GEOSCIENCES (Div III)

Chair: Associate Professor Phoebe A. Cohen

- Alex A. Apotsos, Lecturer in Geosciences
- Alice C. Bradley, Assistant Professor of Geosciences
- Phoebe A. Cohen, Chair and Associate Professor of Geosciences
- José A. Constantine, Assistant Professor of Geosciences
- Mea S. Cook, Professor of Geosciences; on leave 2021-2022
- Rónadh Cox, Edward Brust Professor of Geology and Mineralogy
- Paul M. Karabinos, Edna McConnell Clark Professor of Geology

MAJOR

The Geosciences major offers an understanding of the evolution of our planet and its interacting global systems. In this era of global change, geoscience provides the tools that can help us learn to live sustainably with our environment, and appreciate our place within the vastness of Earth history. Forces within the Earth create mountain ranges and ocean basins and drive the movements of continents. Wind, water and ice shape the surface of the Earth, making and changing the landscapes around us. Sedimentary rocks and the fossils within them teach us how life and climate have evolved over the vastness of time.

Geosciences graduates have a wide range of career options, both with and without graduate training. The many choices include environmental consulting, hazard assessment, hydrology, gemology, the energy and mining industries, outdoor education, and research and teaching in universities, colleges, and secondary schools. Many students choose to double-major in fields as diverse as Art, Economics, History, Physics, Mathematics, English, and Philosophy, and often find jobs where they can apply the synergies of their Geosciences double major. No matter what field they enter, all our Geosciences graduates pursue their lives and careers with a deeper appreciation for the natural world around them.

The major is designed to provide a solid grounding in the geosciences while being adaptable enough to accommodate diverse paths driven by student interests. There are no required courses, but students work through the menu below, which allows a lot of scheduling flexibility.

The requirements for the Geosciences major were revised. The new requirements are immediately below, and the old requirements follow. Students who entered Williams in fall 2019 or after are under the new requirements. Students who entered Williams before fall 2019 are under the old requirements but may opt into the new requirements. Please talk to the Geosciences chair if you have questions about the major requirements.

Geosciences major requirements for students who entered Williams in fall 2019 or after:

At least one and at most two 100-level courses:

GEOS 100 Introduction to Weather and Climate

GEOS 101 Co-Evolution of Earth and Life

GEOS 102 An Unfinished Planet

GEOS 103 Global Warming and Environmental Change

GEOS 104 Oceanography

GEOS 107 Astrobiology

At least two 200-level courses selected from this group:

GEOS 201 Geomorphology

GEOS 202 Mineralogy

GEOS 203 Field Methods and Structural Geology

GEOS 205 Economic Geology and Earth Resources

GEOS 210 Oceanographic Processes

GEOS 212 Paleobiology

GEOS 214 Mastering GIS

GEOS 215 Climate Changes

GEOS 217 Planets and Moons

GEOS 255 Environmental Observation

At least two 300-level courses selected from this group:

GEOS 301 Structural Geology

GEOS 302 Sedimentology

GEOS 303 Igneous and Metamorphic Petrology

GEOS 309 Modern Climate

GEOS 314 Analytical Historical Geology

GEOS 324 Corals and Sea Level

At least one of the following 400-level courses:

GEOS 401 Global Tectonics and the Rise of Mountains

GEOS 404 Coastal Processes and Geomorphology

GEOS 405 Geochemistry: Understanding Earth's Environment

GEOS 410 The Cryosphere

GEOS 411 Geobiology

Finally, students must take enough electives to bring the total to a minimum of nine courses.

In addition, courses taken for the major must include at least two courses from each of the following three groups:

Climate and Oceans:

GEOS 100 Introduction to Weather and Climate

GEOS 104 Oceanography

GEOS 210 Oceanographic Processes

GEOS 215 Climate Changes

GEOS 221T Climate Science and Politics

GEOS 255 Environmental Observation

GEOS 309 Modern Climate

GEOS 324 Corals and Sea Level

Sediments and Life:

GEOS 101 Co-Evolution of Earth and Life

GEOS 103 Global Warming and Environmental Change

GEOS 107 Astrobiology

GEOS 201 Geomorphology

GEOS 212 Paleobiology

GEOS 302 Sedimentology

GEOS 312T Mass Extinctions

GEOS 314 Analytical Historical Geology

Solid Earth:

GEOS 102 Unfinished Planet

GEOS 202 Mineralogy

GEOS 203 Field Methods and Structural Geology

GEOS 205 Economic Geology and Earth Resources

GEOS 217 Planets and Moons

GEOS 220T Evolution of and on Volcanic Islands

GEOS 250T Tectonic Geomorphology and Landscape Evolution

GEOS 301 Structural Geology

GEOS 303 Igneous and Metamorphic Petrology

Geosciences major requirements for students who entered Williams before fall 2019:

At least one and at most two 100-level courses:

GEOS 100 Introduction to Weather and Climate

GEOS 101 The Co-Evolution of Earth and Life

GEOS 102 An Unfinished Planet

GEOS 103 Global Warming and Environmental Change the Reshaping of Landscapes

GEOS 104 Oceanography

GEOS 107 Astrobiology

At least two 200-level courses selected from this group:

GEOS 201 Geomorphology

GEOS 202 Mineralogy

GEOS 203 Field Methods and Structural Geology

GEOS 205 Earth Resources

GEOS 210 Oceanographic Processes

GEOS 212 Paleobiology

GEOS 214 Mastering GIS

GEOS 215 Climate Changes

GEOS 217 Planets and Moons

GEOS 255 Environmental Observation

At least two 300-level courses selected from this group:

GEOS 302 Sedimentology

GEOS 303 Igneous and Metamorphic Petrology

GEOS 309 Modern Climate

GEOS 314 Analytical Historical Geology

GEOS 324 Corals and Sea Level

At least one of the following 400-level courses:

GEOS 401 Global Tectonics and the Rise of Mountains

GEOS 404 Coastal Processes and Geomorphology

GEOS 405 Geochemistry: Understanding Earth's Environment

GEOS 410 The Cryosphere

GEOS 411 Geobiology

Finally, students must take enough electives to bring the total to a minimum of nine courses.

PREPARATION FOR GRADUATE SCHOOL

Although many of our majors take geoscience jobs after graduation, many choose to go to graduate school, and most graduate programs will expect students to have a background in mathematics as well as a year or so of study in related sciences, in addition to the requirements of the Geosciences major. Students considering graduate work in geosciences should therefore consult with faculty to ensure that they plan wisely. The selection of outside courses will depend on the field in which a student wants to specialize. Graduate programs in solid-earth geosciences commonly expect entering students to have taken courses in chemistry. For those going into environmental geosciences, courses in chemistry, computer science and/or statistics are recommended. For those considering geobiology programs, biology courses are important. For students entering planetary geology, physics is recommended.

THE DEGREE WITH HONORS IN GEOSCIENCES

The degree with honors in Geosciences provides students with an opportunity to undertake an independent research project under the supervision of a faculty member, culminating in a thesis that demonstrates outstanding achievement of an original and innovative nature. In addition to the major requirements listed above, those who are candidates for the degree with honors take the following sequence in the Fall, Winter Study, and Spring of their senior year:

GEOS 493-031-494 Senior Research and Thesis

The principal considerations in admitting a student to a program of independent research are interest and motivation, mastery of fundamental material and skills, and ability to pursue independent study successfully. Interested students should talk to members of the department about project options at any time, but generally no later than January of the Junior year.

STUDY AWAY

Students planning to study off-campus should meet as early as possible with the Department Chair to plan and to discuss how potential courses might be used in the major. Although most study-away programs do not offer geoscience courses, there are some that dovetail well with Geosciences. Examples include the Williams-Mystic program, the Frontiers Abroad program at Canterbury University in New Zealand, and the program at the University of Otago in New Zealand. Courses offered at Norwegian Technical Universities and at several universities in the United Kingdom have also been accepted. Up to two geoscience courses taken away from Williams can be counted toward the nine-course major. Be sure to meet with a Geosciences faculty advisor or Department Chair to discuss your plans and ideas for off-campus work.

FAQ

Students MUST contact departments/programs BEFORE assuming study away credit will be granted toward the major or concentration.

Can your department or program typically pre-approve courses for major/concentration credit?

Generally not until after a student returns and can provide course material for review (e.g. Syllabus and/or completed work such as exams, portfolios, lab reports and the like).

What criteria will typically be used/required to determine whether a student may receive major/concentration credit for a course taken while on study away?

Complete syllabus and course description, including readings, assignments, evaluation criteria.

Does your department/program place restrictions on the number of major/concentration credits that a student might earn through study away?

Yes. A maximum of two courses can be credited toward major requirements.

Does your department/program place restrictions on the types of courses that can be awarded credit towards your major?

No.

Are there specific major requirements that cannot be fulfilled while on study away?

No.

Are there specific major requirements in your department/program that students should be particularly aware of when weighing study away options? (Some examples might include a required course that is always taught in one semester, laboratory requirements.)

Students should consult with the chair or other department faculty members to plan ahead and make sure that requirements can be met.

Give examples in which students thought or assumed that courses taken away would count toward the major or concentration and then learned they wouldn't:

None to date.

GEOS 100 (S) Introduction to Weather and Climate

Cross-listings: GEOS 100 ENVI 100

Primary Cross-listing

How is it that we have such a hard time predicting if it's going to rain next week, but we can be confident in projections of future climate change

decades from now? This course will explore the atmosphere and how air moves and changes, understanding the wind, clouds, precipitation, and extreme events (including thunderstorms, hurricanes, and tornados) that form our weather. Building off of our understanding of the atmosphere, we'll look at longer time scales to develop a basic understanding of earth's climate, global heat and moisture transport, climate change, and the ways that humans can change our planet. We will look at weather and climate models to learn how to scientists and meteorologists predict future conditions. Labs will include local field trips, bench top experiments, and running a climate model on a computer. This course is in the Oceans and Climate group for the Geosciences major.

Requirements/Evaluation: lab assignments, a midterm, and a final exam

Prerequisites: none

Enrollment Limit: 40

Enrollment Preferences: first year and second year students, Geosciences majors

Expected Class Size: 40

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 100 (D3) ENVI 100 (D3)

Attributes: ENVI Natural World Electives EXPE Experiential Education Courses GEOS Group A Electives - Climate + Oceans

Not offered current academic year

GEOS 101 (F) The Co-Evolution of Earth and Life

Cross-listings: GEOS 101 ENVI 105

Primary Cross-listing

Our planet is about 4.6 billion years old and has supported life for at least the last 3.5 billion of those years. This course will consider the inter-related nature of Earth and the life that inhabits it, starting with the first living organisms and progressing to the interaction of our own species with the Earth today. Students will investigate the dynamic nature of the Earth-life system, examine many of its feedbacks, and learn about the dramatic changes that have occurred throughout the history of the Earth. We will ask questions such as: How did the Earth facilitate biologic evolution, and what effects did those biologic events have on the physical Earth? When did photosynthesis evolve, how can we detect that in the rock record, and how did this biological event lead to profound changes in the environment? How and why did animals evolve and what role did environmental change play in the radiation of animal life? How did the rise and radiation of land plants affect world climate? How do plate tectonics, glaciation, and volcanism influence biodiversity and evolutionary innovation? What caused mass extinctions in the past and what can that teach us about our current extinction crisis? Labs will involve hands-on analysis of rocks, fossils, and real-world data as well as conceptual and analytical exercises; field trips will contextualize major events in Earth history and will help students learn to read the rock record. Through these investigations, the class will provide a comprehensive overview of Earth history, with special attention paid to the geological and paleontological history of the northeastern United States. This course is in the Sediments and Life group for the Geosciences major.

Class Format: one laboratory per week plus one all-day field trip

Requirements/Evaluation: lab work, short quizzes, midterms, an independent project, and a final exam

Prerequisites: none

Enrollment Limit: 30

Enrollment Preferences: first year and second year students, Geosciences majors

Expected Class Size: 30

Grading: yes pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 101 (D3) ENVI 105 (D3)

Attributes: ENVI Natural World Electives EXPE Experiential Education Courses GEOS Group B Electives - Sediments + Life

Not offered current academic year

GEOS 102 (S) An Unfinished Planet

The Earth is a work-in-progress, an evolving planet whose vital signs--as expressed by earthquakes, volcanic eruptions, and shifting plates--are still strong. In a geological time frame, nothing on Earth is permanent: ocean basins open and close, mountains rise and fall, continental masses collide and pull apart. There is a message here for all of us who live, for an infinitesimally brief time, on the moving surface of the globe. This course uses the plate tectonics model--one of the fundamental scientific accomplishments of the past century--to interpret the processes and products of a changing Earth. The emphasis will be on mountain systems (on land and beneath the oceans) as expressions of plate interactions. Specific topics include the rocks and structures of modern and ancient mountain belts, the patterns of global seismicity and volcanism, the nature of the Earth's interior, the changing configurations of continents and ocean basins through time, and, in some detail, the formation of the Appalachian Mountain system and the geological assembly of New England. Readings will be from a physical geology textbook, a primary source supplement, selected writings of John McPhee, and references about the geology of the Northeast. This course is in the Solid Earth group for the Geosciences major.

Class Format: lecture three hours per week and lab (several involving field work) two hours per week; one required all-day field trip on the last Monday of the semester to the Connecticut Valley and the highlands of western Massachusetts

Requirements/Evaluation: two hour-tests, weekly lab work, and a scheduled final exam

Prerequisites: none

Enrollment Limit: 40

Enrollment Preferences: first year and second year students, Geosciences majors

Expected Class Size: 40

Grading: yes pass/fail option, no fifth course option

Distributions: (D3)

Attributes: ENVI Natural World Electives EXPE Experiential Education Courses GEOS Group C Electives - Solid Earth

Spring 2022

LEC Section: 01 MWF 10:00 am - 10:50 am Paul M. Karabinos

LAB Section: 02 M 1:00 pm - 3:00 pm Paul M. Karabinos

LAB Section: 03 W 1:00 pm - 3:00 pm Paul M. Karabinos

GEOS 103 (F) Global Warming and Environmental Change

Cross-listings: GEOS 103 ENVI 103

Primary Cross-listing

Earth is the warmest it has been for at least five centuries, and the surface of our planet is responding. From extreme floods and drought to landslides and soil erosion, the natural processes that shape Earth's surface are tied to temperature and precipitation. As those change, the landscape reacts. People are beginning to feel the impacts, but in different ways depending on where they call home. In this course, we will investigate how climate change is altering landscapes and the natural processes that support them, highlighting all the ways that people are being affected today. Ultimately, we will develop an understanding of the consequences of climate change that connects physical processes with the geography of place. Specific topics include foundations of the Earth system, plate tectonics and the construction of landscapes, Earth materials, rivers and flooding, hillslope processes, coastal processes, and climate impacts on natural resources such as fresh water and soil. Labs will use local field sites and analytical exercises to evaluate recent cases that reflect an interaction of the landscape and climate. This course is in the Sediments and Life group for the Geosciences major.

Requirements/Evaluation: written reports from laboratories and readings, class participation, a midterm and final exam

Prerequisites: none

Enrollment Limit: 40

Enrollment Preferences: first year and second year students, Geosciences majors and Environmental Studies majors and concentrators

Expected Class Size: 40

Grading: yes pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 103 (D3) ENVI 103 (D3)

Attributes: ENVI Natural World Electives EXPE Experiential Education Courses GEOS Group B Electives - Sediments + Life

Not offered current academic year

GEOS 104 (F) Oceanography

Cross-listings: GEOS 104 MAST 104 ENVI 104

Primary Cross-listing

In this wide-ranging and integrated introduction to the oceans we will examine formation and history of the ocean basins; composition and origin of seawater; currents, tides, and waves; ocean-atmosphere interactions; oceans and climate; deep-marine environments; coastal processes; productivity in the oceans; marine resources; and human impacts. We will discuss current research, and address issues of colonialism and racism in oceanographic science. This course is in the Oceans and Climates group for the Geosciences major.

Class Format: 3 50-minute lecture/discussion meetings each week; 2-hour lab every second week. 3 mini-symposia (during scheduled class time). All-day field trip to the Atlantic coast of New England.

Requirements/Evaluation: 6 graded lab exercises, mini-symposium participation, a 4-page term paper, and final exam.

Prerequisites: none

Enrollment Limit: 60

Enrollment Preferences: first year and second year students, Geosciences majors, Maritime Studies concentrators

Expected Class Size: 60

Grading: yes pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 104 (D3) MAST 104 (D3) ENVI 104 (D3)

Attributes: ENVI Natural World Electives EXPE Experiential Education Courses GEOS Group A Electives - Climate + Oceans

Fall 2021

LEC Section: 01 MWF 9:00 am - 9:50 am Rónadh Cox

LAB Section: 02 M 1:00 pm - 3:00 pm Rónadh Cox

LAB Section: 03 W 1:00 pm - 3:00 pm Rónadh Cox

GEOS 106 (F) Being Human in STEM (DPE)

Cross-listings: PHYS 106 GEOS 106 STS 106

Secondary Cross-listing

This course combines academic inquiry and community engagement to investigate the themes of diversity and social climate within STEM (science, technology, engineering and mathematics) disciplines. Students will examine how diverse identities including but not limited to gender, race, disability, sexuality, national origin, socioeconomic status, religion, and ethnicity shape the STEM experience both at Williams and nationally. We will ground our understanding through critical reading of primary scholarly research on topics such as implicit bias, identity threat, and effects of team diversity on excellence. From there, we will execute small group projects. Students will design, execute, and evaluate interventions that relate to the course goals and that have direct relevance to Williams students, faculty, and staff. For example, a student group could implement a survey of minoritized STEM students, or create a qualitative interview-based assessment of how socioeconomic status impacts students' abilities to participate in STEM fields. Course work includes weekly readings, reflective/opinion writing, in class discussion, and the development and presentation of a group project.

Class Format: class discussions, group project work (out of class time required)

Requirements/Evaluation: short response papers, class discussion participation, leading class discussions, group work, and final project

Enrollment Limit: 15

Enrollment Preferences: DIV III majors; statement of interest may be requested

Expected Class Size: 15

Grading: no pass/fail option, yes fifth course option

Unit Notes: does not count towards GEOS or PHYS major credit

Distributions: (D3) (DPE)

This course is cross-listed and the prefixes carry the following divisional credit:

PHYS 106 (D3) GEOS 106 (D3) STS 106 (D2)

Difference, Power, and Equity Notes: This course explicitly addresses the intersection of marginalized identities and the STEM experience. Students will learn how to critically address how issues such as gender, race, ethnicity, and disability impact participation in and the experience of STEM fields. For example, students will read and critique literature documenting bias in STEM fields, and will also learn about and create interventions that can address these biases.

Not offered current academic year

GEOS 107 (F) Astrobiology

Cross-listings: GEOS 107 ASTR 107

Primary Cross-listing

Astrobiology is the study of the origin, evolution, and distribution of life in the universe. As such it is an inherently interdisciplinary field, incorporating all of the basic natural sciences: biology, chemistry, physics, astronomy, and the earth sciences, as well as aspects of philosophy, sociology, and engineering. Questions we will seek answers to in this class include: How, why, when, and where did life evolve on Earth, and what does that tell us about how it might evolve elsewhere? What are the chances that there is life on other planets and moons in our solar system, and why? Are there habitable planets elsewhere in the universe, and will we ever truly know if any of them contain life? We will approach these questions using a combination of lectures, activities, labs, homework assignments, and visits from some of the country's leading Astrobiology researchers. Examples of lab and homework activities include exploring our definition of life by making observations about living and non-living systems, examining evidence for ancient habitable environments in rocks, and modeling chemical fingerprinting tools used by Mars rovers. Assessment will be based on participation, quizzes, labs and homework assignments, and a final group project where students will present a mock NASA mission proposal. This course requires no previous experience in the sciences. This course is in the Sediments and Life group for the Geosciences major.

Class Format: Lectures will be partially flipped with student responsible for watching videos before class; class time will be split between short lectures, small group activities, and class discussions. Lab groups will meet in person every other week and have group project work on alternate weeks that may be done virtually or in person.

Requirements/Evaluation: Assessment will be based on participation, quizzes, labs and homework assignments, and a final group project where students will present a mock NASA mission proposal.

Prerequisites: none

Enrollment Limit: 46

Enrollment Preferences: first year and second year students, Geosciences majors

Expected Class Size: 46

Grading: yes pass/fail option, yes fifth course option

Unit Notes: This course counts towards the GEOS Group B Electives - Sediments and Life

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 107 (D3) ASTR 107 (D3)

Attributes: GEOS Group B Electives - Sediments + Life

Fall 2021

LEC Section: 01 TR 9:55 am - 11:10 am Phoebe A. Cohen

LAB Section: 02 T 1:00 pm - 3:00 pm Phoebe A. Cohen

LAB Section: 03 R 1:00 pm - 3:00 pm Phoebe A. Cohen

GEOS 111 (F) Radical Science- How Geology Changed the Way We See the World (WS)

Copernicus shocked Europe when he suggested that the Earth is not the center of the universe. Hutton and other geologists made an equally radical proposal more than two centuries later when they introduced the concept of deep time and argued that the Earth was much older than 6,000 years, as determined by biblical scholars. Several decades later, Darwin and Wallace shook the foundation of western philosophy once more when they

proposed that organisms evolved. When geologists reinterpreted landscape features once attributed to the great flood as evidence for past continental glaciation, the concept of extreme climate change through time sprang to life. During the 20th century, the permanence of Earth's geography was challenged by the continental drift hypothesis, which was initially rejected for decades until it reemerged as plate tectonic theory. This tutorial explores how geologic breakthroughs challenged western views of humans as the center of creation living in a world with limited change. There will be weekly tutorial meetings with pairs of students, and students will alternate writing papers on assigned topics. This course is in the Solid Earth group for the Geosciences major.

Requirements/Evaluation: five 5-page papers and five oral critiques of partner's papers

Prerequisites: none

Enrollment Limit: 10

Enrollment Preferences: First year students then second year students

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3) (WS)

Writing Skills Notes: Students will write five 5-page papers and will receive peer and instructor feedback on how to improve their writing skills and formulate sound arguments.

Attributes: GEOS Group C Electives - Solid Earth

Fall 2021

TUT Section: T1 TBA Paul M. Karabinos

GEOS 201 (F) Field Methods and Structural Geology (WS)

Geologic history is preserved in rocks and it can be deciphered using fundamental principles such as superposition and cross-cutting relationships. Field observations are essential to understanding the rock record, and data and interpretations are encoded in geologic maps. This course introduces students to topographic and geologic maps, best practices for geologic field work, the field identification of common minerals and rocks, geologic contacts, and structures such as folds, and faults. Students will develop skills for presenting field data in papers, figures, and oral presentations. This course is in the Solid Earth group for the Geosciences major.

Class Format: lecture and discussion, three hours per week and laboratory, three hours per week

Requirements/Evaluation: short weekly writing assignments will form the basis for two 10-page papers based on field trips and a final independent project

Prerequisites: none

Enrollment Limit: 12

Enrollment Preferences: Geosciences majors or students with a strong interest in geosciences

Expected Class Size: 8

Grading: no pass/fail option, no fifth course option

Materials/Lab Fee: $15 for field supplies

Distributions: (D3) (WS)

Writing Skills Notes: There will be two 10-page papers, each based on four field trips. Students will submit short field descriptions and figures with captions after each field trip. The shorter assignments will be incorporated in two papers. Students will receive from the instructor timely comments on their writing skills, with suggestions for improvement.

Attributes: GEOS Group C Electives - Solid Earth

Fall 2021

LEC Section: 01 MW 11:00 am - 12:15 pm Paul M. Karabinos

LAB Section: 02 M 1:00 pm - 4:00 pm Paul M. Karabinos

GEOS 202 (F) Mineralogy

This course could be subtitled "An Introduction to Earth Materials and Analytical Techniques." As the basis for all subsequent solid-earth courses in the major, it provides a systematic framework for the study of minerals--Earth's building blocks: their physical and chemical properties at all scales and the common analytical methods used to identify and interpret them. The course progresses from hand-specimen morphology and crystallography through element distribution and crystal chemistry to the phase relations, compositional variation, and mineral associations within major rock-forming mineral systems. Laboratory work includes the determination of crystal symmetry; mineral separation; the principles and applications of optical emission spectroscopy; wavelength- and energy-dispersive x-ray spectrochemical analysis; x-ray diffraction; the use of the petrographic microscope; and the identification of important minerals in hand specimen and thin section. This course is in the Solid Earth group for the Geosciences major.

Class Format: Lecture three hours per week and laboratory three hours per week; independent study of minerals in hand specimen; one afternoon field trip

Requirements/Evaluation: one hour test, lab work, and a final exam

Prerequisites: one 100-level GEOS course or permission of instructor

Enrollment Limit: 14

Enrollment Preferences: sophomores and juniors planning to take GEOS 301, 302 and/or 303 in the subsequent year

Expected Class Size: 12

Grading: yes pass/fail option, no fifth course option

Distributions: (D3)

Attributes: EXPE Experiential Education Courses GEOS Group C Electives - Solid Earth MTSC Courses

Not offered current academic year

GEOS 205 (F) Economic Geology and Earth Resources

Cross-listings: GEOS 205 ENVI 207

Primary Cross-listing

"If it can't be grown, it must be mined." We depend on the solid Earth for a huge array of resources. The metal in your soda can, the plastic in your Nalgene, the components of your computer, the glass in your window, the hydrocarbons being burned to keep you warm in the winter or to transport you in cars or aircraft, the cars and aircraft themselves: all are made of materials mined from the Earth. Right now there are more people building more houses, paving more roads, making more vehicles, more electronics, and more plastic packaging-all with geologic materials. As demand soars in both established and growing economies, and as we realize the environmental damage that can result from resource extraction and processing, the importance of understanding Earth's resources increases. Finding new deposits and managing those we have requires insight into the geology that underlies the location and origin of strategic Earth materials. This class introduces the geologic processes that control formation, distribution, and extent of materials reserves: dimension stone and gravel, base and precious metal ores, gemstones, petroleum, nuclear energy sources, and specialty materials for medical, technological, and military uses. This course is in the SOLID EARTH GROUP for the Geosciences major.

Class Format: 2.5 hours lecture per week and one 3 hour lab per week, including some field labs

Requirements/Evaluation: one hour exam, a final exam, lab exercises, and a group project

Prerequisites: one 100-level GEOS course or permission of instructor

Enrollment Limit: 18

Enrollment Preferences: sophomores and Geosciences majors

Expected Class Size: 18

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 205 (D3) ENVI 207 (D3)

Attributes: ENVI Natural World Electives GEOS Group C Electives - Solid Earth

Not offered current academic year

GEOS 207 (S) The Geoscience of Epidemiology and Public Health (DPE)

Cross-listings: ENVI 201 GEOS 207

Primary Cross-listing

The Coronavirus pandemic has highlighted the many ways that diseases can be transmitted in the environment. As a society we are becoming aware of the many ways that geological processes and materials and influence human health, in ways both beneficial and dangerous. This course unites geoscience, biomedicine and public health approaches to address a wide range of environmental health problems. These include water-related illnesses (e.g. diarrhea, malaria); minerals and metals, both toxic (e.g. asbestos, arsenic) and essential (e.g. iodine); radioactive poisoning (e.g. radon gas); and the transport of pathogens by water and wind. In many cases, the environmental health problems disproportionately affect marginalised populations, contributing to greater disease and death among poor communities and populations of colour. We will examine the broad array of dynamic connections between human health and the natural world. We will discuss the social justice implications of a range of environmental health problems. And we will examine current research into how coronaviruses, such as the one causing COVID-19, are transported in the environment. This course is in the Sediments and Life group for the Geosciences Major.

Requirements/Evaluation: Evaluation will be based on short weekly writing assignments as well as an individual project and poster presentation.

Prerequisites: No prerequisites

Enrollment Limit: 34

Enrollment Preferences: Preference to first-years, sophomores, and prospective Geosciences majors

Expected Class Size: 30

Grading: yes pass/fail option, yes fifth course option

Distributions: (D3) (DPE)

This course is cross-listed and the prefixes carry the following divisional credit:

ENVI 201 (D3) GEOS 207 (D3)

Difference, Power, and Equity Notes: Through a series of case studies, we will examine ways in which marginalised groups (whether due to poverty, race, or ethnicity) are disproportionately affected by environmental health issues. Themes of power and equity in terms of decision making, access to knowledge, and funding availability, will be woven into all aspects of the class and will underpin our analysis of the science.

Attributes: ENVI Natural World Electives GEOS Group B Electives - Sediments + Life PHLH Nutrition,Food Security+Environmental Health

Not offered current academic year

GEOS 210 (F)(S) Oceanographic Processes

Cross-listings: MAST 211 GEOS 210

Secondary Cross-listing

This course examines ocean and coastal environmental science issues including carbon dioxide and the ocean's role in climate, El Niño and other ocean-atmosphere oscillations that influence our weather, coastal erosion and other hazards, coastal pollution, and fisheries. The focus is on controlling processes with regional comparisons. Blue water oceanography is conducted in the Atlantic and comparative coastal oceanography includes trips to southern New England shores, and the West and Gulf coasts of the US as part of the Williams-Mystic program. This course is in the Oceans and Climate group for the Geosciences major.

Class Format: including coastal and near-shore field trips, 11 days offshore, and a laboratory or field research project

Requirements/Evaluation: two tests, a research project, and a presentation

Prerequisites: none

Enrollment Limit: 24

Enrollment Preferences: none

Expected Class Size: 10

Grading: yes pass/fail option, yes fifth course option

Unit Notes: offered only at Mystic Seaport

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

MAST 211 (D3) GEOS 210 (D3)

Attributes: ENVI Natural World Electives EVST Living Systems Courses EXPE Experiential Education Courses GEOS Group A Electives - Climate + Oceans

Fall 2021

LEC Section: 01 TR 9:30 am - 10:45 am Rachel Scudder

LAB Section: 02 T 1:00 pm - 4:30 pm Rachel Scudder

Spring 2022

LEC Section: 01 TR 9:30 am - 10:45 am Rachel Scudder

LAB Section: 02 T 1:00 pm - 4:30 pm Rachel Scudder

GEOS 212 (S) Paleobiology

Cross-listings: GEOS 212 BIOL 211

Primary Cross-listing

The fossil record is a direct window into the history of life on Earth and contains a wealth of information on evolution, biodiversity, and climate change. This course investigates the record of ancient life forms, from single-celled algae to snails to dinosaurs. We will explore how, why, when, and where fossils form and learn about the major groups of fossilized organisms and how they have changed through time. In addition, we will cover a range of topics central to modern paleobiology. These include: how the fossil record informs our understanding of evolutionary processes including speciation; the causes and consequences of mass extinctions; how fossils help us tell time and reconstruct the Earth's climactic and tectonic history; statistical analysis of the fossil record to reconstruct biodiversity through time; analysis of fossil morphology to recreate the biomechanics of extinct organisms; and using fossil communities to reconstruct past ecosystems. Laboratory exercises will take advantage of Williams' fossil collections as well as published datasets to provide a broad understanding of fossils and the methods we use to study the history of life on Earth, including using the programming language R (no previous experience is required). We will also view a diversity of fossils in their geologic and paleo-environmental context on our field trip to Eastern New York. This course is in the Sediments and Life group for the Geosciences major.

Class Format: One day field trip to the the Paleozoic of New York State

Requirements/Evaluation: Weekly lab assignments, frequent short quizzes and writing assignments, and a final project with a written and oral presentation component.

Prerequisites: any 100-level GEOS course or BIOL 102, 203 or 205

Enrollment Limit: 24

Enrollment Preferences: sophomore and junior GEOS majors

Expected Class Size: 20

Grading: no pass/fail option, no fifth course option

Unit Notes: does not satisfy the distribution requirement for the Biology major

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 212 (D3) BIOL 211 (D3)

Attributes: EXPE Experiential Education Courses GEOS Group B Electives - Sediments + Life MAST Interdepartmental Electives

Spring 2022

LEC Section: 01 TR 9:55 am - 11:10 am Phoebe A. Cohen

LAB Section: 02 T 1:00 pm - 4:00 pm Phoebe A. Cohen

LAB Section: 03 W 1:00 pm - 4:00 pm Phoebe A. Cohen

GEOS 214 (S) Mastering GIS

Cross-listings: GEOS 214 ENVI 214

Primary Cross-listing

The development of Geographic Information Systems (GIS) has allowed us to investigate incredibly large and spatially complex data sets like never before. From assessing the effects of climate change on alpine glaciers, to identifying ideal habitat ranges for critically endangered species, to determining the vulnerability of coastal communities to storms, GIS tools have opened the door for important, large-scale environmental analyses. And as these technologies improve, our ability to understand the world grows ever greater. This course will teach you how to use GIS tools to investigate

environmental problems. We will review fundamental principles in geography, the construction and visualization of geospatial datasets, and tools for analyzing geospatial data. Special attention will also be given to analysis of remotely sensed (satellite) imagery and to collection of field data. By the end of the course, you will be able to conduct independent GIS-based research and produce maps and other geospatial imagery of professional quality.

Class Format: lecture, three hours per week and laboratory, three hours per week

Requirements/Evaluation: weekly lab exercises, weekly quizzes, and a research project

Prerequisites: at least one course in Geosciences or Environmental Studies

Enrollment Limit: 18

Enrollment Preferences: Geosciences majors and Environmental Studies majors and concentrators.

Expected Class Size: 18

Grading: yes pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 214 (D3) ENVI 214 (D3)

Attributes: ENVI Natural World Electives EVST Methods Courses EXPE Experiential Education Courses

Spring 2022

LEC Section: 01 MW 11:00 am - 12:15 pm José A. Constantine

LAB Section: 02 M 1:00 pm - 4:00 pm José A. Constantine

LAB Section: 03 W 1:00 pm - 4:00 pm José A. Constantine

GEOS 215 (F) Climate Changes

Cross-listings: GEOS 215 ENVI 215

Primary Cross-listing

In recent years, there has been a growing public and scientific interest in the Earth's climate and its variability. This interest reflects both concern over future climate changes resulting from anthropogenic increases in atmospheric greenhouse gases and growing recognition of the economic impact of "natural" climate variability (for example, El Niño events), especially in the developing world. Efforts to understand the Earth's climate system and predict future climate changes require both study of parameters controlling present day climate and detailed studies of climate changes in the past. In this course, we will review the processes that control the Earth's climate, like solar radiation, the greenhouse effect, ocean circulation, configuration of continents, and positive and negative feedbacks. At the same time, we will review the geological record of climate changes in the past, examining their causes. Laboratories and problem sets will emphasize developing problem solving skills as well as sampling and interpreting geological archives of climate change. This course is in the Oceans and Climate group for the Geosciences major.

Class Format: This class has three scheduled lectures per week, and one lab meeting per week which will consist of lab exercises, problem solving and discussion

Requirements/Evaluation: lab exercises and problem sets (25%), three exams (50%), and a final project (25%) where students will collect, analyze, and interpret data

Prerequisites: 100-level course in GEOS, CHEM, or PHYS or ENVI 102 or permission of instructor

Enrollment Limit: 16

Enrollment Preferences: Geosciences and Environmental Studies majors

Expected Class Size: 16

Grading: yes pass/fail option, yes fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 215 (D3) ENVI 215 (D3)

Attributes: ENVI Natural World Electives EVST Environmental Science EXPE Experiential Education Courses GEOS Group A Electives - Climate + Oceans MAST Interdepartmental Electives

Not offered current academic year

GEOS 217 (S) Planets and Moons

Cross-listings: ASTR 217 GEOS 217

Primary Cross-listing

This course examines the history and geology of the solar system. No two planets are exactly alike, and as we acquire more data and higher-resolution images, our sense of wonder grows. However, we can't hike around and hammer rocks on Venus or Titan, so we have to infer composition, form, texture and process from remotely-captured images and sparse chemical and spectral data. We will consider the origin of the solar system, the formation and evolution of planetary bodies, and the role of impacts, volcanism, tectonics and geomorphology in shaping them. We will summarize basic geological concepts of stratigraphy, structure and chronology and show how they can be applied off-world. We will review solar system exploration, and will include planetary data in lab exercises. This course is in the Solid Earth group for the Geosciences major.

Requirements/Evaluation: Periodic short quizzes, reading journal, lab exercises, class participation

Prerequisites: any 100-level GEOS or any 100-level ASTR course, or permission of instructor

Enrollment Limit: 20

Enrollment Preferences: Geosciences majors, Astronomy/Astrophysics majors, and sophomores

Expected Class Size: 12

Grading: yes pass/fail option, yes fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

ASTR 217 (D3) GEOS 217 (D3)

Attributes: GEOS Group C Electives - Solid Earth

Not offered current academic year

GEOS 220 (F) Evolution of and on Volcanic Islands (WS)

Cross-listings: GEOS 220 ENVI 219

Primary Cross-listing

Plate tectonic theory accounts for the vast majority of volcanic islands in ocean basins. They form above mantle plume hot spots (Hawaiian and Galapagos Islands), subduction zones (Aleutian and Indonesian arcs), and mid-ocean ridges (Azores and Ascension Island). Iceland is unusual because it is located above a hot spot and the mid-Atlantic ridge. Each plate tectonic setting produces chemically distinctive magmas, and the lifespan of volcanic islands varies widely. Islands above hot spots may be geographically remote and emergent for only several million years, but be part of a long-lived sequence of islands that persists for over a hundred million years. In contrast, island arc volcanoes belong to long geographically continuous chains of volcanoes, commonly in close proximity to continents. This tutorial explores the geologic evolution and lifespan of volcanic islands from formation to submergence, and searches for correlations between these characteristics and plate tectonic setting. We will also consider how geographic isolation, areal extent, lifespan, and climate affect biological evolution on volcanic islands.There will be weekly tutorial meetings with pairs of students, and students will alternate writing papers on assigned topics. This course is in the Solid Earth group for the Geosciences major.

Class Format: One-hour weekly meetings with tutorial partner and instructor

Requirements/Evaluation: five 5-page papers and critiques of partner's papers

Prerequisites: 100-level GEOS course or permission of instructor

Enrollment Limit: 10

Enrollment Preferences: Geosciences majors and students with a demonstrated interest in geosciences

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3) (WS)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 220 (D3) ENVI 219 (D3)

Writing Skills Notes: Students will write five 5-page papers and will receive instructor feedback on how to improve their writing skills and formulate

sound arguments.

Attributes: ENVI Natural World Electives GEOS Group C Electives - Solid Earth

Not offered current academic year

GEOS 221 (F) Examining Inconvenient Truths: Climate Science meets U.S. Senate Politics (WS)

Cross-listings: GEOS 221 ENVI 222 LEAD 221

Primary Cross-listing

Former President Barack Obama once said: "There's one issue that will define the contours of this century more dramatically than any other, and that is the urgent threat of a changing climate." While consensus regarding the causes and impacts of climate change has been growing steadily among scientists and researchers (and to some extent, the general public) over the past two decades, the U.S. has yet to confront this issue in a manner consistent with its urgency. This lack of action in the U.S. is at least partly due to the fact that science provides necessary but insufficient information towards crafting effective climate change legislation and the unfortunate fact that climate change has become a highly partisan issue. The primary objective of this tutorial will be to help students develop a greater understanding of the difficulties associated with crafting climate change legislation, with an emphasis on the role of science and politics within the legislative process. To this end, the tutorial will address how the underlying scientific complexities embedded in most climate policies (e.g., offsets, carbon capture and sequestration, uncertainty and complexity of the climate system, leakage) must be balanced by and blended with the different operational value systems (e.g., economic, social, cultural, religious) that underlie U.S. politics. Over the course of this tutorial, students will develop a nuanced sense of how and when science can support the development of comprehensive national climate change legislation within the current partisan climate. This course will take a practical approach, where students will craft weekly policy oriented documents (e.g., policy memos, action memos, research briefs) targeted to selected members of the current U.S. Senate Environment and Public Works Committee, the committee that has historically held jurisdiction over a majority of the major climate change bills that have moved through the legislative process. This course is in the Oceans and Climate group for the Geosciences major.

Requirements/Evaluation: weekly papers (2 - 5 pages in length) and a final oral presentation

Prerequisites: none

Enrollment Limit: 10

Enrollment Preferences: sophomores, Geosciences and Environmental Studies juniors and seniors

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3) (WS)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 221 (D3) ENVI 222 (D3) LEAD 221 (D3)

Writing Skills Notes: You will learn to write in a variety of policy-focused formats

Attributes: ENVI Environmental Policy EXPE Experiential Education Courses GEOS Group A Electives - Climate + Oceans

Not offered current academic year

GEOS 227 (S) Climate Data Analysis

Cross-listings: GEOS 227 ENVI 226

Primary Cross-listing

In this tutorial, students will learn how to access and work with the datasets that show how our climate is changing. The course introduces a series of analytical methods used in climate science, and students then apply those 'recipes' to data of their choosing to research parts of the climate system. Over the course of the term, a student might investigate the seasonality of global atmospheric carbon dioxide levels, maps of sea level anomalies, and the impact El Niño patterns have on Western US rainfall. Students will present their findings, and their insights into the particular aspect of the climate system, at weekly tutorial meetings. Analytical approaches covered in the class include climatologies, time series analysis (trends, periodicity, and autocorrelation), anomaly maps, composites, and zonal/meridional averaging. As for regions and climate systems students can explore: the sky is the limit. This course is in the Oceans and Climates group for the Geosciences major.

Class Format: Asynchronous recorded lectures will provide instruction on new analytical techniques every two weeks. Students will meet in pairs for one hour every week with the instructor: each student will present the results of their data analysis and their interpretation for discussion every other week.

Requirements/Evaluation: Five 3-4 page papers including figures made from analyzing data.

Prerequisites: At least one GEOS or ENVI course

Enrollment Limit: 10

Enrollment Preferences: Students with a strong interest in Geosciences and Geoscience majors.

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 227 (D3) ENVI 226 (D3)

Attributes: ENVI Natural World Electives EVST Environmental Science GEOS Group A Electives - Climate + Oceans

Spring 2022

TUT Section: T1 TBA Alice C. Bradley

GEOS 234 (S) Introduction to Materials Science (QFR)

Cross-listings: GEOS 234 PHYS 234

Secondary Cross-listing

Materials Science is the study of how the microscopic structure of materials--whether steel, carbon fiber, glass, wood, plastic, or mayonnaise--determines their macroscopic mechanical, thermal, electric, and other properties. Topics of this course include classifying materials; material structure; thermodynamics and phase transformations; material properties and testing; how solids bend, flow, and ultimately break; and how to choose the right material for design applications. Materials Science is a highly interdisciplinary field and as a result the course prerequisites are broad but also flexible. Interested students who are unsure about their preparation are strongly encouraged to contact the instructor.

Class Format: lecture (3 hours per week) plus three to four small-group laboratory sessions throughout the semester (to be scheduled with instructor)

Requirements/Evaluation: weekly problem sets, class participation, and midterm and final exams, all of which have a substantial quantitative component

Prerequisites: high school physics and chemistry, preferably at the AP level, and MATH 140 or AP Calculus (BC), and one 200-level PHYS, CHEM, or GEOS course; or permission of instructor

Enrollment Limit: 20

Enrollment Preferences: based on students' scientific background and seniority

Expected Class Size: 10

Grading: yes pass/fail option, yes fifth course option

Unit Notes: This course does not count toward the Geosciences major.

Distributions: (D3) (QFR)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 234 (D3) PHYS 234 (D3)

Attributes: MTSC Courses

Not offered current academic year

GEOS 250 (S) Climate,Tectonics, and Erosion (WS)

Traditionally tectonics investigated processes operating deep in the crust and mantle, whereas geomorphology focused on surficial processes that shape the landscape. This course explores the complex interactions between tectonic and surficial processes. It has long been recognized that crustal uplift during mountain building creates new landscapes, but we now suspect that variations in erosion rate can fundamentally influence the development of mountains. Climate plays a central role in this feedback loop; the rise of mountains can change climate, and such changes can alter regional erosion rates. This course will examine how geologists use characteristic markers to estimate the amount of surface uplift, methods for determining uplift rate, surface response to faulting and folding, measuring displacement of the crust with GPS and interferometry methods, how mountain building affects erosion and exhumation rates, the limits to relief in mountains, and the interaction between mountains and climate. This course is in the Solid Earth group for the Geosciences major.

Class Format: After an initial group meeting, students will meet in pairs for one hour each week with the instructor; each student will orally present a written paper every other week for criticism during the tutorial session

Requirements/Evaluation: five 4- to 5-page papers based on journal articles

Prerequisites: at least one of the following courses: GEOS 101, 102, 103, 202, 203, 215, 302, 303, 303 or permission of instructor

Enrollment Limit: 10

Enrollment Preferences: Geosciences majors and students with a strong interest in Geosciences

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3) (WS)

Writing Skills Notes: Five 4- to 5-page papers distributed throughout the semester. Students will receive from the instructor timely comments on their writing skills, with suggestions for improvement.

Attributes: GEOS Group C Electives - Solid Earth

Not offered current academic year

GEOS 255 (F) Environmental Observation

Cross-listings: GEOS 255 ENVI 255

Primary Cross-listing

To study the environment, we need to observe and measure it. We collect data--numbers that represent system states--and analyze them to create understanding of the world we live in. Advances in technology create more opportunities to discover how the planet works. Through a survey of observational approaches (including weather stations, direct sampling, remote sensing, community-based monitoring, and other techniques), this course will investigate the process of turning a physical property in the environment into a number on a computer and then into meaningful information. We will explore both direct field measurements and remote sensing techniques, diving into how to choose the appropriate sensor for a scientific question, how sensors work, analysis approaches and statistical methods, and how to interpret the resulting data. We will also learn how to mitigate measurement bias through a combination of lab experiments and field work and how to make interpretations of measurements that accurately reflect what is being measured. The course will focus on the near-surface environment, including the atmosphere, water, and biosphere. Students will carry out a research project using observation techniques covered in class to explore a scientific question of interest. This course is in the Oceans and Climate group for the Geosciences major.

Requirements/Evaluation: Weekly labs, four quizzes, and a final project

Prerequisites: at least one prior course in GEOS or ENVI

Enrollment Limit: 20

Enrollment Preferences: sophomores, then GEOS majors

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 255 (D3) ENVI 255 (D3)

Attributes: ENVI Natural World Electives EVST Methods Courses EXPE Experiential Education Courses GEOS Group A Electives - Climate + Oceans

Fall 2021

LEC Section: 01 MWF 10:00 am - 10:50 am Alice C. Bradley

LAB Section: 02 W 1:00 pm - 4:00 pm Alice C. Bradley

LAB Section: 03 R 1:00 pm - 4:00 pm Alice C. Bradley

GEOS 301 (F) Geomorphology

Cross-listings: GEOS 301 ENVI 205

Primary Cross-listing

Geomorphology is the study of landforms, the processes that shape them, and the rates at which these processes change the landscape in which we live. The course is designed for Geosciences majors and for environmental studies students interested in the evolution of Earth's surface and the ways our activities are changing the planet. We will examine the ways in which climatic, tectonic, and volcanic forces drive landscape evolution over relatively short periods of geologic time, generally thousands to a few millions of years. More recently, the impacts of human activity in reshaping landscapes, determining the movement of water, and changing climate could not be clearer. We will also examine how these impacts are affecting communities, including causes and possible solutions to environmental injustice. We will learn a range of practical skills for describing physical environments and for predicting how they change, including field surveys, GIS analysis, and numerical modelling. This course is in the Sediments and Life group for the Geosciences major.

Class Format: lecture, three hours per week and laboratory, three hours per week

Requirements/Evaluation: weekly lab exercises, a research project, and a midterm and final exam

Prerequisites: At least one 100-level and one 200-level GEOS or ENVI course or permission of instructor

Enrollment Limit: 18

Enrollment Preferences: GEOS and ENVI majors

Expected Class Size: 18

Grading: yes pass/fail option, yes fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 301 (D3) ENVI 205 (D3)

Attributes: AMST Space and Place Electives ENVI Natural World Electives EVST Environmental Science EXPE Experiential Education Courses GEOS Group B Electives - Sediments + Life

Fall 2021

LEC Section: 01 TR 9:55 am - 11:10 am José A. Constantine

LAB Section: 02 R 1:00 pm - 4:00 pm José A. Constantine

GEOS 302 (S) Sedimentology (WS)

Sediments and sedimentary rocks are the book in which Earth's history is recorded, where we read the stories of ancient oceans and continents, and how life evolved. Sand and dirt preserve information about the rocks that were eroded to form them, the fluids and forces that transported them, the ways in which they were deposited, and the ecosystems that they supported. Understanding sediments is also fundamental to society, for many kinds of civil engineering as well as pollution and environmental remediation. We will investigate sediment composition, fluid mechanics, bedforms, and depositional environments, building to an integrated understanding of erosion, deposition, and changes over time. We will also acknowledge and examine the roles that racism and colonialism have played in sedimentologic research. This course is in the Sediments and Life group for the Geosciences major.

Class Format: lecture/discussion three hours per week and laboratory three hours per week; field trips: two half-day and one all-day

Requirements/Evaluation: lab work, writing assignments, participation in discussions, and final exam.

Prerequisites: At least one course in GEOS Group B (Solid Earth) AND one course in GEOS Group C (Sediments and Life); or permission of instructor

Enrollment Limit: 15

Enrollment Preferences: Geosciences majors

Expected Class Size: 12

Grading: yes pass/fail option, no fifth course option

Distributions: (D3) (WS)

Writing Skills Notes: Weekly 2-3 page writing assignments will be thoroughly edited for style, grammar, and syntax; each student will compile their papers as a growing body of work, and each new assignment will be read and edited in the context of previous submissions.

Attributes: EXPE Experiential Education Courses GEOS Group B Electives - Sediments + Life MAST Interdepartmental Electives

Spring 2022

SEM Section: 01 TR 11:20 am - 12:35 pm Rónadh Cox

LAB Section: 02 R 1:00 pm - 4:00 pm Rónadh Cox

GEOS 303 (S) Igneous and Metamorphic Petrology

Using plate tectonics and the geologic assembly of New England as a template, this course explores the origin of crystalline rocks--volcanic, plutonic, and metamorphic--that comprise 94% of the Earth's crust. Field and lab studies are the crux of the course, supported by experimental work and thermodynamic principles. Chemical and mineralogical compositions and rock fabrics provide evidence for crystallization environments and tectonic settings, past and present. This course is in the Solid Earth group for the Geosciences major.

Class Format: Discussion, three hours per week and laboratory, two hours per week; several field trips during lab hours.

Requirements/Evaluation: lab work, one hour test, and a final exam

Prerequisites: GEOS 202 or permission of instructor

Enrollment Limit: 10

Enrollment Preferences: GEOS majors

Expected Class Size: 7

Grading: yes pass/fail option, no fifth course option

Distributions: (D3)

Attributes: GEOS Group C Electives - Solid Earth

Not offered current academic year

GEOS 309 (F) Modern Climate (QFR)

Cross-listings: GEOS 309 ENVI 209

Primary Cross-listing

What will happen to the Earth's climate in the next century? What is contributing to sea level rise? Is Arctic sea ice doomed? In this course we will study the components of the climate system (atmosphere, ocean, cryosphere, biosphere and land surface) and the processes through which they interact. Greenhouse gas emission scenarios will form the basis for investigating how these systems might respond to human activity. This course will explore how heat and mass are moved around the atmosphere and ocean to demonstrate how the geographic patterns of climate change arise. We will also focus on climate feedback effects--like the albedo feedback associated with sea ice and glacier loss--and how these processes can accelerate climate change. In labs we will learn MATLAB to use process and full-scale climate models to investigate the behavior of these systems in response to increasing greenhouse gasses in the atmosphere. This course is in the Oceans and Climate group for the Geosciences major.

Requirements/Evaluation: 4 multi-week lab projects and several short quizzes

Prerequisites: Any of GEOS 100, GEOS 103, ENVI 102, GEOS 215, or permission of instructor

Enrollment Limit: 30

Enrollment Preferences: GEOS and ENVI majors

Expected Class Size: 20

Grading: yes pass/fail option, yes fifth course option

Distributions: (D3) (QFR)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 309 (D3) ENVI 209 (D3)

Quantative/Formal Reasoning Notes: Labs consist of a series of numerical climate modeling projects, which require significant quantitative and logical reasoning.

Attributes: ENVI Natural World Electives EVST Environmental Science EVST Methods Courses GEOS Group A Electives - Climate + Oceans

Not offered current academic year

GEOS 312 (S) Mass Extinctions: Patterns and Processes

Over the last 542 million years of Earth history, five major mass extinctions have occurred, each dramatically changing the makeup and course of life

on our planet. During some of these events, over 75% of all marine animal species went extinct and groups like the dinosaurs vanished from the planet after over 100 million years of ecological dominance. This tutorial course will explore the idea of extinction from the evolution of the concept in human thought to current research on the mechanisms and patterns of extinctions through time. We will examine what makes an extinction "mass", delve into the causes and consequences of the major mass extinction events of the phanerozoic, and discuss the potential human-induced "6th extinction" event occurring in the present day. This course is in the Sediments and Life group for the Geosciences major.

Requirements/Evaluation: four 4-5-page papers, one revision, tutorial presentations, the student's effectiveness as a critic, and 1 problem set

Prerequisites: GEOS 101 or GEOS 212; or permission of instructor + any 200 level GEOS course

Enrollment Limit: 10

Enrollment Preferences: Geosciences majors

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

Attributes: GEOS Group B Electives - Sediments + Life

Not offered current academic year

GEOS 314 (S) Analytical Historical Geology (QFR)

In this course you will learn to collect, interpret, and analyze deep time paleontological, stratigraphic, and sedimentological records through readings, labs, and projects all coordinated around a week long spring break trip to explore the House Range of Utah. The Cambrian and Ordovician successions of Utah's West Desert offers an outstanding record of one of the most important periods in Earth history, tracking the rise of animal ecosystems and major increases in diversity. The first 6 weeks of class will be spent learning the fundamentals of quantitative methods in paleontology and stratigraphy. Labs will focus on skill building including learning basic coding in R, and learning how to interpret paleontological, sedimentological, and stratigraphic data. We will also read widely on the field locality and on the Cambrian and Ordovician Periods. During the field trip, we will explore the House Range. Students will learn skills including geological mapping, measuring stratigraphic section, finding and identifying fossils, and correlating rock units across basins. We will collect samples and data on the field trip and bring them back to Williams. The second 6 weeks of the course will be spent processing and analyzing the samples and data collected during the field trip, culminating in final projects to be done in small groups. Students will determine what data we will collect in the field. Examples might be trilobite taxonomy and phylogenetic analyses, quantitative biostratigraphic correlation using conodont fossils, reconstructing paleoenvironment based on sedimentological analyses of thin sections, or building a sequence stratigraphic framework for a subset of the field locality. This course is in the Sediments and Life group for the Geosciences major.

Class Format: weekly lectures, paper discussions, and hands-on labs

Requirements/Evaluation: short papers and lab assignments, spring break field course participation (REQUIRED), and a final group project

Prerequisites: GEOS majors who have taken at least one of the following courses: GEOS 212, GEOS 203, GEOS 324, GEOS 401, GEOS 302, or permission of instructor

Enrollment Limit: 10

Enrollment Preferences: junior and senior Geosciences majors

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3) (QFR)

Quantative/Formal Reasoning Notes: This course will rely on the programming language R. Students will learn how to code in R, and will use R to analyze large data sets of geological data. The majority of labs, as well as the final project, will rely on R, statistical analyses, and wrangling data.

Attributes: GEOS Group B Electives - Sediments + Life

Not offered current academic year

GEOS 317 (S) Current topics in Planetary Geology (WS)

Cross-listings: GEOS 317 ASTR 317

Primary Cross-listing

We will look in detail at geological processes on rocky and icy bodies of the Solar System. Each week will have a specific theme, and students will read a series of scientific articles on that topic. The readings will form the basis for writing and discussion. Areas to be investigated may include ice

ages on Mars, the origin of Earth's moon, tectonics on Venus, chaos terrain on Europa, geysers on Enceladus, cryovolcanism on Triton, methane lakes on Titan, the viability of mining in the Asteroid Belt, and the prospects for life on other worlds. This course is in the Solid Earth group for the Geosciences major.

Class Format: Students meet with the professor weekly, in pairs, with one student writing each week and the other critiquing; and both engaging in detailed discussion of the readings.

Requirements/Evaluation: Evaluation is based on written papers, critiques, and discussion.

Prerequisites: GEOS/ASTR 217 (Planets and Moons); OR any two courses at 200-level or higher in Geosciences and/or Astronomy; OR permission of instructor

Enrollment Limit: 10

Enrollment Preferences: Geosciences and Astronomy majors and prospective majors

Expected Class Size: 6

Grading: yes pass/fail option, yes fifth course option

Distributions: (D3) (WS)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 317 (D3) ASTR 317 (D3)

Writing Skills Notes: This tutorial-style course focuses on writing, with 6 papers (5-7 pages) written bi-weekly throughout the semester, and partner critiques in alternate weeks.

Attributes: GEOS Group C Electives - Solid Earth

Not offered current academic year

GEOS 324 (S) Corals and Sea Level

Cross-listings: GEOS 324 MAST 324 ENVI 324

Primary Cross-listing

In coastal communities, increasing flood damage from storm surges and chronic inundation by seawater are already happening as a result of sea level rise. How do we know what contributes to the observed change in sea level in the last century? What does the geological record teach us about what controls the natural variation in sea level on short and long timescales? How can we use this information to separate anthropogenic effects from natural change in modern systems? And how does this inform us on what to expect through the 21st century and beyond? In this course, we will examine how sea level is reconstructed using geological archives and how coral-based sea level data led to breakthroughs in our understanding of the long-term evolution of the ocean and climate, the controls in the timing of ice age cycles, the singularity of modern climate change, and how high the future seas will rise. During Spring Break, the class will travel to Barbados, a renowned locality for Quaternary sea level reconstruction, to observe modern and ancient reefs, and collect samples that will be the basis of individual or group projects in the second half of the semester. Participation in the Spring Break trip is not required for successful completion of the course, but course enrollment is necessary to attend the trip. This course is in the Oceans and Climate group for the Geosciences major.

Requirements/Evaluation: short papers, labs, participation in discussion, and a research project

Prerequisites: GEOS 104 or GEOS 210 or GEOS 215 or MAST 311 or permission of instructor

Enrollment Limit: 10

Enrollment Preferences: Geoscience majors, students who commit to the Spring Break trip

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

GEOS 324 (D3) MAST 324 (D3) ENVI 324 (D3)

Attributes: ENVI Natural World Electives EXPE Experiential Education Courses GEOS Group A Electives - Climate + Oceans

Not offered current academic year

GEOS 401 (F) Global Tectonics and the Rise of Mountains (WS)

Fifty years after the sea-floor spreading hypothesis was first verified using magnetic anomalies, we have spectacular data sets from paleomagnetism, seismology, volcanism, the Global Positioning System, and digital elevation models that provide rich details into the kinematics and mechanisms of present and past plate motions. We will read journal articles to explore how plate tectonics can help explain the evolution of mountain belts with special emphasis on the Appalachians.

Class Format: Remote, weekly one-hour meetings with tutorial partner and instructor

Requirements/Evaluation: five papers based on journal articles, and critiques of partner's papers

Prerequisites: GEOS 203, 302, or 303 or permission of instructor

Enrollment Limit: 10

Enrollment Preferences: senior Geosciences majors, then juniors

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Unit Notes: As a 400-level seminar, this capstone course is intended to build on and extend knowledge and skills students have developed during previous courses in the major

Distributions: (D3) (WS)

Writing Skills Notes: Five 5-page papers throughout the semester based and journal articles. Students will receive from the instructor timely comments on their writing skills, with suggestions for improvement.

Not offered current academic year

GEOS 404 (F) Coastal Processes and Geomorphology (QFR)

Cross-listings: ENVI 404 MAST 404 GEOS 404

Primary Cross-listing

Can people live safely along the coast? Recent events like SuperStorm Sandy and the Tohoku Tsunami have shown us how the ocean can rise up suddenly and wreak havoc on our lives and coastal infrastructure. Only educated geoscientists can evaluate the risks and define informed strategies to prevent future coastal catastrophes. Currently almost half the global population lives within 100 km of the coast, with a large percent of those living in densely populated cities (e.g., New York, New Orleans, Los Angeles, Shanghai, Hong Kong, Cape Town, Sydney, Mumbai). Despite the growing risks and challenges associated with climate change and rising sea levels, the coastal population continues to grow rapidly. To help ensure these growing populations can live safely along the coast requires a detailed understanding of the processes that shape the coastal zone. These processes act across a variety of scales, from deep-time geologic processes that dictate coastal shape and structure, to decadal-scale processes that determine shoreline position and evolution, to weekly and daily processes such as storms and tides. This course will provide an in-depth look at the forces--wind, waves, storms, and people--that shape the coastal zone, as well as the geologic formations--sandy beaches, rocky cliffs, barrier islands, deltas, and coral reefs--that are acted upon and resist these forces. Coastal dynamics are strongly affected by human interventions, such as seawalls, dredged channels, and sand dune removal, as well as by sea level rise and changes in storm frequency and magnitude associated with climate change. Finally, the course will provide students with a perspective on how the U.S. seeks to manage its coastal zone, focusing on sea level rise and coastal development. This class will include a quantitative lab that will use MATLAB software to model and evaluate various coastal processes. Students will gain a basic understanding of MATLAB functionality, and will be asked to independently apply what they have learned to various data sets provided by the instructor.

Class Format: lecture two times a week with a lab one time per week

Requirements/Evaluation: lab reports, tests, and an independent research project

Prerequisites: Either GEOS 104 or GEOS 210; or permission of instructor

Enrollment Limit: 12

Enrollment Preferences: senior Geosciences majors, then juniors

Expected Class Size: 10

Grading: yes pass/fail option, yes fifth course option

Unit Notes: As a 400-level seminar, this capstone course is intended to build on and extend knowledge and skills students have developed during previous courses in the major

Distributions: (D3) (QFR)

This course is cross-listed and the prefixes carry the following divisional credit:

ENVI 404 (D3) MAST 404 (D3) GEOS 404 (D3)

Quantative/Formal Reasoning Notes: This course will involve the use of MATLAB software to quantitatively analyze coastal process and geomorphological data.

Attributes: ENVI Natural World Electives

Fall 2021

LEC Section: 01 MW 8:30 am - 9:45 am Alex A. Apotsos

LAB Section: 02 F 8:30 am - 9:45 am Alex A. Apotsos

GEOS 405 (F) Geochemistry: Understanding Earth's Environment

Cross-listings: ENVI 405 GEOS 405

Primary Cross-listing

Rocks, water, air, life: what comprises these interconnected components of the Earth system? How do they interact today, and how did these interactions differ in the past? In this course we will study how chemical elements are distributed in the Earth, cycle through the Earth system, and act together to produce a planet that is habitable. As Earth's landscapes and oceans, and the life they harbor, have evolved through time, they have left an imprint in the geological record that we can read using geochemical tools such as molecular fossils, elemental ratios, and stable and radioactive isotopes. Topics include the synthesis of elements in stars, the formation and differentiation of planet Earth; radiometric dating; the major constituents of the atmosphere, rain, rocks, rivers and the ocean; how they're linked by chemical weathering and biological activity; and reconstruction of past environments. Students will explore these topics through lecture; reading and discussing articles from the scientific literature; and collecting, analyzing and interpreting data from environmental samples.

Requirements/Evaluation: seminar discussions, two 10-page lab reports, lab activities, and final project

Prerequisites: two 200-level GEOS courses and at least one of GEOS 302 or 303

Enrollment Limit: 10

Enrollment Preferences: senior Geosciences majors, then juniors

Expected Class Size: 10

Grading: no pass/fail option, no fifth course option

Unit Notes: As a 400-level seminar, this capstone course is intended to build on and extend knowledge and skills students have developed during previous courses in the major

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

ENVI 405 (D3) GEOS 405 (D3)

Attributes: ENVI Natural World Electives

Not offered current academic year

GEOS 410 (S) The Cryosphere

Cross-listings: ENVI 410 GEOS 410

Primary Cross-listing

The Earth's climate system is often described in terms of its spheres, including the atmosphere, biosphere, lithosphere, oceans, and the cryosphere. The cryosphere is the naturally occurring ice on Earth in all its many forms: snow, glaciers, ice sheets, sea ice, frozen lakes and rivers, and permafrost (frozen soil). These parts of the climate system may seem remote, but have implications for climate and weather around the world. Melting glaciers and ice sheets have already contributed to sea level rise, and are projected to do so even more in the future. This course will explore the cryosphere, including snow, sea ice, permafrost, and glaciers through lectures, hands-on and data analysis labs, reading journal articles, and a final project. A spring break field trip to Alaska offers the opportunity to get boots-on-the-snow experience with glaciers, sea ice, and permafrost. As a 400-level seminar, this capstone course is intended to build on and extend knowledge and skills students have developed during previous courses in the major.

Class Format: Class periods and lab periods will be used interchangeably based on the weather. The spring break trip to Alaska is optional.

Requirements/Evaluation: Evaluation will be based on short papers, labs responses, and a research project

Prerequisites: GEOS 215 or GEOS 255 or GEOS 309 or MAST 311 or permission of instructor

Enrollment Limit: 10

Enrollment Preferences: Senior GEOS majors, then other GEOS majors and senior ENVI majors

Expected Class Size: 10

Grading: yes pass/fail option, yes fifth course option

Unit Notes: As a 400-level seminar, this capstone course is intended to build on and extend knowledge and skills students have developed during previous courses in the major

Materials/Lab Fee: Labs will be outside during the winter: students should be prepared to dress appropriately for the weather.

Distributions: (D3)

This course is cross-listed and the prefixes carry the following divisional credit:

ENVI 410 (D3) GEOS 410 (D3)

Attributes: ENVI Natural World Electives

Spring 2022

SEM Section: 01 WF 8:30 am - 9:45 am Alice C. Bradley

LAB Section: 02 M 8:30 am - 9:45 am Alice C. Bradley

GEOS 411 (F) Geobiology

Geobiology--the study of interactions between earth and life over geologic timescales--is a new and interdisciplinary field that has grown out of exciting advances in earth and life sciences. During this course we will examine the many ways in which organisms -- from bacteria to trees -- have left their mark on our planet. Topics include the origin of life, the rise of oxygen in the earth's atmosphere, the evolution of biomineralization, the environmental context for animal evolution, the role of microbial communities in the earth system, the emergence of land plants, and the potential for planet-life interactions elsewhere in our solar system. Geobiology incorporates tools and ideas from geochemistry, paleontology, microbiology, and sedimentology. Class time will be divided between lectures and student-led discussions of primary literature. Labs will be varied and involve everything from growing our own microbial ecosystems to querying online databases and analyzing geological, geochemical, genetic, and paleontological data. Our field trip will take us to Upstate New York where we will sample water from a stratified lake and visit ancient microbial fossil reefs. The final project will involve writing a proposal in small groups on a geobiological topic based on the style and format of a National Science Foundation grant, and presenting the idea to the class.

Requirements/Evaluation: labs, short papers, final grant proposal and presentation

Prerequisites: GEOS 212 or GEOS 312T; or GEOS 101 + any 200-level GEOS course; or permission of instructor

Enrollment Limit: 15

Enrollment Preferences: senior Geosciences majors, then juniors

Expected Class Size: 10

Grading: no pass/fail option, yes fifth course option

Unit Notes: As a 400-level seminar, this capstone course is intended to build on and extend knowledge and skills students have developed during previous courses in the major

Distributions: (D3)

Attributes: EXPE Experiential Education Courses

Not offered current academic year

GEOS 493 (F) Senior Thesis: Geosciences

Geosciences senior thesis; this is part of a full-year thesis (493-494).

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

Fall 2021

HON Section: 01 TBA Phoebe A. Cohen

GEOS 494 (S) Senior Thesis: Geosciences

Geosciences senior thesis; this is part of a full-year thesis (493-494).

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

Spring 2022

HON Section: 01 TBA Phoebe A. Cohen

GEOS 497 (F) Independent Study: Geosciences

Geosciences independent study.

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

Fall 2021

IND Section: 01 TBA Phoebe A. Cohen

GEOS 498 (S) Independent Study: Geosciences

Geosciences independent study.

Grading: no pass/fail option, no fifth course option

Distributions: (D3)

Spring 2022

IND Section: 01 TBA Phoebe A. Cohen

Winter Study ----------

GEOS 11 (W) Islands in Deep Time: Lost and Found

Thousands of rocky islands sit on continental shelves, where they rise above sea level as drowned monadnocks. More are scattered across the oceans, where volcanic processes prevail. Due to their smaller size and distance from the nearest mainland, islands represent fragile settings where the balance between natural colonization and extinction is easily perturbed by human interference. With a recognizable geological history tracing back 500 million years, island paleoshores represent one of the oldest ecosystems on the planet. Former shores often reveal fossils preserved in life position (i.e. barnacles and corals), as well as distinct events related to storms. This course examines the geomorphology and paleontology of former islands preserved in the rock record, but now exhumed as fixed windows in ecological time showing how islands are created, how they disappear, and how life managed to reach distant outposts. Lectures include details on Wisconsin's Baraboo Archipelago and South Dakota's Black Hills in Cambrian time, the Ordovician Munk Archipelago on Canada's Hudson Bay, Devonian Mowanbini Archipelago of Western Australia, Jurassic Saint David's Archipelago of Wales, Cretaceous Eréndira islands of Mexico's Pacific coast, ending with Pliocene and Pleistocene examples of oceanic islands in Portuguese Madeira, Azores, and the Cape Verde Islands. Since 2000, UNESCO has sponsored a system of international Geoparks, many of which feature unusual island settings and draw attention to Geoheritage. Some paleoislands have already achieved conservation as Geoparks and others are potential candidates. Course readings will be assigned from the existing scientific literature.

Requirements/Evaluation: final project or presentation

Prerequisites: none

Enrollment Limit: 15

Enrollment Preferences: priority to first-year students with a demonstrated prior interest in or experience visiting national and state parks

Grading: pass/fail only

Unit Notes: Markes Johnson is Professor Emeritus in the Geosciences Department at Williams College and the author of several books on the geology of islands in Mexico's Gulf of California and elsewhere.

Materials/Lab Fee: none

Winter 2022

LEC Section: 01 MTWR 10:00 am - 12:50 pm Markes E. Johnson

GEOS 12 (W) Learning in Groups

We will explore theory and practice of learning collaboratively in teams, focusing on both workshop facilitation skills and the skills associated with being an active participant. We will engage with topics relevant to teaching, learning, and academic support through a mix of readings, reflections, and discussions from a variety of academic disciplines including: education, student development, cognitive and behavioral psychology, communication, and quantitative reasoning. This course is relevant to all, but is recommended for tutors and TAs working with students.

Requirements/Evaluation: final project or presentation

Prerequisites: none

Enrollment Limit: 20

Enrollment Preferences: students hired as spring semester tutors and TAs will be chosen first, then students who have been tutors and TAs

Grading: pass/fail only

Unit Notes: Laura Muller is Director of Quantitative Skills Programs and Peer Support. She has worked in both residence life (as a Resident Tutor at Kirkland House, Harvard University, and as Resident Supervisor for The Jackson Lab Summer Student Program) and as teacher-scholar (3 years at Boston College and 18 years at Wheaton College in Norton MA) before coming to Williams. She is excited to understand and facilitate student learning outside the classroom through her work with peer support on campus.

Materials/Lab Fee: none

Winter 2022

LEC Section: 01 Cancelled

GEOS 22 (W) Geosciences Research

Students will spend part of Winter Study doing fieldwork collecting data. Back at Williams, they will analyze the data. Each student will have responsibility for a subset of the data, and the individual sub-projects will contribute to the overall research.

Class Format: to be arranged with instructor

Requirements/Evaluation: final project

Prerequisites: two Geosciences courses; permission of the instructor required before registering for the course

Enrollment Limit: 3

Expected Class Size: 3

Grading: pass/fail only

Not offered current academic year

GEOS 31 (W) Senior Thesis: Geosciences

To be taken by students registered for Geosciences 493-494.

Class Format: thesis

Grading: pass/fail only

Distributions: (D3)

Winter 2022

HON Section: 01 TBA Phoebe A. Cohen

GEOS 99 (W) Independent Study: Geosciences

Open to upperclass students. Students interested in doing an independent project (99) during Winter Study must make prior arrangements with a faculty sponsor. The student and professor then complete the independent study proposal form available online. The deadline is typically in late September. Proposals are reviewed by the pertinent department and the Winter Study Committee. Students will be notified if their proposal is approved prior to the Winter Study registration period.

Class Format: independent study

Grading: pass/fail only

Winter 2022

IND Section: 01 TBA Phoebe A. Cohen