GEOLGY AND GEOPHYSICS  

GEOS F101X  The Dynamic Earth  
4 Credits
An introduction to how the Earth works and the geophysical and
geochemical basis for our understanding of the Earth, emphasizing
Alaskan examples. A course theme is that the Earth is changing around
us, at a variety of scales. In all laboratory exercises students collect,
analyze and interpret data, including that generated by a variety of
geochemical and geophysical tools. Includes at least one field exercise in
the Fairbanks area and an opportunity to observe freshly-poured lava.
Prerequisites: Placelement in WRTG F111X; placement in DEVFM F105.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0
GEOS F106X  Life in the Age of Dinosaurs  
4 Credits
Offered Spring Even-numbered Years
Promote a broader understanding of deep time through an examination
of life and environments during the Mesozoic, or "Age of Dinosaurs." Discussions and exercises will fo
focus on major events and processes that shaped the physical environments of the Mesozoic, such as the
formation and break up of continents, global climate, and changing sea
levels. Building on this foundation, the course will examine the fossil
record to learn what it reveals about the major patterns in the diversity
of terrestrial and marine life. Special emphasis will be placed on the
origin, extinction, and paleobiology of dinosaurs. Important groups of
temporary vertebrates and invertebrates, including marine reptiles,
mammals, flying reptiles, and ammonites will also be examined. The rise
of flowering plants and the importance of fossil floras in understanding
Mesozoic climates will be explored. Labs will provide opportunities
to examine and identify fossils and use them to reconstruct ancient
environments.
Prerequisites: Placement in WRTG F111X; placement in DEVFM F105.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0
GEOS F112X  The History of Earth and Life  
4 Credits
Offered Spring
Historical geologic interpretation, geologic time scale, stratigraphic
record and interpretation. Sedimentation and plate tectonics, fossil
record and utilization, biostratigraphy, and geologic evolution of the North
American continent. Lab examination of fossils, interpretation of geologic
maps and stratigraphic columns.
Prerequisites: GEOS F101X; placement in WRTG F111X; placement in
DEVFM F105.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0
GEOS F120X  Glaciers, Earthquakes and Volcanoes: Past, Present and Future  
4 Credits
A survey course for the nonspecialist on the causes, effects,
measurements and prediction of glaciers, earthquakes and volcanoes.
Prerequisites: Placement in WRTG F111X; placement in DEVFM F105.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0
GEOS F190  The Geology of Wine  
2 Credits
Offered Spring Even-numbered Years
This course explores the relationship between geology, climate, and
viticulture. Aspects of geology that influence landscape, soil development
and climate are evaluated in reference to their effects on wine-growing
regions. The geology, tectonic setting, soil and climate of individual
wine-growing areas will be explored through lectures, discussions, class
projects/presentations, and lab wine tastings.
Prerequisites: Student must be 21 years of age to enroll.
Lecture + Lab + Other: 1.5 + 0.5 + 0
GEOS F192  Seminar  
1-6 Credits
Lecture + Lab + Other: 0 + 0 + 0
GEOS F212  Geology of Alaska  
3 Credits
Offered As Demand Warrants
Modern geologic processes in Alaska as a basis for understanding past
gologic evolution of the region. The origin and recovery of Alaska's
petroleum and mineral resources will be discussed. For non-majors.
Prerequisites: GEOS F101X.
Lecture + Lab + Other: 3 + 0 + 0
GEOS F213  Mineralogy  
4 Credits
Offered Fall
Mineral chemistry, atomic structure, elementary crystallography,
optical crystallography and descriptive and determinative mineralogy.
Instrumental determinative techniques (x-ray diffraction, petrographic
microscope).
Prerequisites: MATH F151X (may be taken concurrently); CHEM F105X;GEOS F101X.
Lecture + Lab + Other: 2 + 6 + 0
GEOS F214  Petrology and Petrography  
4 Credits
Offered Spring
Origin, occurrence and classification of igneous and metamorphic
rocks. Laboratory work involves hand lens identification and thin section
examination of representative rocks.
Prerequisites: GEOS F213.
Lecture + Lab + Other: 2 + 6 + 0
GEOS F222  Fundamentals of Geospatial Science  
3 Credits
Offered As Demand Warrants
This course is an introduction to the principles and applications of
geospatial science (remote sensing, GIS and GPS). Fundamental
concepts include electromagnetic radiations, map projections, basic
computer science, data formats, map-reading and map-making, etc.
Practical exercises include field data collections using GPS, photo-
interpretation using image processing and GIS software packages.
Prerequisites: GEOG F222 or GEOS F101X.
Cross-listed with GEOG F222.
Lecture + Lab + Other: 2.5 + 1.5 + 0
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<tr>
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<tr>
<td>GEOS F225</td>
<td>Field and Computer Methods in Geology (n)</td>
<td>2</td>
<td></td>
<td>Basic field methods, including field notes, topographic maps, measurement of structural elements, field safety, illustration, field mapping, and the use of GPS for field work are discussed and practiced. Use of computers for processing geologic field data and analytical data, and integration of field data into a simple Geographic Information System. Computers are used for the production of reports and technical illustration. This course will fulfill the department requirement for computer literacy. Prerequisites: GEOS F214 or GEOS F262 (may be taken concurrently). Lecture + Lab + Other: 1 + 3 + 0</td>
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<tr>
<td>GEOS F252</td>
<td>Volcanism and Active Geology of the Island of Hawai'i</td>
<td>2</td>
<td>Offered Wintermester</td>
<td>A field-based course introducing students to the volcanism and active geology of the island of Hawai'i, and by extension, other oceanic islands. Topics include physical features of the volcanoes, plate tectonics and the origin of volcanism, and the development and &quot;life cycle&quot; of oceanic islands. Students cannot take both GEOS F252 and GEOS F352 for credit. Prerequisites: GEOS F101X, GEOS F120X or GE E F261. Stacked with GEOS F352. Lecture + Lab + Other: 7.5 + 25 + 0</td>
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<tr>
<td>GEOS F262</td>
<td>Rocks and Minerals</td>
<td>3</td>
<td>Offered Fall Even-numbered Years</td>
<td>Physical properties of minerals and rocks, classification, mode of occurrence and economic applications. Labs on recognition and measurement of physical properties. Course may not be used to satisfy degree requirements in geology or geological engineering. Prerequisites: GE F261, GEOS F101X. Lecture + Lab + Other: 2 + 3 + 0</td>
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<tr>
<td>GEOS F292</td>
<td>Seminar</td>
<td>1-6</td>
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<tr>
<td>GEOS F292P</td>
<td>Seminar</td>
<td>1-6</td>
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<tr>
<td>GEOS F304</td>
<td>Geomorphology (n)</td>
<td>3</td>
<td>Offered Fall</td>
<td>Surface features of the Earth and the processes which create or modify them. Application to Quaternary history, environmental science and related fields. Laboratory examination of topographic maps and aerial photographs, introduction to geomorphic measurements. Prerequisites: GEOS F101X. Lecture + Lab + Other: 3 + 0 + 0</td>
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<tr>
<td>GEOS F309</td>
<td>Tectonics (W)</td>
<td>3</td>
<td>Offered Fall</td>
<td>In-depth exploration of the theory of Plate Tectonics including plate boundary interactions—which trigger volcanoes and earthquakes, form mountain belts and oceans—via geochemistry, sedimentology, geophysics and structure. Understanding the creation and evolution of the lithosphere and mantle, how we detect tectonic processes and how present tectonic environments help reconstruct ancient crustal events. Prerequisites: WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; GEOS F112X; GEOS F214 or GEOS F262 (either may be taken concurrently). Lecture + Lab + Other: 3 + 0 + 0</td>
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<tr>
<td>GEOS F314</td>
<td>Structural Geology</td>
<td>4</td>
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<td>GEOS F315</td>
<td>Paleobiology and Paleontology (W, n)</td>
<td>4</td>
<td>Offered Fall</td>
<td>Survey of the history of life on Earth as represented in the fossil record. Contribution of paleontology to the study of evolution, past environments and paleogeography; biostratigraphically important invertebrate fossil groups and their temporal ranges; evolution of terrestrial flora and fauna; current issues in paleontology. Emphasis on recognition of major fossil groups and paleontological problem solving in labs and assignments. Prerequisites: BIOL F103X or BIOL F115X or GEOS F112X; MATH F152X; PHYS F103X or PHYS F211X. Lecture + Lab + Other: 3 + 3 + 0</td>
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<tr>
<td>GEOS F317</td>
<td>Paleontological Research and Laboratory Methods (O)</td>
<td>2</td>
<td>Offered Spring</td>
<td>Introduction to the research methods in paleontology. This course covers the fundamentals of fossil preparation, digital techniques for imaging and analyzing paleontological data, and discusses the current theory and practice of curation of fossil material in a museum setting. Common techniques for presenting research results to a scientific and public audience are also covered, with an emphasis on oral presentations. Labs emphasize practical experiences in the methods and presentation of research. Prerequisites: GEOS F101X and GEOS F112X. Lecture + Lab + Other: 1 + 3 + 0</td>
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GEOS F225  Lecture + Lab + Other: 2 + 3 + 0

GEOS F252  Lecture + Lab + Other: 3 + 3 + 0

GEOS F262  Lecture + Lab + Other: 3 + 3 + 0

GEOS F213  Lecture + Lab + Other: 3 + 3 + 0

GEOS F214  Lecture + Lab + Other: 3 + 3 + 0

GEOS F222  Lecture + Lab + Other: 3 + 3 + 0

GEOS F225  Lecture + Lab + Other: 2 + 3 + 0

GEOS F320  Sedimentology for Geological Engineers 3 Credits
Origin, classification, composition, transportation, deposition and diagenesis of sediments. Emphasis on sedimentary processes, sedimentary petrology and interpretation of ancient sedimentary rocks. Laboratory covers identification and description of hand specimens as well as techniques of textural and compositional analysis. Not intended for geoscience majors and does not substitute for GEOS F322. Special fees apply.

Corequisites: GEOS F213.

Lecture + Lab + Other: 2 + 3 + 0

GEOS F322  Stratigraphy and Sedimentation  (n) 4 Credits
Offered Fall
Analysis and interpretation of sedimentary rocks in stratigraphic successions based on comparison with features found in modern depositional environments. Application of the principles of facies analysis and litho-, bio-, sequence, and chronostratigraphy in surface and subsurface examples. Emphasis in the laboratory on interpretation of depositional environments based on lithofacies, biofacies and sedimentary structures and correlation of stratigraphic sequences using surface and subsurface data.

Prerequisites: GEOS F101X or GE F261; GEOS F112X.

Lecture + Lab + Other: 3 + 3 + 0

GEOS F332  Ore Deposits and Structure 3 Credits
Offered Spring
Distribution and characteristics (especially mineralogy, morphology, and structure) of major mineral deposit types with background on structural techniques. Emphasis on application to mineral exploration and development. Laboratory exercises stress recognition of major mineral deposit types, zoning and grade patterns; and use of structural techniques in mineral deposit exploration/development.

Prerequisites: GEOS F252 or GEOS F213 and GEOS F214.

Lecture + Lab + Other: 1 + 6 + 0

GEOS F339  Maps and Landscape Analysis  (n, n) 4 Credits
Offered Spring Odd-numbered Years
This course will build student knowledge and practical experience regarding the visualization and mapping of landform evolution in response to Earth surface processes. A semester long research project will allow students to gain experience in the collection and use of a variety of datasets and equipment used in landscape analysis including ground penetrating radar, real-time-kinematic GPS, Drones and GIS. Overnight field trip required. Special fees apply.

Prerequisites: GEOG F111X; GEOS F304.

Crosslisted with GEOG F339.

Lecture + Lab + Other: 3 + 3 + 0

GEOS F352  Volcanism and Active Geology of the Island of Hawai’i 2 Credits
Offered WINTERmester
A field-based course introducing students to the volcanism and active geology of the island of Hawai’i, and by extension, other oceanic islands. Topics include physical features of the volcanoes, plate tectonics and the origin of volcanism, and the development and “life cycle” of oceanic islands. Students cannot take both GEOS F252 and GEOS F352 for credit.

Prerequisites: GEOS F213 or GEOS F262; GEOS F214, GEOS F222 or GEOS F225.

Stacked with GEOS F252.

Lecture + Lab + Other: 7.5 + 25 + 0

GEOS F370  Sedimentary and Structural Geology for Petroleum Engineers  (n) 4 Credits
Offered Fall Odd-numbered Years
Origin and distribution of sedimentary rocks including depositional environments, stratigraphic relationships and structures. Emphasis on the relationship to petroleum occurrences and petroleum exploration. Laboratory exercises on mapping, structural problems and facies relationships in petroleum exploration.

Prerequisites: GEOS F101X or GE F261. Cross-listed with PETE F370.

Lecture + Lab + Other: 3 + 3 + 0

GEOS F375  Oral Communication Skills for Geoscientists 1 Credit
Offered As Demand Warrants
This course will give you skills and practice in oral communication, especially as applied to professional geology. The course will provide a comfortable environment for students to develop and improve their skills both in creating and delivering oral presentations. The specific focus will vary with the instructor.

Prerequisites: COJO F131X or COJO F141X; GEOS F225; junior standing.

Lecture + Lab + Other: 0.5 + 0 + 1.5

GEOS F380  Geological Hazards 3 Credits
Offered Spring
Survey of natural hazards and the disasters they cause, with emphasis on geological hazards in Alaska. Investigation of hazardous phenomena, prediction and mitigation. Topics to include: earthquakes, volcanoes, tsunamis, weather/climate, and asteroid impacts. Provides a foundation in basic geological hazards related to science, suitable for use in teaching, communications, policy and emergency management careers.

Prerequisites: GEOS F101X or GEOS F120X or GEOS F106X.

Lecture + Lab + Other: 3 + 0 + 0

GEOS F392  Seminar 1-6 Credits
Lecture + Lab + Other: 0 + 0 + 0

GEOS F392P  Seminar 1-6 Credits
Lecture + Lab + Other: 1-6 + 6 + 0

GEOS F398  Research 1-6 Credits
Lecture + Lab + Other: 0 + 0 + 0

GEOS F401  Invertebrate Paleontology  (n) 3 Credits
Offered Fall Even-numbered Years
Study of invertebrate phyla with extensive geologic records. Emphasis on principles of biostratigraphy and paleoecology, application to geologic problems and case studies from Alaska. Laboratory study of fossil assemblages with emphasis on stratigraphically significant groups. Designed to complement GEOS F322.

Prerequisites: GEOS F315.

Recommended: GEOS F322.

Lecture + Lab + Other: 2 + 3 + 0
GEOS F406  Volcanology  3 Credits  
Offered Spring Odd-numbered Years  
Physical processes of volcanism. Topics include physical properties of magmas, eruption mechanisms, deposition mechanism and volcanic hazards. Emphasis on explosive volcanism and its products, pyroclastic rocks. Geochemistry and petrology will not be emphasized in this course.  
Prerequisites: GEOS F101X or GEOS F120X; MATH F251X; PHYS F103X or PHYS F211X. 
Lecture + Lab + Other: 3 + 0 + 0  

GEOS F408  Photogeology  (n)  2 Credits  
Offered Spring Even-numbered Years  
Use of topographic maps, geologic maps, aerial photographs and satellite imagery in interpretation of geological structures, landscapes, landforms and geomorphic processes. Techniques included are map compilation, photo mapping, statistical treatment of map data and composite mapping for planning.  
Prerequisites: GEOS F304. 
Lecture + Lab + Other: 2 + 3 + 0  

GEOS F416  Applied Geophysics  (n)  3 Credits  
Offered Spring Even-numbered Years  
Introduction to the theory and practice of geophysical techniques and the interpretation and modeling of geophysical data. Topics include: gravity, GPS, magnetic seismic, and electrical methods and their application to regional and local geophysical exploration in Alaska.  
Prerequisites: GEOS F318. 
Lecture + Lab + Other: 2 + 3 + 0  

GEOS F417  Introduction to Geochemistry  (n)  3 Credits  
Offered Fall  
Application of chemical principles and elemental/isotopic behavior to the study of the Earth. Topics include: aqueous geochemistry, high-temperature mineral-elemental chemistry, isotopic chemistry, kinetics and thermochromy.  
Prerequisites: CHEM F106X; GEOS F322 or CHEM F202. 
Stacked with GEOS F618. 
Lecture + Lab + Other: 3 + 0 + 0  

GEOS F419  Solid Earth Geophysics  3 Credits  
Offered Alternate Fall  
Concepts and techniques of geophysics including origin of the Earth, its structure and large scale dynamic processes responsible for its surface features. Geophysical techniques including seismology, gravity and magnetic methods are discussed along with measurements of the Earth's thermal structure, rotation rates, and tidal effects.  
Prerequisites: MATH F251X; PHYS F104X. 
Lecture + Lab + Other: 3 + 0 + 0  

GEOS F422  Geoscience Applications of Remote Sensing  (n)  3 Credits  
Offered Fall  
Remote sensing and its applications to geologic, environmental and physical sciences. Includes physical principles, digital image processing and hands-on project experience using satellite images for mapping and change detection. Course is not available for audit.  
Prerequisites: PHYS F104X or PHYS F212X; junior standing. 
Lecture + Lab + Other: 2 + 3 + 0  

GEOS F428  Elementary Scanning Electron Microscopy  1 Credit  
Offered Spring  
Basic theory and operating procedures for scanning electron microscopy. Includes sample preparation, imaging and qualitative elemental analysis. Biological and nonbiological applications are covered.  
Prerequisites: Junior standing. 
Stacked with GEOS F628. 
Lecture + Lab + Other: 0.5 + 1.5 + 0  

GEOS F430  Statistics and Data Analysis in Geology  (n)  3 Credits  
Offered Spring  
Applications of continuum mechanics, heat flow theory, and potential theory to geophysical, geologic and glaciological problems. Topics such as postglacial rebound, non-Newtonian fluid flow, thermal convection, stress-relaxation, rheology of earth materials, gravity, and magnetics will be discussed. Emphasis will be placed on methods and tools for solving a variety of problems in global and regional geophysics and the geophysical interpretation of solutions.  
Prerequisites: GEOS F419, MATH F302, and MATH F314. 
Stacked with GEOS F631. 
Lecture + Lab + Other: 3 + 0 + 0  

GEOS F431  Foundations of Geophysics  4 Credits  
Offered Fall  
Applications of continuum mechanics, heat flow theory, and potential theory to geophysical, geologic and glaciological problems. Topics such as postglacial rebound, non-Newtonian fluid flow, thermal convection, stress-relaxation, rheology of earth materials, gravity, and magnetics will be discussed. Emphasis will be placed on methods and tools for solving a variety of problems in global and regional geophysics and the geophysical interpretation of solutions.  
Prerequisites: GEOS F419, MATH F302, and MATH F314. 
Stacked with GEOS F631. 
Lecture + Lab + Other: 3 + 3 + 0  

GEOS F436  Beyond the Mouse: Computer Programming and Automation for Geoscientists  2 Credits  
Offered Fall  
Basic concepts of computer programming and effective automation of tasks using a computer, with an emphasis on tools and problems common to the geosciences and other physical sciences. Use of MATLAB, shell scripting and various command line tools for data analysis, making scientific figures, maps and visualizations.  
Prerequisites: Senior standing. 
Stacked with GEOS F636. 
Lecture + Lab + Other: 1 + 3 + 0  

GEOS F438  Basin Analysis  3 Credits  
Offered Spring Odd-numbered Years  
Examines sedimentary basins as a record of subsidence. Review and discuss techniques used to image basin stratigraphy as well as the quantitative techniques which can be used to recover basin history.  
Prerequisites: GEOS F322 or GEOS F370. 
Recommended: GEOS F314; GEOS F419. 
Stacked with GEOS F638. 
Lecture + Lab + Other: 3 + 0 + 0
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<tr>
<td>GEOS F445</td>
<td>Petroleum Geology</td>
<td>3</td>
<td>Fall Odd</td>
<td>Examines the origin of petroleum, the geologic controls of its distribution and accumulation and the basic tools used in exploration and exploitation, including subsurface mapping, well logging and exploration geophysics.</td>
<td>GEOF F314 and GEOF F322. Cross-listed with ANTH F451. Stacked with GEOS F645; PETE F645. Lecture + Lab + Other: 3 + 0 + 0</td>
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<tr>
<td>GEOS F452</td>
<td>Quaternary Seminar</td>
<td>3</td>
<td>Demand Warrants</td>
<td>Discussion of the Quaternary Period (relatively recent past – spanning the past two million years) in order to gain a better understanding of the landscape, biota and climate of the present day. Quaternary studies are concerned with the historical dimension of the natural sciences. This seminar will range widely over diverse interdisciplinary subjects of Quaternary interest, such as paleoclimatology, paleobiogeography, vertebrate paleontology and sedimentology.</td>
<td>GEOF F304; GEOF F315; GEOF F322. Cross-listed with ANTH F451. Stacked with GEOS F651; ANTH F651. Lecture + Lab + Other: 3 + 0 + 0</td>
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<tr>
<td>GEOS F453</td>
<td>Palynology and Paleopalynology</td>
<td>4</td>
<td>Fall Even</td>
<td>Survey of the evolutionary record of palynomorphs and their uses in biostratigraphy and paleoclimatology. Focus on evolution of palynomorphs from Precambrian to the present and concurrent evolutionary developments of producing plants. Use of Quaternary palynofloras in reconstructing global climates. Labs involve collection of herbarium specimens, processing of fossil palynomorphs, study of type slides and a survey of palynofloras from each geologic period.</td>
<td>GEOF F304 or GEOS F315; GEOF F322. Cross-listed with ANTH F451. Stacked with GEOS F651. Lecture + Lab + Other: 3 + 0 + 0</td>
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<tr>
<td>GEOS F454</td>
<td>Field Geology</td>
<td>8</td>
<td>Summer Odd</td>
<td>Practical experience in a variety of field settings collecting and presenting basic geologic field data. Includes field mapping of stratigraphic and structural problems using topographic maps, airborne and satellite images. Students will prepare geologic maps in a variety of tectonic and lithologic settings and develop written reports detailing the geologic history for several study areas. Exercises in collection and use of geophysical data as an aid to geologic mapping. Hiking off trails in a variety of terrains with up to 2,000 vertical feet of elevation gain per day. Course fees cover transportation and subsistence outside of Fairbanks. Entrance by preregistration only; apply through the department. Early registration recommended.</td>
<td>GEOF F214; GEOF F225; GEOF F309; GEOF F314; GEOF F315; GEOF F322. Lecture + Lab + Other: 8 + 0 + 0</td>
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<tr>
<td>GEOS F456</td>
<td>Paleopedology</td>
<td>3</td>
<td>Fall Even</td>
<td>A survey course focusing on the recognition and use of paleosols (fossil soils) as paleoenvironmental indicators, stratigraphic markers and in paleogeographic reconstructions from Precambrian to Holocene. Examination of theories of soil formation, major soil processes and approaches to soil classification. Review of geochemical, mineralogical, morphological and micromorphological techniques. Use of paleosols for paleolandscape evolution and basin analysis. Geological, tectonic, archaeological and environmental applications of paleosols are discussed.</td>
<td>GEOF F322 or NRM F380. Cross-listed with ANTH F451. Stacked with GEOS F656. Lecture + Lab + Other: 3 + 0 + 0</td>
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<tr>
<td>GEOS F460</td>
<td>The Dynamic Alaska Coastline</td>
<td>3</td>
<td>Spring Even</td>
<td>Alaska's diverse coastal system provides abundant ecosystem services and globally important resources. This course provides an interdisciplinary perspective on the dynamic coastal landscape of Alaska from Southcentral to the Arctic, and delves into the driving geological, oceanographic and climate processes shaping Alaska's past and present coastline. Through a semester long research projects students will learn how to measure and map coastal changes associated with natural and human perturbations. An overnight field trip will serve as an active learning opportunity to integrate course knowledge with hands-on field work.</td>
<td>GEOG F338 or NRM F338. Cross-listed with ANTH F451. Stacked with GEOS F660; GEOG F660. Lecture + Lab + Other: 3 + 0 + 0</td>
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<tr>
<td>GEOS F462</td>
<td>Glacial &amp; Periglacial Geology</td>
<td>(n)</td>
<td></td>
<td>Offered Fall Even-numbered Years A course focusing on the history of glacial landscape evolution and the distribution of glacial and periglacial processes, including sheets, ribbons, and beds of ice.</td>
<td>GEOG F304; ANTH F451. Cross-listed with ANTH F451. Stacked with GEOS F660; GEOG F660. Lecture + Lab + Other: 3 + 0 + 0</td>
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GEOS F463  Glacial and Periglacial Geology (O, n) 4 Credits
Offered Fall Odd-numbered Years
Prerequisites: COJO F131X or COJO F141X; GEOS F304.
Stacked with GEOS F663.
Lecture + Lab + Other: 3 + 3 + 0

GEOS F465  Geoarchaeology (a) 3 Credits
Offered As Demand Warrants
Geological context of archaeological sites and the geologic factors that affect their preservation, with emphasis on Alaska. Includes a one or two-day weekend field trip in late April or early May.
Prerequisites: GEOS F101X; an introductory course in archaeology.
Crosslisted with ANTH F465.
Lecture + Lab + Other: 3 + 0 + 0

GEOS F475  Presentation Techniques in the Geosciences (O, W) 2 Credits
Offered Fall
Instruction and practice in oral and written communication skills specifically related to the geosciences. Oral and written presentation of abstracts, resumes, proposals and reports required. Works critically analyzed by instructor(s) and peers for both geoscience content and communication effectiveness.
Prerequisites: COJO F131X or COJO F141X; WRTG F211X, WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; senior standing.
Stacked with GEOS F675.
Lecture + Lab + Other: 1 + 3 + 0

GEOS F477  Ice in the Climate System (O, n) 3 Credits
Offered Spring Even-numbered Years
Earth's cryosphere includes seasonal snow, permafrost, sea ice, mountain glaciers and ice sheets. This course will cover the formation of each of these forms of snow and ice and their response to changing environmental conditions. Interdisciplinary perspectives allow study of the role snow and ice plays within the Arctic system (including atmosphere, ocean and ecosystems), with an emphasis on Alaska. The cryosphere will also be placed in context of the global climate system. Course will include instructor and peer feedback.
Prerequisites: PHYS F103X or PHYS F211X, MATH F251X.
Lecture + Lab + Other: 2 + 3 + 0

GEOS F478  Ice Age Alaska (a) 3 Credits
An overview of the paleoenvironments of Alaska including climate, glacier and biotic history including humans. Emphasis on events of the past that have left important legacies on present landscapes. The course begins with two weekend field trips and then surveys key literature describing Alaska's ice-age history. The focus is on Alaska and the Yukon, but topics will range more widely into other parts of the Arctic and its adjacent seas.
Prerequisites: Senior standing in anthropology, biological Sciences, Earth science, geography, geoscience, or northern studies.
Cross-listed with GEOG F478.
Stacked with GEOG F678;GEOS F678.
Lecture + Lab + Other: 3 + 0 + 0

GEOS F482  Geoscience Seminar 1 Credit
A weekly seminar, given by guest speakers, on a topic in geosciences. Students are expected to prepare for the seminars and to participate in discussion following the seminars.
Stacked with GEOS F682.
Lecture + Lab + Other: 1 + 0 + 0

GEOS F483  Research Design, Writing and Presentation Methods (O, W, n) 3 Credits
Offered Fall
This course is designed as a capstone research and professional development course for geography, natural resources management and geoscience majors. Students will focus on designing an individual research project and proposal. This course will provide real world active learning assignments that seek to integrate the knowledge and skills gained through undergraduate work, and prepares students for graduate and professional level projects. The course will focus on scientific writing, and the oral, written and graphical presentation of data and research results.
Prerequisites: COJO F131X or COJO F141X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; junior standing.
Cross-listed with GEOG F483.
Lecture + Lab + Other: 3 + 0 + 0

GEOS F485  Mass Extinctions, Neocatastrophism and the History of Life 3 Credits
Offered Spring Odd-Numbered Years
In-depth analysis of the literature regarding mass extinction, focusing on evidence for catastrophes and impact on the uniformitarian paradigm. Effects of mass extinctions on the evolutionary history of extant and fossil animals and plants will be explored through readings from classic and current literature in paleontology. The course will emphasize critical reading and application of scientific methods to reconstruction of geologically rapid events in deep time.
Prerequisites: GEOS F322 and GEOS F315.
Lecture + Lab + Other: 3 + 0 + 0

GEOS F486  Vertebrate Paleontology (n) 3 Credits
Offered Spring Odd-numbered Years
The study of vertebrate evolution through geologic time. Covers the temporal range, diversity and systematics of major vertebrate groups as documented in the fossil record, with an emphasis on current problems in vertebrate evolutionary pattern and process. Labs emphasize comparative morphology and identification of major vertebrate groups.
Prerequisites: BIOL F310 or GEOS F315.
Cross-listed with BIOL F486.
Stacked with GEOS F686; BIOL F686.
Lecture + Lab + Other: 2 + 3 + 0

GEOS F488  Undergraduate Research 1-3 Credits
Advanced research topics from outside the usual undergraduate requirements.
Prerequisites: Permission of instructor.
Recommended: A substantial level of technical/scientific background.
Lecture + Lab + Other: 1-3 + 0 + 0
GEOS F488P  Undergraduate Research
1-3 Credits
Advanced research topics from outside the usual undergraduate requirements.
**Prerequisites:** Permission of instructor.
**Recommended:** A substantial level of technical/scientific background.

**Lecture + Lab + Other:** 1-3 + 0 + 0

GEOS F492  Seminar
1-6 Credits
**Lecture + Lab + Other:** 0 + 0 + 0

GEOS F492P  Seminar
1-6 Credits
**Lecture + Lab + Other:** 0 + 0 + 0

GEOS F499  Geology and Geophysics Senior Thesis
3 Credits
This course is intended for talented students to explore geology or geophysics more deeply through research under the mentorship of a faculty member in the department.
**Prerequisites:** Geology and Geophysics major with senior standing and a GPA of 3.2 or higher, completion of a minimum of 2 credits of GEOS F488 on a project approved by faculty mentor and department chair, and submission of a proposal approved by faculty mentor and department chair.

**Lecture + Lab + Other:** 3 + 0 + 0

GEOS F600  Introduction to X-ray Spectrometry
3 Credits
Offered Fall
Theory of X-ray spectrometry, qualitative and quantitative elemental analysis. Mechanics of electron, microprobe and X-ray fluorescence analysis. Applicable to geologic, materials science and biologic samples. Required for use of the microprobe at UAF.
**Prerequisites:** PHYS F212X; STAT F300; GEOS F417; graduate standing in the sciences or engineering.

**Lecture + Lab + Other:** 2 + 3 + 0

GEOS F602  Geophysical Fields
3 Credits
Offered Spring Odd-numbered Years
Introduction to the application of potential theory and its associated mathematical tools to fields of geophysical interest, namely gravity, magnetics, and heat flow. Emphasis will be placed on methods and tools for solving a variety of problems in global and regional geophysics, and the geophysical interpretation of solutions.
**Prerequisites:** MATH F421 and MATH F422; or graduate standing.

**Lecture + Lab + Other:** 3 + 0 + 0

GEOS F604  Seismology
3 Credits
Offered Spring Odd-numbered Years
Sources of ground motion including focal mechanisms, magnitude and propagation of waves within the earth. Measurement of seismic data by analog and digital techniques and subsequent treatment of seismic data by various techniques including inversion.

**Lecture + Lab + Other:** 3 + 0 + 0
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Offered</th>
<th>Prerequisites</th>
<th>Lecture + Lab + Other</th>
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<tr>
<td>GEOS F614</td>
<td>Ice Physics</td>
<td>(a) 3</td>
<td>Spring Even-numbered</td>
<td>MATH F421 and MATH F422; OR graduate standing.</td>
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<td>GEOS F615</td>
<td>Sea Ice</td>
<td>(a) 3</td>
<td>Fall Odd-numbered Years</td>
<td>GEOS F417.</td>
<td>3 + 0 + 0</td>
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<td>GEOS F616</td>
<td>Permafrost</td>
<td>(a) 3</td>
<td>Spring Odd-numbered</td>
<td>MATH F421 and MATH F422; OR graduate standing.</td>
<td>3 + 0 + 0</td>
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<tr>
<td>GEOS F617</td>
<td>Glaciers</td>
<td>(a) 3</td>
<td>Fall Odd-numbered Years</td>
<td>GEOS F417.</td>
<td>3 + 0 + 0</td>
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<td>GEOS F618</td>
<td>Introduction to Geochemistry</td>
<td>3</td>
<td>Fall</td>
<td>CHEM F106X; GEOS F322 OR CHEM F331 and CHEM F332; graduate standing.</td>
<td>3 + 0 + 0</td>
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<tr>
<td>GEOS F619</td>
<td>Advanced X-ray Spectroscopy</td>
<td>2</td>
<td>As Demand Warrants</td>
<td>GEOS F600.</td>
<td>1 + 3 + 0</td>
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<tr>
<td>GEOS F620</td>
<td>Geodynamics</td>
<td>3</td>
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<td>MATH F253X; MATH F314.</td>
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<td>GEOS F621</td>
<td>Advanced Petrology: Igneous Petrology</td>
<td>4</td>
<td>As Demand Warrants</td>
<td>MATH F253X; MATH F314.</td>
<td>3 + 3 + 0</td>
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<tr>
<td>GEOS F622</td>
<td>Digital Image Processing in the Geosciences</td>
<td>3</td>
<td>Fall Odd-numbered Years</td>
<td>CHEM F106X; GEOS F322 OR CHEM F331 and CHEM F332; graduate standing.</td>
<td>3 + 0 + 0</td>
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<td>GEOS F626</td>
<td>Applied Seismology</td>
<td>4</td>
<td>Spring Even-numbered</td>
<td>MATH F253X; MATH F314.</td>
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**Prerequisites:**
- GEOS F417
- CHEM F106X; GEOS F322 OR CHEM F331 and CHEM F332; graduate standing.
- MATH F421 and MATH F422; OR graduate standing.
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<th>Description</th>
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| GEOS F627   | Inverse Problems and Parameter Estimation          | 3       | Spring Odd-numbered Years | An inverse problem uses observations to infer properties of an unknown physical model. One example is how seismometer recordings can be used to infer the location of an earthquake. This course covers inverse theory and methods for solving inverse problems, including numerous examples arising in the natural sciences. Topics include linear regression, method of least squares, discrete ill-posed inverse problems, estimation of uncertainties, iterative optimization, and probabilistic (Bayesian) and sampling approaches. Assignments and computational laboratory exercises require familiarity with linear algebra and computational tools such as Matlab.  
Prerequisites: MATH F253X; MATH F314.  
Cross-listed with PHYS F625.  
Lecture + Lab + Other: 2 + 3 + 0 |
| GEOS F628   | Elementary Scanning Electron Microscopy            | 1       | Spring           | Basic theory and operating procedures for scanning electron microscopy. Includes sample preparation, imaging and qualitative elemental analysis. Biological and nonbiological applications are covered.  
Prerequisites: Graduate standing.  
Stacked with GEOS F428.  
Lecture + Lab + Other: 0.5 + 1.5 + 0 |
| GEOS F629   | Geologic Hazards and Natural Disasters             | 3       | Spring Odd-numbered Years | Examination of hazardous geologic processes which produce natural disasters, including volcanism, tectonism, flooding, etc. Includes scientific approaches to evaluating the magnitude and probability of risk from future hazardous events.  
Prerequisites: Graduate standing.  
Lecture + Lab + Other: 3 + 0 + 0 |
| GEOS F631   | Foundations of Geophysics                          | 4       | Fall             | Applications of continuum mechanics, heat flow theory, and potential theory to geophysical, geologic and glaciological problems. Topics such as postglacial rebound, non-Newtonian fluid flow, thermal convection, stress-relaxation, rheology of earth materials, gravity, and magnetics will be discussed. Emphasis will be placed on methods and tools for solving a variety of problems in global and regional geophysics and the geophysical interpretation of solutions.  
Prerequisites: Graduate standing.  
Recommended: GEOS F419; MATH F302; MATH F314.  
Stacked with GEOS F431.  
Lecture + Lab + Other: 3 + 3 + 0 |
| GEOS F632   | Aquatic and Environmental Geochemistry             | 3       | Spring Odd-numbered Years | Chemistry of aquatic and terrestrial environments, covering thermodynamic, kinetic and structural principles involved in aqueous geochemical systems; builds on prior physical chemistry courses. Emphasis on aquatic speciation and heterogeneous interactions (dissolution/precipitation, sorption and microbial processes) involved in the partitioning, transformation and transport of chemical species in the environment.  
Prerequisites: ENVE F641 or GEOS F618.  
Cross-listed with CHEM F609.  
Lecture + Lab + Other: 3 + 0 + 0 |
| GEOS F635   | Advanced Economic Geology                          | 1-4     | As Demand Warrants | An advanced course providing an in-depth treatment of various aspects of economic geology. Specific topics will be considered in different semesters. They include ore microscopy, industrial minerals, economics of minerals, geochemistry of ore deposits, modern fossil fuel exploration and detailed study of particular ore deposit type. Each time the course is offered, only one topic will be presented. May be repeated for credit.  
Prerequisites: Graduate standing.  
Lecture + Lab + Other: 1-4 + 3 + 0 |
| GEOS F635D  | Geochemistry of Ore Deposits                       | 1-4     |                  | Offered As Demand Warrants  
Lecture + Lab + Other: 1-4 + 3 + 0 |
| GEOS F635F  | Adv Econ Geology: Ore Deposits                     | 1-4     |                  |  
Lecture + Lab + Other: 1-4 + 3 + 0 |
| GEOS F636   | Beyond the Mouse: Computer Programming and Automation for Geoscientists | 2       | Fall             | Basic concepts of computer programming and effective automation of tasks using a computer, with an emphasis on tools and problems common to the geosciences and other physical sciences. Use of MATLAB, shell scripting and various command line tools for data analysis, making scientific figures, maps and visualizations.  
Prerequisites: Graduate standing.  
Stacked with GEOS F436.  
Lecture + Lab + Other: 1 + 3 + 0 |
| GEOS F637   | Rock-Forming Minerals                              | 4       | Spring Odd-numbered Years | Examination of the rock-forming minerals; their structure and composition. Application of mineral data to problems in geochemy, petrology and ore deposits. Laboratory involves analysis of minerals by various analytical techniques.  
Prerequisites: GEOS F417 and permission of instructor; or graduate standing.  
Lecture + Lab + Other: 3 + 3 + 0 |
GEOS F638  Basin Analysis
3 Credits
Offered Spring Odd-numbered Years
Examines sedimentary basins as a record of subsidence. Review and
discuss techniques used to image basin stratigraphy as well as the
quantitative techniques which can be used to recover basin history.
Prerequisites: Graduate standing.

GEOS F639  InSar and Its Applications
3 Credits
Offered As Demand Warrants
Introduction to the concepts of repeat-pass spaceborne SAR
interferometry. Practical use of the technique to derive displacements of
the solid earth, glaciers and ice sheets to a precision of a few centimeters
and accurate digital elevation models of the Earth’s surface.
Prerequisites: Basic remote sensing course.

GEOS F640  Petrology of Carbonate Rocks
4 Credits
Offered Spring As Demand Warrants
Origin, depositional environments, diagenesis and classification of
limestones, dolostones and related rocks.
Prerequisites: Graduate standing.

GEOS F643  Sandstone Depositional Environments
3 Credits
Offered Fall Even-numbered Years
Sedimentary depositional environments treating the hydrodynamics,
sediment dispersal patterns and preservation potential of modern
terrigenous clastic depositional environments and criteria for recognizing
their ancient counterparts in the geologic record.
Prerequisites: GEOS F320 and GEOS F322; or graduate standing.

GEOS F645  Petroleum Geology
3 Credits
Offered Fall Even-numbered Years
Examines the origin of petroleum, the geologic controls of its distribution
and accumulation and the basic tools used in exploration and
exploitation, including subsurface mapping, well logging and exploration
geophysics.
Prerequisites: Graduate standing.

GEOS F647  Advanced Sedimentology and Stratigraphy
3 Credits
Offered Spring As Demand Warrants
Various topics in sedimentology and stratigraphy. Specific offerings to
be presented at various times include sequence stratigraphy and sea-
level analysis, paleoclimatic and paleoceanographic analyses, sandstone
petrology, thermal maturation and geohistory analysis of sediments.
Prerequisites: Graduate standing.

GEOS F651  Quaternary Seminar
3 Credits
Offered As Demand Warrants
Discussion of the Quaternary Period (relatively recent past – spanning
the past two million years) in order to gain a better understanding of
the landscape, biota and climate of the present day. Quaternary studies
are concerned with the historical dimension of the natural sciences.
This seminar will range widely over diverse interdisciplinary subjects
of Quaternary interest, such as paleoclimatology, paleobiogeography,
vertebrate paleontology and sedimentology.
Prerequisites: Graduate standing.

GEOS F653  Palynology and Paleopalynology
4 Credits
Offered Fall Even-numbered Years
Survey of the evolutionary record of palynomorphs and their uses
in biostratigraphy and paleoclimatology. Focus on evolution of
palynomorphs from Precambrian to the present and concurrent
evolutionary developments of producing plants. Use of Quaternary
palynofloras in reconstructing global climates. Labs involve collection of
herbarium specimens, processing of fossil palynomorphs, study of type
slides and a survey of palynofloras from each geologic period.
Prerequisites: Graduate standing.

GEOS F654  Visible and Infrared Remote Sensing
3 Credits
Offered Spring Even-numbered Years
In-depth coverage of the principles, physics, sensor technology,
processing and applications of remote sensing in the visible and
infrared region, including but not limited to electromagnetic spectrum,
radiation laws, spectral signatures, atmospheric interactions, temperature
emissivity estimation, analysis and feature extraction from data sets. The
laboratory part of the course will provide hands-on experience on special
processing techniques, and the possibility of using these techniques for a
student-defined term project in areas of geology, volcanology, glaciology,
hydrology, environmental sciences, etc.

GEOS F655  Tectonic Geodesy
3 Credits
Offered Spring Even-numbered Years
Introduction to modern space geodetic methods and details their
application to the study of active earth processes such as plate tectonics,
fault mechanics and volcanology. Includes space geodesy methods such
as global positioning system, as standard geophysical tools for the study
of earthquakes, active tectonics and volcanology.
Prerequisites: MATH F314; MATH F421; MATH F422; graduate standing.

GEOS F438, GEOS F445, GEOS F453.

ANTH F451; GEOS F452.

ANTH F651.
GEOS F656  Paleopedology
3 Credits
Offered Fall Even-numbered Years
A survey course focusing on the recognition and use of paleosols (fossil soils) as paleoenvironmental indicators, stratigraphic markers and in paleogeographic reconstructions from Precambrian to Holocene. Examination of theories of soil formation, major soil processes and approaches to soil classification. Review of geochemical, mineralogical, morphological and micromorphological techniques. Use of paleosols for paleolandscpe evolution and basin analysis. Geological, tectonic, archaeological and environmental applications of paleosols are discussed.
Prerequisites: Graduate standing.
Stacked with GEOS F456.
Lecture + Lab + Other: 3 + 0 + 0

GEOS F657  Microwave Remote Sensing
3 Credits
Offered Spring Odd-numbered Years
The principles and applications of active and passive microwave remote sensing with emphasis on spaceborne remote sensing of the Earth's atmosphere, land and oceans. The laboratory section will provide hands-on experience on special processing techniques, and the possibility of using these techniques for a student-defined term project in areas of geology, volcanology, glaciology, hydrology, environmental sciences, etc.
Prerequisites: GEOS F422.
Lecture + Lab + Other: 2 + 2 + 0

GEOS F658  Applications of GPS and GIS in Geophysics
3 Credits
Offered Spring
Prerequisites: Graduate standing.
Stacked with GEOS F458.
Lecture + Lab + Other: 2 + 3 + 0

GEOS F660  The Dynamic Alaska Coastline
3 Credits
Offered Spring Even-numbered Years
Alaska's diverse coastal system provides abundant ecosystem services and globally important resources. This course provides an interdisciplinary perspective on the dynamic coastal landscape of Alaska from Southcentral to the Arctic, and delves into the driving geological, oceanographic and climate processes shaping Alaska's past and present coastline. Through a semester long research projects students will learn how to measure and map coastal changes associated with natural and human perturbations. An overnight field trip will serve as an active learning opportunity to integrate course knowledge with hands-on field work.
Prerequisites: Graduate standing.
Cross-listed with GEOG F660.
Stacked with GEOG F460; GEOS F460.
Lecture + Lab + Other: 3 + 0 + 0

GEOS F663  Glacial and Periglacial Geology  (a)
4 Credits
Offered Fall Odd-numbered Years
Prerequisites: GEOS F304 or graduate standing.
Stacked with GEOS F463.
Lecture + Lab + Other: 3 + 3 + 0

GEOS F666  Scientific Teaching
2 Credits
Offered Spring Even-numbered Years
This course explores methods for teaching science at the university level. Emphasis is placed on methods of course design, instructional techniques, assessment and course management that have been shown by research to improve student learning. This course is intended for graduate students in the sciences who have an interest in improving their teaching skills. The course format will be a mixture of discussion, workshops and seminars. If the course is over-enrolled, priority will be given to teaching assistants who are assigned to teach large, introductory level (100 or 200 level) courses during the semester they are taking this course.
Prerequisites: Graduate standing.
Lecture + Lab + Other: 2 + 0 + 0

GEOS F670  Selected Topics in Volcanology
2 Credits
Offered Fall
Survey course in subjects relating to volcanology. Possible subjects include, but are not limited to, eruption dynamics, geophysics of eruptions, volatiles in volcanic systems, modeling volcanic systems. May be repeated for credit.
Prerequisites: Graduate standing.
Lecture + Lab + Other: 2 + 0 + 0

GEOS F671  Volcano Seismology
3 Credits
Offered Spring Odd-numbered Years
Survey of seismic behavior of volcanoes. Topics include instrumentation, terminology, swarms and their attributes, high-frequency events, volcanic explosions, volcanic tremor, attenuation and velocity structure, cycles of activity, eruption forecasting, detection of magma chambers, case studies and selected topics. Oral and written student presentations will be required.
Prerequisites: Graduate standing.
Lecture + Lab + Other: 3 + 0 + 0

GEOS F675  Presentation Techniques in the Geosciences
2 Credits
Offered Fall
Instruction and practice in oral and written communication skills specifically related to the geosciences. Oral and written presentation of abstracts, resumes, proposals and reports required. Works critically analyzed by instructor(s) and peers for both geoscience content and communication effectiveness.
Prerequisites: Graduate standing.
Stacked with GEOS F475.
Lecture + Lab + Other: 1 + 3 + 0
GEOS F676  Remote Sensing of Volcanic Eruptions  
3 Credits  
Offered As Demand Warrants  
Focuses on the use of satellite images to detect, monitor and mitigate volcanic hazards, and to understand eruption processes. Thermal anomalies, volcanic clouds and surface morphological features will be discussed in the lecture and test cases analyzed in the laboratory. Satellite data include GOES, AVHRR, MODIS, ASTER, Landsat and SAR. Course may be repeated twice for credit.  
**Recommended:** GEOS F422 or equivalent remote sensing class.  
**Lecture + Lab + Other:** 2 + 3 + 0

GEOS F678  Ice Age Alaska  (a)  
3 Credits  
An overview of the paleoenvironments of Alaska including climate, glacier and biotic history including humans. Emphasis on events of the past that have left important legacies on present landscapes. The course begins with two weekend field trips and then surveys key literature describing Alaska’s ice-age history. The focus is on Alaska and the Yukon, but topics will range more widely into other parts of the Arctic and its adjacent seas.  
**Prerequisites:** Graduate standing in anthropology, biological sciences, Earth science, geography, geoscience, or northern studies.  
**Cross-listed with** GEOG F678.  
**Stacked with** GEOG F478; GEOS F478.  
**Lecture + Lab + Other:** 3 + 0 + 0

GEOS F682  Geoscience Seminar  
1 Credit  
A weekly seminar, given by guest speakers, on a topic in geosciences. Students are expected to prepare for the seminars and to participate in discussion following the seminars.  
**Prerequisites:** Graduate standing.  
**Stacked with** GEOS F482.  
**Lecture + Lab + Other:** 1 + 0 + 0

GEOS F686  Vertebrate Paleontology  
3 Credits  
Offered Spring Odd-numbered Years  
The study of vertebrate evolution through geologic time. Covers the temporal range, diversity and systematics of major vertebrate groups as documented in the fossil record, with an emphasis on current problems in vertebrate evolutionary pattern and process. Labs emphasize comparative morphology and identification of major vertebrate groups.  
**Prerequisites:** Graduate standing.  
**Cross-listed with** BIOL F686.  
**Stacked with** BIOL F486; GEOS F486.  
**Lecture + Lab + Other:** 2 + 3 + 0

GEOS F692A  Geol/Geophys Seminar  
1-6 Credits  
**Lecture + Lab + Other:** 0 + 0 + 0

GEOS F692B  Geology/Geophysics Seminar  
1-6 Credits  
**Lecture + Lab + Other:** 1-6 + 0 + 0

GEOS F692P  Seminar  
1-6 Credits  
**Lecture + Lab + Other:** 0 + 0 + 0

GEOS F698  Non-thesis Research/Project  
1-9 Credits  
**Lecture + Lab + Other:** 0 + 0 + 0

GEOS F699  Thesis  
1-12 Credits  
**Lecture + Lab + Other:** 0 + 0 + 0