Department of Earth and Ocean Sciences

SPRING 2018 COURSES

eos.tufts.edu

Course #	Title	Instructor	Block	Day & Time
EOS 2	**ENVIRONMENTAL GEOLOGY W/LAB**	Jack Ridge	C or E	TWF 9:30AM-10:20AM or MWF 10:30AM-11:20AM
	LAB	Jack Ridge Jacob Benner	5+, 6+, 7+, 8+, or 9+	M, T, W, R or F 1:20PM-4:20PM

Environmental geology is an introduction to geologic environments and the processes that shape and modify Earth's surface. Of particular interest are the roles of water, ice, wind, and gravity and their effects in different surface environments and climates. These modern surficial processes strongly influence humans and their ability to live and interact with their surroundings. They also provide us with much of the evidence for interpreting ancient geologic environments, allowing us to understand how the earth has evolved over time and to predict the changes we can expect it to undergo in the future.

Specific topics covered in environmental geology include an overview of earth materials, groundwater, and processes of the hydrologic cycle. Also considered from a geological and human perspective are weathering and erosion, landslides, river, glacial, and ocean systems, and environments ranging from arid to periglacial (cold climate). The past climatic and sea level history of Earth's recent ice ages is discussed in relation to modern climate change.

No prerequisite.

EOS 12	**IGNEOUS AND METAMORPHIC PETROLOGY W/LAB**	Jennifer Axler	D	M 9:30AM-10:20AM TR 10:30AM-11:20AM
EOS 192-06	**LAB**	Jennifer Axler	6+	T 1:20PM-4:20PM

The history of our planet is recorded in the igneous, sedimentary, and metamorphic rocks that formed throughout Earth's development. In these rocks we find the evidence for ancient volcanic eruptions, shallow inland seas, and extensive mineralogical and structural changes which occurred deep beneath the earth's surface. EOS 12 is the study of the igneous and metamorphic rocks and the processes that form them. Together, these rocks comprise 95% of Earth's crust and are exposed over approximately one-third of the continental land masses.

Petrology begins with a review of the classification of igneous rocks, followed by a study of the field occurrences, mineralogy, textures, compositions and origins for the major extrusive and intrusive rock associations. As the semester proceeds, experimental evidence is evaluated which can shed light on the origin and crystallization of magmas. During the second half of the term, metamorphic rocks, processes, and structures are considered from a field, laboratory, and experimental perspective. Igneous and metamorphic rocks and processes are considered at all scales, from global plates, mountain ranges, large outcrops, and hand-samples, through microscopic and submicroscopic observations.

Laboratory work emphasizes hand sample and microscopic analysis of rocks and rock suites, often in the context of their natural field occurrences. Interpretation of igneous and metamorphic rocks will be one of the major goals of the course. Weather permitting we will visit several igneous and metamorphic rock localities late in the semester.

Prerequisite: EOS 11. Note: must register separately for Lab EOS 192-06.

EOS 22	**STRUCTURAL GEOLOGY**	Anne Gardulski	E+MW	MW 10:30AM-11:45AM
	RECITATION	Anne Gardulski	E (Fri only)	F 10:30AM-11:20AM (F only)

Deformation of the earth's crust occurs on all scales, from microscopic crystal lattice dislocations to huge structures such as the San Andreas Fault that are hundreds of kilometers long. This course will address different aspects of structural analysis, with the ultimate goal of understanding structures in hand samples and outcrops as well as the regional and tectonic significance of structurally deformed rocks. The structure course is organized into three major sections and will begin with methods of evaluating the strain or deformation in rocks. Quantification of stretching or compression of geologic structures will be undertaken through geometrical construction, as well as measurement and calculation. The array of structures that can occur in rocks, including folds, faults, joints, and cleavage, will be discussed in the second section of the course. Structural information from folds, for example, can be gleaned from many characteristics, such as the fold orientation and relative thickness of limbs and hinges. The last section will be concerned with dynamic analysis of structures, the orientations and magnitudes of stresses that produced deformation. Finally, the tectonic context of structures will complete the semester.

Problem sets and projects will emphasize experimentation and practical techniques for structural study and interpretation.

Prerequisite: Recommended EOS 1 or 2

EOS 52	**PALEOCLIMATE**	Andrew Kemp	C	TWF 9:30AM-10:20AM

A key component of almost all disciplines within the Earth and Ocean Sciences is the evolution of climate through geological time on scales of billions of years to decades and from the birth of Earth to the present day and into the future. Understanding the important phases and events in paleoclimate provides context for research in related fields and is a critical part of the discussion surrounding modern climate changes. By the end of this course you will be familiar with the major climate shifts that took place during the last ~4bn years, understand the evidence on which current thinking is based, and be able to explain the mechanism(s) that drove paleoclimatic change. We will begin by developing some basic understanding of how Earth's climate system works before moving onto discussion of widely used proxies. We will then embark on a 4bn year journey beginning with the wrongly perceived "hell" of the Hadean and ending with Quaternary glaciations, the Holocene, the Hockey Stick and a glimpse into the near future.

Two lectures per week. Prerequisite: EOS 2 or EOS 51. For graduate credit, register for EOS 152.

EOS 104	**GEOLOGICAL APPLICATIONS OF GIS**	Jacob Benner	F+	TR 12:00PM-1:15PM

This course covers the basic functions of the software ArcGIS by ESRI, with a particular focus on geological applications. The course is based on lessons derived from textbook-tutorials with additional weekly assignments incorporating the manipulation of geologic data. You will learn how to create maps displaying complex data, how and when to incorporate charts and graphs, and how to prepare professional-quality presentations of our maps and data. The course will help you develop a technical skill that can be applied in both geological and environmental fields.

The course is designed for upper level geology majors who are familiar with the concepts and methods involved in complex geologic interpretation and problem solving. This background will allow a rapid progression from learning the fundamentals of GIS to using it for specific geological applications. You will emerge from this course with a strong foundation in GIS basics and the ability to move quickly into more advanced geological application of GIS.

Prerequisite: 2 prior EOS courses.

EOS 133	**FIELD METHODS IN HYDROGEOLOGY**	Grant Garven	8+	R	1:20PM-4:20PM

Field aspects of geohydrology, groundwater mapping and sampling, aquifer testing, well drilling, monitoring, and instrumentation of boreholes. The course will blend lecture with basic field methods to understand how monitoring and production wells are planned and drilled, and what types of geologic, geophysical, and geochemical data can be gathered for subsurface flow systems. A network of boreholes on the Tufts campus will be used as field sites to characterize subsurface parameters in the unsaturated and saturated zones, and study regional flow in an urban watershed. Field trips, with quantitative analysis of geohydrologic data.

Prerequisite: EOS 1 or 2 and Physics 1 or 11 or equivalent. Note: Engineers register for CEE 114, cross-listed.

EOS 288	**GROUNDWATER MODELING**	Grant Garven	E+ MW	MW	10:30AM-11:45AM

Numerical analysis of groundwater flow, with applications. Topics include: numerical formulation of the governing equations using finite difference, finite element, integrated finite difference, particle tracking, boundary element, and discrete element techniques; matrix and iterative solutions; algorithms for 1-D, 2-D, and 3-D flow; stability and accuracy; applications using popular USGS software in the public domain. Students will be expected to apply existing Fortran programs for 1-D, 2-D, and 3-D solutions as part of computational laboratory modeling assignments.

Prerequisite: Graduate standing.

PROJECTED FUTURE COURSE OFFERINGS*

Spring 2018
EOS 2 - Environmental Geology
EOS 12 - Ign & Meta Petrology
EOS 22 - Structural Geology
EOS 52/152 - Paleoclimate
EOS 104 - Geol Applications of GIS
EOS 133 – Field Methods in Hydrogeology
EOS 288 - Groundwater Modeling

Fall 2018
EOS 1 - The Dynamic Earth
EOS 5 - Oceanography
EOS 38 – Historical Geol/Paleontology
EOS 115 - Glacial & Quaternary Geol
EOS 131 - Groundwater
EOS 51/151 Global Climate Change
EOS 287 - Subsurface Fluid Dynamics

Spring 2019
EOS 2 - Environmental Geology
EOS 42 – Sedimentology/Stratigraphy
EOS 52/152 - Paleoclimate
EOS 104 - Geol Applications of GIS
EOS 133 – Field Methods in Hydrogeology
EOS 288 - Groundwater Modeling

Fall 2019
EOS 1 - The Dynamic Earth
EOS 5 - Oceanography
EOS 11 - Mineralogy
EOS 32 - Geomorphology
EOS 38 – Historical Geol/Paleontology
EOS 131 - Groundwater
EOS 51/151 Global Climate Change
EOS 287 - Subsurface Fluid Dynamics

*Please consult a faculty member regarding course selection as some required courses are offered in alternate years