prerequisites may be listed for these offerings.

EOSC 595 | DIRECTED READINGS**Units: 1-3 Repeatability: No**

Specific sets of readings tailored to address particular needs of a student. Generally, this course would be related to the research interests of a student and would be under the guidance of a member of the student's thesis committee. Typically, a maximum of three units may be used toward the degree requirements without consent of the program director.

EOSC 596 | RESEARCH**Units: 0.5-9 Repeatability: Yes (Can be repeated for Credit)**

Research toward the master's thesis. This research will be under the general supervision of a thesis advisor. No more than three units may be taken prior to candidacy. Pass/Fail only. A passing grade is contingent upon participation in the annual Graduate Student Colloquium during the same academic year.

EOSC 597 | THESIS**Units: 0.5-1 Repeatability: Yes (Can be repeated for Credit)**

Independent writing of the thesis with consultation of the major advisor. Master's candidates must be enrolled in this course to turn in a thesis. It may be taken more than once, but only 1 unit will be counted toward the degree requirements.