Department of Earth and Ocean Sciences

SPRING 2017 COURSES

eos.tufts.edu

Course #	Title	Instructor	Block	Day & Time
EOS 0002	**ENVIRONMENTAL GEOLOGY W/LAB**	Jack Ridge	C or E	TWF 9:30AM-10:20AM or MWF 10:30AM-11:20AM
	LAB	Staff	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 0022	**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.

Weekly laboratory exercises will emphasize experimentation and practical techniques for structural study and interpretation.

Prerequisite: EOS 1 or consent

EOS 0042	**SEDIMENTOLOGY & STRATIGRAPHY**	Anne Gardulski	I+	MW	3:00PM-4:15PM
	LAB	Anne Gardulski	K+ M only	M	4:30PM-5:45PM

Sediments and sedimentary rocks form a thin veneer enveloping Earth, and reveal a wealth of information about modern and ancient tectonic, climatic, and oceanographic processes. The principles of sedimentology applied to observations and interpretations of modern sediments allow geologists to decipher and model ancient depositional environments and controls on sediment accumulation. Stratigraphy encompasses the study of how these depositional environments change in time and space. We will use information gathered from sedimentary rocks to unravel the dynamics of environments and how they record events such as mountain-building episodes, sea level changes, extinctions, and the splitting apart of continents at rifts.

In this course, we will examine the major types of sediments and how strata are arranged in depositional basins. Topics covered will include rock description and classification, water and wind as transport agents, provenance and biogenic sources of sediment, and statistical analysis of grain parameters, such as size, sorting, and roundness. The identification and interpretation of sedimentary structures as clues to depositional environments will be an integral part of the course. We will also consider what happens to sediment after it is deposited, by studying diagenesis - the complex processes by which unconsolidated sediments are transformed into rock. Study of sediments and sedimentary rocks in hand sample and thin section will be supplemented by field trips during the labs to examine rocks in their natural setting.

We will address the types of depositional processes that operate in various marine and continental environments, and we will integrate the tectonic, climatic, and oceanographic processes and events that may lead to changes in the environments. Stratigraphic studies require a detailed record of the timing of sedimentary depositional units. A number of techniques can provide such age constraints, such as isotopic compositions of certain fossils (isotope stratigraphy), radiometric dating of interbedded volcanic units, the pattern of polarity changes recorded in magnetic minerals (magnetostratigraphy), and assemblages of fossils in the strata (biostratigraphy). These methods and others will be studied to resolve sedimentary correlation problems and to evaluate the effects of events such as change in sea level, from one location to another.

Prerequisite: EOS 2 or consent

EOS 104	**GEOLOGICAL APPLICATIONS OF GIS**	Jacob Benner	F+ (T,R)	T,R	12:00PM-1:15PM

A Geographic Information System (GIS) is a computer-based system that combines the capabilities of mapping software with a powerful database. GIS allows geographic data to be quickly and easily visualized, manipulated, queried, and analyzed. It can uncover hidden patterns and spatial relationships, and aid in solving complex analytical problems that would be challenging or impossible to complete by hand. GIS is recognized by the Earth science community as an important map-preparation and analytical tool.

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 0133	**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 2 and Physics 1 or 11 or equivalent

EOS 0288	**GROUNDWATER MODELING**	Grant Garven	K+ MW	MW	4:30PM-5:45PM

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*

Fall 2017
EOS 1 - The Dynamic Earth
EOS 5 - Oceanography
EOS 11 - Mineralogy
EOS 38 - Historical Geology & Paleontology
EOS 51/151 Global Climate Change
EOS 131 - Groundwater
EOS 287 - Subsurface Fluid Dynamics

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

Fall 2018
EOS 1 - The Dynamic Earth
EOS 5 - Oceanography
EOS 11 - Mineralogy
EOS 38 - Historical Geology & Paleontology
EOS 32 - Geomorphology
EOS 131 - Groundwater
EOS 51/151 Global Climate Change
EOS 287 - Subsurface Fluid Dynamics

Spring 2019
EOS 2 - Environmental Geology
EOS 12 - Igneous & Metamorphic Petrology
EOS 22 - Structural Geology
EOS 42 - Sedimentology & Stratigraphy
EOS 104 - Geological Applications of GIS
EOS 133 - Field Methods in Hydrogeology
EOS 52/152 - Paleoclimate
EOS 288 - Groundwater Modeling

*Please consult a faculty member regarding course selection

FACULTY CONTACTS IN THE DEPARTMENT

Any one of our faculty members would be happy to speak with you about your interest in our courses or major and minor concentration programs.

Jack Ridge, Professor, Chair *jack.ridge@tufts.edu*
- Glacial Geology & Geomorphology

Anne Gardulski, Associate Professor *anne.gardulski@tufts.edu*
- Stratigraphy & Sedimentology

Grant Garven, Professor *grant.garven@tufts.edu*
- Groundwater Hydrology & Modeling

Andrew Kemp, Assistant Professor *andrew.kemp@tufts.edu*
- Sea-Level & Climate Change

Jacob Benner, Senior Lecturer *jacob.benner@tufts.edu*
- Ichnology & Paleoecology