

# Earth, Environmental, and Planetary Sciences

Website: <https://eeps.wustl.edu/>

## Courses

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### EEPS 5000 Special Topics in the Geosciences

Content varies each time course is offered, as announced by Department. With permission of the Chair, course may be repeated for credit.

Credit 3 units.

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### EEPS 5004 Special Topics

The content of this course varies each time it is offered, as announced by the Department. With permission of the advisor, this course may be repeated for credit. Variable credit.

Credit 3 units. A&S IQ: NSM Art: NSM

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### EEPS 5014 Earth Systems Science

This is a quantitative introduction to physical and chemical interactions among the atmosphere, oceans and solid earth. Topics covered include terrestrial atmospheric chemistry, geochemical cycles, inventories, and reservoirs of carbon, nitrogen, & sulfur, and bulk composition of the Earth.

Credit 3 units. A&S IQ: NSM Art: NSM

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### EEPS 5074 Remote Sensing

Use of different parts of the electromagnetic spectrum (visible, ultraviolet, infrared, and radio wavelengths) for interpretation of physical and chemical characteristics of the surfaces of Earth and other planets. Digital image systems and data processing.

Credit 3 units. A&S IQ: NSM Art: NSM

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### EEPS 5084 Earth's Atmosphere & Global Climate

Structure and dynamics of Earth's atmosphere. Basic factors controlling global climate of Earth. Quantitative aspects of remote sensing of atmosphere. Remote sensing instrumentation.

Credit 3 units. A&S IQ: NSM Art: NSM

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### EEPS 5094 Surface Processes

How do landscapes evolve? This course focuses on the physical processes of erosion and deposition that shape Earth and planetary surfaces. Course aims (1) understanding emergent landscape patterns, (2) reconstructing past conditions using the sedimentary record, and (3) predicting landscape change under climate scenarios. Review of relevant climatic and tectonic processes, followed by detailed discussion of rivers and deltas, hillslopes, weathering, glaciers, and coasts.

Credit 3 units. A&S IQ: NSM Art: NSM BU: SCI

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### EEPS 5104 Earth Remote Sensing Methods and Instrumentation

Detection of electromagnetic radiation reflected, scattered, or emitted by components of the Earth system. Spectroscopy of remote sensing. Interpretation of received radiation via radiative transfer within a context of real measurements. Theory of instruments and detectors. Comparison of realized equipment to theoretical models.

Credit 3 units. A&S IQ: NSM Art: NSM BU: SCI

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### EEPS 5110 Minerals in Aqueous Environments

Systematic mineralogy and crystal chemistry of common low-temperature minerals, including clays, zeolites, carbonates, oxides of aluminum, iron, and manganese, and metal sulfides. Reactions between minerals and aqueous solutions, including growth and dissolution, surface complexation, and redox reactions. Role of these reactions in chemical weathering, contaminant fate, microbe-mineral interactions, and biomineralization. Focus will be on processes and mechanisms. Common analytical methods introduced.

Credit 3 units.

Typical periods offered: Spring

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### EEPS 5134 Introduction to Soil Science

Physical, chemical, and biological processes that occur within soil systems. Types of soils and their formation. Major components of soil, including soil water, minerals, organic matter, and organisms. Soils in wetlands and arid regions. Mapping of soils and their spatial variability. Cycling of nutrients and contaminants in soils. Sustainable use of soils and their role in climate change.

Credit 3 units. A&S IQ: NSM Art: NSM

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### EEPS 5173 Soil Science

Physical, chemical, and biological processes that occur within soil systems. Types of soils and their formation. Major components of soil, including soil water, minerals, organic matter, and organisms. Soils in wetlands and arid regions. Mapping of soils and their spatial variability. Cycling of nutrients and contaminants in soils. Sustainable use of soils and their role in climate change.

Credit 3 units. A&S IQ: NSM

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### EEPS 5224 Sedimentary Geology

Survey introduction to sedimentary processes and materials, including description, formation, and interpretation. Sedimentary materials account for most of the Earth's crust, and much of our understanding of Earth history comes from their examination. Many of our economic resources, such as coal, oil, and natural gas, and many environmental problems, are related to or derive from sediments. Goals: understanding and identifying sediments and processes and using them to interpret stratigraphic, paleoenvironmental, and tectonic information; obtaining the understanding of sedimentology that is relevant to environmental issues; increasing scientific literacy and critical thinking.

Credit 4 units. A&S IQ: NSM Art: NSM

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### EEPS 5254 Invertebrate Paleontology

Study of fossil invertebrates with emphasis on morphology of hard parts, geochronological and geographical distribution, and taxonomy. Comparison of fossil taxa with living representatives and interpretation of paleobiological patterns. Two class hours and one two-hour lab a week.

Credit 3 units. A&S IQ: NSM Art: NSM

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**EEPS 5284 Hydrology**

Survey of principles that govern the flow of water in river and groundwater systems in deep geologic environments. Basic equations of fluid flow, dynamics, and the characteristics of drainage basins, rivers, floods, and important aquifers. Exploitation of ground water systems.

Credit 3 units. A&S IQ: NSM Art: NSM

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**EEPS 5304 Environmental Mineralogy**

Topics connected with environmental mineralogy, some selected by students. Topics may include: mineral dust such as asbestos, containment materials for nuclear waste disposal, environmental ramifications of the processing and use of phosphate fertilizers, lead in the environment, acid mine drainage, microbial mediation of sulfide oxidation, minerals in the human body, weathering of building materials, materials engineering, and engineering of materials for more effective recycling. Three class hours and one two-hour laboratory a week. Participation in discussions, term paper, two field trips required. Most readings from primary sources.

Credit 3 units. A&S IQ: NSM Art: NSM

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**EEPS 5370 Igneous & Metamorphic Petrology**

Classification, origin, mineralogy, and geological occurrence of major igneous and metamorphic rocks. Laboratory emphasis on identification of rocks and minerals in hand specimens and in thin sections. Three class hours and one two-hour laboratory a week.

Credit 4 units. A&S IQ: NSM Art: NSM

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**EEPS 5374 Igneous & Metamorphic Petrology**

Classification, origin, mineralogy, and geological occurrence of major igneous and metamorphic rocks. Laboratory emphasis on identification of rocks and minerals in hand specimens and in thin sections. Three class hours and one two-hour laboratory a week.

Credit 4 units. A&S IQ: NSM Art: NSM

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**EEPS 5414 Introduction to Geochemistry**

Application of the principles of nuclear and physical chemistry to problems of the composition and differentiation of the Earth. Introduction to nucleosynthesis of the elements, stellar evolution, the periodic properties of the elements, chemical bonding and ionic substitution, geochronology and stable isotope geochemistry, and the age and composition of the Earth, Moon and meteorites.

Credit 3 units. A&S IQ: NSM Art: NSM

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**EEPS 5420 Chemical Petrology**

Application of chemical data to the petrogenesis of selected metamorphic, igneous, and sedimentary rock suites. Topics include: abundance and distribution of elements in crustal materials; crystal-chemical controls on elemental fractionations; elemental mobility and immobility in crustal metamorphic processes; uses and abuses of discriminant diagrams; secular trends in crustal composition. Two class hours and one two-hour discussion period a week.

Credit 3 units.

Typical periods offered: Fall

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**EEPS 5424 Aqueous Geochemistry**

Introduction to the geochemistry of natural waters and the processes that alter their composition. Key principles of aqueous geochemistry are introduced and then used to describe the main controls of the chemistry of pristine and polluted soil, surface, and ground water environments. Topics covered include mineral solubility, complexation, acids and bases, carbonate chemistry, rock weathering and clay

formation, adsorption and ion exchange, redox reactions, microbial energetics and redox zonation, the geochemistry of iron, sulfur, trace elements, and radionuclides, and geochemical kinetics. Geochemical modeling will be introduced.

Credit 3 units. A&S IQ: NSM Art: NSM BU: SCI

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**EEPS 5440 Methods of Geochemistry**

This course is intended to give advanced students a practical understanding and appreciation of major instrument-based research in the geosciences. Topics considered will include general laboratory practice and error analysis but will focus primarily on one or two of the major experimental facilities operated within the department, e.g., mass spectrometers, electron probe, INAA equipment, etc. The topics will vary from offering to offering, and this course may be repeated for credit with the permission of the department. Variable credit 1-5 units.

Credit 5 units.

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**EEPS 5444 Environmental Geochemistry**

Introduction to the geochemistry of natural waters and the processes that alter their composition. Key principles of aqueous geochemistry and their application to describe the main controls on the chemistry of pristine and polluted soil, surface, and ground water environments. Acids and bases, mineral solubility, carbonate chemistry, chemical speciation, redox reactions, adsorption and ion exchange, and the speciation, mobility, and toxicity of metals.

Credit 3 units. A&S IQ: NSM Art: NSM BU: SCI

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**EEPS 5450 Radiogenic Isotope Geochemistry**

Applications of variations in abundance of daughter isotopes of major natural radionuclides. Topics include the use of isotopes such as <sup>87</sup>Sr, <sup>143</sup>Nd, <sup>206</sup>-<sup>207</sup>-<sup>208</sup>Pb, <sup>40</sup>Ar, <sup>4</sup>He, etc. as isotopic tracers in petrogenetic studies, and as sources of constraints on the evolution of the Earth's mantle, crust, and atmosphere.

Credit 3 units.

Typical periods offered: Spring

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**EEPS 5454 Organic Geochemistry**

Introduction to the composition and analysis of organic material in the environment and geological record. Molecular to global-level perspective of organic matter cycling, reactivity, and fluxes; formation and classification of organic matter, its preservation potential, diagenesis, catagenesis, and kerogen formation; coal, petroleum, and gas formation and accumulation; biomarkers in Earth history; genetics and phylogeny of biomarker compounds; overview of analytical techniques including both structural and isotopic aspects; oceanographic and paleoenvironmental applications of organic biomarkers; contaminants and residue analysis.

Credit 3 units. A&S IQ: NSM Art: NSM

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**EEPS 5464 Stable Isotope Geochemistry**

Applications of equilibrium and kinetic isotope fractionation and material balance principles to the distribution of oxygen and hydrogen isotopes in natural systems. Geothermometry and paleotemperatures, mass spectrometry, isotope hydrology and ice cores, fluid-rock interaction, igneous rocks and meteorites. Prerequisites: EEPS 441 and MATH 233.

Credit 3 units. A&S IQ: NSM Art: NSM

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**EEPS 5524 Introduction to Seismology**

Introduction to earthquake and exploration seismology. Seismic wave propagation, data analysis and processing, earthquake mechanisms, seismic constraints on the structure of the Earth, relationship of seismicity to plate tectonics.

Credit 3 units. A&S IQ: NSM Art: NSM

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**EEPS 5530 Geophysical Data Analysis**

Survey of geophysical data analysis techniques with applications to seismology, geodynamics, and remote sensing. Time series analysis techniques, including Fourier transforms, convolution and deconvolution, and filters. Linear and non-linear geophysical inverse problems, including discussion of solution uncertainty and uniqueness. Credit 3 units.

Typical periods offered: Fall, Spring

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**EEPS 5534 Interior of the Earth**

Composition and temperature of Earth's mantle and core, determined by geophysical methods. Inferences about mantle and core dynamics, especially interactions. Current understanding and history of interior in fields of seismology, geomagnetism, mineral physics, geodynamics.

Credit 3 units. A&S IQ: NSM Art: NSM

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**EEPS 5544 Exploration and Environmental Geophysics**

Basic geophysical techniques used in exploration and environmental geophysics, emphasizing seismic and electromagnetic methods. Basic theory, field procedures, and interpretation of data. Use of geophysical instruments on field trips, followed by reduction and analysis of acquired data. Two class hours and one two-hour laboratory a week, and approximately four one-day field trips during the semester.

Credit 4 units. A&S IQ: NSM Art: NSM

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**EEPS 5550 Mathematical Methods in Earth, Environmental, and Planetary Sciences**

This course introduces a variety of mathematical approaches commonly used in Earth, environmental, and planetary sciences. The course is structured to progress in difficulty throughout the semester, starting with dimensional analysis, order-of-magnitude estimates, and basic analytical methods, then advancing to numerical solutions of differential equations. Examples of problems that can be considered include population growth, radioactive decay, landscape evolution, carbon cycle, thermal and chemical diffusion, wave phenomena, groundwater flow, glacier dynamics, magma transport, thermal convection, and secular cooling of Earth and planets. The specific methods and problems may vary from year to year, tailored to students' interests and needs. A key element of the course is developing the ability to effectively communicate quantitative concepts. This includes presenting the material in a clear and concise manner, both orally and in writing, as well as creating compelling visualizations of quantitative information.

Credit 3 units.

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**EEPS 5560 Data Analysis in Earth, Environmental, and Planetary Sciences**

Develop skills in data processing, analysis, and problem solving as applied to typical datasets in earth, environmental, and planetary sciences. Students will acquire an understanding of the statistical analysis of data, observational noise, and error propagation, as well as the uncertainty and uniqueness of solutions. Development of techniques for solution of linear and non-linear inverse problems, signal processing, smoothing and filtering of data, removal of noise and unwanted effects, factor analysis, and other statistical methods. Allow students to gain experience applying these techniques to datasets in their research areas.

Credit 3 units.

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**EEPS 5594 Geodynamics**

Fundamental physical processes necessary to understand plate tectonics and a variety of geological phenomena. Heat flow, gravity, elasticity and flexure, rheology of Earth materials.

Credit 3 units. A&S IQ: NSM Art: NSM

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**EEPS 5604 Introduction to Structural Geology**

The landforms that surround us are being modified constantly by tectonic forces. Structural geology provides a framework for investigating, describing, and quantifying these changes. This course provides an introduction to the structures that form at all scales, from millimeter-sized fractures to plate-boundary-scale rifts. Topics include descriptive analysis of microscopic and macroscopic structures, field methods, the physical basis for rock deformation, and global tectonics. Three hours of lecture and one two-hour laboratory a week.

Credit 4 units. A&S IQ: NSM Art: NSM

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**EEPS 5610 Advanced Seismology**

Advanced treatment of seismology theory and computational methods, including: ray theory, plane waves, cylindrical waves, attenuation, anisotropy, seismic waves in laterally heterogeneous media, surface waves, free oscillations of the earth. Calculation of synthetic seismograms using several methods.

Credit 3 units.

Typical periods offered: Fall

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**EEPS 5640 Multidisciplinary Study of Subduction Zones**

Earth is a dynamic planet, and the most geologically hazardous areas on Earth are subduction zones. Activity in subduction zones may be sudden and violent, often with dramatic societal consequences. In addition, subduction zones are crucial for understanding Earth as a planet as they control the circulation of material from the surface back into the mantle. This course is a graduate-level survey intended for students concerned with Earth processes at subduction zones. The course integrates principles of geology, geophysics, geochemistry, experimental petrology, mineral physics, geodynamics, and seismology. It will review the current state of scientific knowledge for subduction on Earth. Topics range from the physics and chemistry of downgoing slabs from the surface to the deep mantle, mantle flow and structure in the wedge, earthquakes and deformation, melting and volcanism at arcs, and the geology of subduction initiation.

Credit 3 units.

Typical periods offered: Spring

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**EEPS 5650 Mantle Geochemistry**

This is a graduate-level seminar-style course on fundamentals of mantle geochemistry. The course will use important papers in the scientific literature to introduce key topics in this field, including ocean island basalt and mid-ocean ridge basalt geochemical systematics, crust-mantle chemical exchange, and early Earth processes. The course will provide a foundation for high-temperature geochemical studies of the Earth's interior and a basis for understanding geochemical ties to adjacent disciplines such as geodynamics and seismology. Some introductory lectures will supplement discussions of readings. A substantial portion of the course will involve student-led discussions and development of scientific communication skills.

Credit 3 units.

Typical periods offered: Spring

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**EEPS 5661 Advances in Stable Isotope Geochemistry**

The development of non-traditional isotope geochemistry in the past decade has greatly expanded our understanding of many facets of Earth and planetary sciences. Over 1000 papers have been published using non-traditional isotopes to study the origin of the solar system, the formation of planetary bodies, the differentiation of mantle and core, the evolution of the crust, the changes of paleo-climate, the global geochemical cycle of elements, and the genesis of natural resources. This course will survey these new isotope systems in either high-temperature igneous differentiation or low-temperature environments.

It aims to help students understand the wide applications of these new isotopes in tracing chemical, biological and physical processes. The course is divided into three parts. Part I will first introduce the principles and theories of non-traditional isotopic fractionation and then it will review analytical methods that are primarily used for non-traditional isotopes such as MC-ICP-MS, TIMS and SIMS. Part II will dive into individual isotopic systems (Li, Mg, Si, Cl, Ca, Fe, Ni, Cu, Zn, Ge, Se, Mo, Hg, Tl and U stable isotopes) and it will focus on one or two of their main applications. Part III will be carried out in the instructor's lab for the last three weeks of the class. The instructor and the students will decide together on the one topic of the final project carried out all class members. The scope of the final project will depend on the students' own research interests and the instructor's role is to help the students to identify useful non-traditional isotope tools to advance the students' main research goals.

Credit 3 units. Art: NSM

Typical periods offered: Fall

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#### EEPS 5670 Planetary Materials

In-depth look at suites of materials from the Moon, Mars, Vesta, and selected other achondrite meteorite groups. Mineralogy, geochemistry, petrography, and petrology of samples and their geologic settings. Relationships between samples and orbital mineralogical and geochemical data. Comparative planetology and origins.

Credit 3 units.

Typical periods offered: Fall, Spring

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#### EEPS 5675 Planetary Mission Design

This course will introduce EEPS, physics, and engineering students to the combined scientific and engineering aspects required for the development of a robotic spacecraft exploration mission to a body in the Solar System. Through Instructor delivered lectures, individual presentations, and a group presentation and a report, students will design a robotic spacecraft exploration mission that satisfies specific target, cost and schedule constraints.

Credit 3 units.

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#### EEPS 5680 Scientific Exploration of the Moon

Detailed look at scientific exploration of the Moon, focusing on surface and orbital experiments and results: landers, astronauts, and rover activities, photogeology, surface processes, what has been learned from Apollo exploration and samples, geophysical experiments, petrology and origin of lunar rock suites, impact craters and basins, lunar meteorites, results from recent missions, and plans for future missions. Origin and geologic history of the Moon, potential resources, and the role of the Moon for understanding planetary and solar system processes and history.

Credit 3 units.

Typical periods offered: Fall, Spring

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#### EEPS 5684 Geospatial Field Methods

This course is an introduction to field geospatial surveying using high-precision GNSS systems and UAVs (drones) outfitted with a variety of sensors such as cameras, multispectral sensors, and lidar. Coursework will cover basic principles as well as provide hands on experience. Most of the course is project based, and students will complete a series of exercises designed to familiarize them with the effective use of field equipment. Students will design data collection strategies, collect data, and become familiar with data processing pipelines and visualization techniques. After completing the course, students will be prepared to safely and effectively conduct independent GNSS and drone surveys, and use the data for studies in Earth, environmental, and planetary science, archaeology, environmental science, ecology, landscape architecture, urban design, agriculture and a variety of other field-based disciplines.

Credit 3 units. A&S IQ: NSM Art: NSM

Typical periods offered: Fall

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#### EEPS 5690 Thermodynamics & Phase Equilibria

Basic equilibrium thermodynamics relevant to geological systems, including derivation of reaction log K as f(T,P) and activity-composition models for various minerals and co-existing gas/fluid phase. These principles are applied to calculation of phase diagrams for simple systems and interpretations of phase relations for more complex systems determined by experiment and topological constraints.

Credit 3 units.

Typical periods offered: Fall

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#### EEPS 5700 Planetary Geophysics & Dynamics

Relationships between solar system dynamics and planetary evolution, with emphasis on orbital mechanics, gravity fields of planets and satellites, heat transfer in planetary interiors, and tidal interactions. Topics include resonant orbits and rotation rates, effects of large-body impact, volcanism on Io, and the origin of the Moon.

Credit 3 units.

Typical periods offered: Fall

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#### EEPS 5734 Planetary Geology

Discussion of the evolution of the terrestrial planets and the outer-planet satellites as evidenced by the geologic records left on the surfaces of these bodies. Focus on major processes affecting planetary surfaces: impact cratering, volcanism, tectonism, and erosion and sedimentation by wind and water.

Credit 3 units. A&S IQ: NSM Art: NSM

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#### EEPS 5744 Planetary Geochemistry

A survey of the geochemistry of the planets and their satellites using data from Earth-based, Earth-orbital, and spacecraft observations.

Credit 3 units. A&S IQ: NSM Art: NSM

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#### EEPS 5760 Advanced Planetary Geology: Ice Worlds

Discussion of icy bodies and terrains in the solar system. Water and other ices as geologic materials, including remote sensing of ices, impacts into ice, cryovolcanism, and ice tectonics. Focus on major satellites of Jupiter and Saturn (Europa, Ganymede, Callisto, and Titan), mid-sized icy satellites, and the martian polar caps.

Credit 3 units.

Typical periods offered: Fall

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#### EEPS 5853 Earth History

Introduction to the concept of deep time and the parallel biological evolutionary and environmental changes that have occurred throughout Earth history. Topics include early evolution of life, rise of atmospheric oxygen, global glaciation, mass extinctions. Prerequisite: EEPS 202

Credit 3 units. A&S IQ: NSM Art: NSM BU: SCI

Typical periods offered: Spring

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#### EEPS 5863 The Earth's Climate System

This course introduces an integrative view of the Earth's climate system and its coupled components - the atmosphere, the oceans, the cryosphere, the biosphere, and the geosphere - and how they interact with each other. The goal is to provide the physical scientific background that is needed to understand climate variability and climate change, both natural and anthropogenic. Topics include energy balance; general circulation of the atmosphere and the oceans; the greenhouse effect; modes of variability such as El Niño; geologic-scale climate change in the geologic past; climate models; climate

change detection and attribution; projection of future climates; and societal impacts. In addition to lectures, students will gain hands-on experience analyzing and interpreting real datasets through inquiry-based practicum exercises and in-class discussions.

Credit 3 units. Art: NSM BU: SCI

Typical periods offered: Fall, Spring

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#### **EEPS 5864 Paleoclimatology**

The history of Earth's changing climates and environments on timescales from decades to millions of years. Key concepts in paleoclimatology include: external factors affecting the climate system (e.g., orbital cycles, volcanic eruptions, greenhouse gases); internal feedbacks, such as with monsoons and the El Niño–Southern Oscillation; abrupt versus gradual change; interactions with the biosphere (including hominins/humans); and comparison to present-day climate change. Current controversies in paleoclimate.

Credit 3 units. A&S IQ: NSM Art: NSM BU: SCI

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#### **EEPS 5873 Geospatial Science**

This course introduces students to the interdisciplinary field of geospatial science, which bridges the fields of geographic information systems (GIS), remote sensing, data science, and spatiotemporal analysis. This course will provide an overview of the fundamental concepts of geospatial science, including: visualizing and analyzing raster and vector datasets within a GIS database; coordinate systems, reference frames, and projections; the Geoid and geodetic techniques; remote sensing methods; image acquisition and interpretation; spatiotemporal analysis of geospatial data; sampling, interpolation, and time series analysis; uncertainty, error, accuracy, and precision. This course will be available at both the upper-level undergraduate and the graduate levels. Material will be covered through lectures, assignments, and computer exercises that will give students hands-on experience analyzing and interpreting real geospatial datasets. Exercises for students enrolled in the 587 option will be more in-depth and will require some basic programming experience and familiarity with quantitative techniques. These exercises will provide students with a sampling of geospatial science applications, such as environmental studies, cryospheric science, wildlife management, contagious disease monitoring, demography, and human geography. Students will complete a final project of their choosing that synthesizes the concepts and themes learned in this course; students enrolled in the 587 option are encouraged to develop a project proposal that aligns with their own research interests. Students particularly interested in GIS and remote sensing are further encouraged to also consider EnSt 380 and EEPS 407, respectively.

Credit 4 units. A&S IQ: NSM, AN

Typical periods offered: Fall

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#### **EEPS 5883 GIS for the Earth, Environmental, and Planetary Sciences**

This course will introduce fundamental geospatial concepts, tools, and analyses through hands-on exercises and assignments. The course will focus on common applications of geographic information systems (GIS) in the earth sciences to illustrate core geospatial concepts, provide exposure to key data types and analysis tools, and to build proficiency with industry standard GIS software. Class meetings will feature lectures, article discussions, and hands-on exercises to demonstrate common workflows for obtaining, creating, or editing geospatial datasets and using them to perform spatial analysis and create effective map products.

Credit 3 units.

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#### **EEPS 5900 Independent Study**

Independent study for graduate students, supervised by a faculty member. Prerequisite: graduate standing and permission of instructor.

Credit 12 units.

Typical periods offered: Fall, Spring

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#### **EEPS 5910 Graduate Research Project**

In conjunction with a faculty advisor, each candidate for the Doctoral program selects, designs, and completes a one-semester research project in a field of interest to the student.

Credit 12 units.

Typical periods offered: Spring

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#### **EEPS 5920 Research**

Individual research work under the direct supervision of a faculty member. Open only to graduate students. May be repeated for credit.

Credit 12 units.

Typical periods offered: Fall, Spring

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#### **EEPS 5950 Seminar**

Weekly discussions to orient first-year students to graduate school. Topics to be covered include an introduction to the Department, program requirements, time management, working with a supervisor, ethics, the scientific literature, written and oral communication skills, scientific publishing, grant writing, and professional development. Required for all first-year graduate students in EEPS.

Credit 1 unit.

Typical periods offered: Fall

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#### **EEPS 8830 Master's Continuing Student Status**

Credit 0 units.

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#### **EEPS 8840 Doctoral Continuing Student Status**

Credit 0 units.

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#### **EEPS 8850 Masters Nonresident**

Credit 0 units.

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#### **EEPS 8860 Doctoral Nonresident**

Credit 0 units.

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