GEO 100. *NATURAL DISASTERS: HOLLYWOOD VERSUS REALITY. (4 Credits)
Introduction to natural hazards, as seen through the lens of popular media. Course will explore the causes and consequences of natural disasters via in-class exercises and activities designed to develop students’ skills in scientific analysis and problem solving. (Bacc Core Course)
Attributes: CPPS – Core, Pers, Physical Science

GEO 101. *THE SOLID EARTH. (4 Credits)
Solid earth processes and materials. Earthquakes, volcanoes, earth structure, rocks, minerals, ores. Solid earth hazard prediction and planning. Geologic time. Lec/lab. (Bacc Core Course)
Attributes: CPPS – Core, Pers, Physical Science

GEO 199. SPECIAL STUDIES. (1-16 Credits)
This course is repeatable for 16 credits.

GEO 201. *PHYSICAL GEOLOGY. (4 Credits)
Study of earth’s interior. Tectonic processes and their influence on mountains, volcanoes, earthquakes, minerals, and rocks. Field trip(s) required; transportation fee charged. Lec/lab. (Bacc Core Course)
Attributes: CPPS – Core, Pers, Physical Science

GEO 202. *EARTH SYSTEMS SCIENCE. (4 Credits)
Surficial processes (glaciers, rivers), climate, soils, vegetation, and their interrelationships. Field trip(s) required; transportation fee charged. Lec/lab. (Bacc Core Course)
Attributes: CPPS – Core, Pers, Physical Science

GEO 203. *EVOlUTION OF PLANET EARTH. (4 Credits)
History of earth and life as interpreted from fossils and the rock record. Field trip(s) required; transportation fee charged. Lec/lab. (Bacc Core Course)
Attributes: CPPS – Core, Pers, Physical Science

GEO 204. *INTRODUCTION TO FIELD GEOLOGY. (3 Credits)
Two-week course taught in the fall program in various locations throughout the west. Collect field data to make geological maps, cross-sections, columns, and reports. Serves as an introduction to upper-level course work for Geology degree. Lec/lab.
Prerequisites: GEO 201 with C- or better

GEO 205. *LIVING WITH ACTIVE CASCADE VOLCANOES. (3 Credits)
The impact of volcanic activity on people, infrastructure, and natural resources; how and why volcanic activity in the Cascade Range occurs; volcano monitoring and hazard assessment. Field trip required, transportation fee charged. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society

GEO 206. *MINERALS, ENERGY, WATER, AND THE ENVIRONMENT. (3 Credits)
Geologic occurrences, environmental consequences, and future of non-renewable earth resources, including metals, materials, oil, soil, and groundwater. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society

GEO 207. *NATIONAL PARK GEOLOGY AND PRESERVATION. (3 Credits)
National parks as classrooms to study geological processes and the importance of preserving natural landscapes. Field trip(s) required; transportation fee charged. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Equivalent to: GEO 307H

GEO 307H. *NATIONAL PARK GEOLOGY AND PRESERVATION. (3 Credits)
National parks as classrooms to study geological processes and the importance of preserving natural landscapes. Field trip(s) required; transportation fee charged. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society; HNRS – Honors Course Designator
Equivalent to: GEO 307

GEO 308. *GLOBAL CHANGE AND EARTH SCIENCES. (3 Credits)
Study of global change over different time scales during the history of the earth, with emphasis on evolution of its atmosphere, plate tectonics, paleoclimates, and mass extinctions. (Bacc Core Course)
Attributes: CSGI – Core, Synth, Global Issues

GEO 309. *ENVIRONMENTAL JUSTICE. (3 Credits)
Technical and social issues surrounding the unequal exposure to environmental hazards based on race and the environmental justice movement that has grown to address charges of such environmental racism. (Bacc Core Course)
Attributes: CPDP – Core, Perspective, Difference/Power/Discrimination
Prerequisites: WR 121 with C- or better or WR 121H with C- or better
Recommended: Sophomore standing

GEO 310. EARTH MATERIALS I: MINERALOGY. (4 Credits)
Principles of crystal morphology, and structure. Characteristics, identification, and origins of minerals. Lec/lab.
Prerequisites: (GEO 201 with D- or better or GEO 221 with D- or better) and (GEO 201 with D- or better or GEO 221 with D- or better or CH 231 with D- or better and CH 261 [D-] or CH 231H [D-] and CH 261H [D-])

GEO 315. EARTH MATERIALS II: PETROLOGY. (4 Credits)
Origin, identification and classification of igneous, sedimentary, and metamorphic rocks. Field trip(s) required, transportation fee charged. Lec/lab.
Prerequisites: GEO 310 with D- or better

GEO 322. SURFACE PROCESSES. (4 Credits)
Examination of surficial processes and terrestrial landforms of the earth, including slopes, rivers, glaciers, deserts, and coastlines. Field trip(s) required, transportation fee charged. Lec/lab.
Prerequisites: (GEO 102 with D- or better or GEO 202 with D- or better) and (MTH 251 [C-] or MTH 251H [C-]) and (PH 201 [D-] or PH 201H [D-] or PH 211 [D-] or PH 211H [D-])

GEO 340. STRUCTURAL GEOLOGY. (4 Credits)
Analysis of geometry and kinematics of geologic structures including brittle and ductile faults, folds, joints, deformation fabrics. Field trip(s) required; transportation fee charged. Lec/lab.
Prerequisites: GEO 201 with D- or better
GEO 352. *OREGON: GEOLOGY, PLACE, AND LIFE ON THE RING OF FIRE. (4 Credits)
Provides an overview of the geology of Oregon in the context of the Pacific Northwest including tectonic setting, geologic features and landscapes, as well as topics and concepts of interest to society in general. Lessons will include discussion of the relationship between people and the landscape, incorporating the concept of ethnohistoric landscapes--geologic structures, natural resources and geologic hazards that are part of the identity of a place. Emphasizes written and graphic communication skills. Field trip required, transportation fee charged. Lec/lab. (Bacc core course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society
Equivalent to: GEO 352H
Recommended: Introductory science course

GEO 352H. *OREGON: GEOLOGY, PLACE, AND LIFE ON THE RING OF FIRE. (4 Credits)
Provides an overview of the geology of Oregon in the context of the Pacific Northwest including tectonic setting, geologic features and landscapes, as well as topics and concepts of interest to society in general. Lessons will include discussion of the relationship between people and the landscape, incorporating the concept of ethnohistoric landscapes--geologic structures, natural resources and geologic hazards that are part of the identity of a place. Emphasizes written and graphic communication skills. Field trip required, transportation fee charged. Lec/lab. (Bacc core course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society, HNRS – Honors Course Designator
Equivalent to: GEO 352
Recommended: Introductory science course

GEO 370. STRATIGRAPHY AND SEDIMENTOLOGY. (4 Credits)
Basic principles of sedimentology and stratigraphy. Sedimentology is largely concerned with classifying and interpreting the origin of sedimentary rocks. Stratigraphy provides formal rules and strategies for organizing sedimentary (and other) rocks into a temporal framework. Reconstruction of Earth history with various approaches centered on paleoclimatology, paleogeography, paleoceanography, and tectonics. Lec/lab.
Prerequisites: GEO 201 with C- or better and GEO 203 [C-]

GEO 380. *EARTHQUAKES IN THE PACIFIC NORTHWEST. (3 Credits)
Earthquake hazards in the Northwest; responses to reducing earthquake risk at state, local, and personal levels. (Bacc Core Course)
Attributes: CSST – Core, Synthesis, Science/Technology/Society

GEO 399. SPECIAL TOPICS. (1-16 Credits)
Equivalent to: GEO 399H
This course is repeatable for 16 credits.

GEO 399H. SPECIAL TOPICS. (1-16 Credits)
Attributes: HNRS – Honors Course Designator
Equivalent to: GEO 399
This course is repeatable for 16 credits.

GEO 400. FIELD TRIPS. (1-16 Credits)
Participation in group field trips that are not a part of any other course. Transportation fee is charged. Students may prepare guides for trips. Faculty sponsor must be prearranged. Graded P/N.
This course is repeatable for 48 credits.

GEO 401. RESEARCH. (1-16 Credits)
Independent, original research subjects guided by faculty conferences and resulting in a brief written report. Faculty sponsor must be prearranged.
This course is repeatable for 24 credits.

GEO 403. THESIS. (1-16 Credits)
Independent, original study that culminates in a senior thesis. Faculty sponsor must be prearranged.
This course is repeatable for 24 credits.

GEO 405. READING AND CONFERENCE. (1-16 Credits)
Independent reading in specialized topics guided by and discussed in faculty conferences. Faculty sponsor must be prearranged.
This course is repeatable for 16 credits.

GEO 407. SEMINAR. (1-16 Credits)
Graded P/N.
This course is repeatable for 12 credits.

GEO 408. WORKSHOP. (1-16 Credits)
This course is repeatable for 12 credits.

GEO 410. INTERNSHIP. (1-15 Credits)
Pre-career professional experience under joint faculty and employer supervision. Graded P/N.
This course is repeatable for 48 credits.
Recommended: 12 credits of upper-division geosciences

GEO 412. IGNEOUS PETROLOGY. (4 Credits)
Petrogenesis of igneous rocks. Petrographic analysis using polarizing microscopes. Field trip may be required, transportation fee charged. Lec/lab.
Prerequisites: GEO 315 with D- or better
Recommended: GEO 415

GEO 415. EARTH MATERIALS III: PETROGRAPHY. (4 Credits)
Microscope-based study of minerals and igneous, sedimentary and metamorphic rocks. Representation and interpretation of geological processes based on microscopic observation. Lec/lab.
Prerequisites: GEO 201 with D- or better and GEO 310 [D-] and GEO 315 [D-]

GEO 427. *VOLCANOLOGY. (4 Credits)
A survey of volcanoes: their distribution, forms, composition, eruptive products, eruptive styles, and associated phenomena. Field trip may be required; transportation fee charged. Offered alternate years. Lec/lab. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Prerequisites: GEO 315 with D- or better

GEO 430. GEOCHEMISTRY. (4 Credits)
Principles of geochemistry applied to problems of earth science. Field trip(s) may be required; transportation fees charged. Lec/rec.
Prerequisites: GEO 315 (may be taken concurrently) with D- or better and (((CH 121 with D- or better and CH 122 [D-]) or ((CH 231 [D-] or CH 231H [D-]) and (CH 261 [D-] or CH 261H [D-]) and (CH 232 [D-] or CH 232H [D-]) and (CH 262 [D-] or CH 262H [D-])))

GEO 431. ENVIRONMENTAL GEOCHEMISTRY. (3 Credits)
An introduction to natural processes at and near the earth's surface, as well as an examination of the impact of human activities on the natural environment. Study includes discussion of the sources, transformations, transport, and fate of contaminants. Field trip(s) required; transportation fee charge.
Prerequisites: (CH 121 with D- or better and CH 122 [D-] and CH 123 [D-]) or ((CH 231 [D-] or CH 231H [D-]) and (CH 232 [D-] or CH 232H [D-]) and (CH 233 [D-] or CH 233H [D-]))
GEO 432. APPLIED GEOMORPHOLOGY. (3 Credits)
Effect of landform processes upon human activity; consequences of resource management strategies on erosional balance within landscape; identification of mitigation of natural hazards; role of geomorphic process studies in environmental planning. Taught as seminar, themes TBA. Field trip(s) may be required; transportation fee charged.
Recommended: GEO 322

GEO 433. COASTAL GEOMORPHOLOGY. (3 Credits)
Morphodynamic approach to coastal landforms, processes and evolution including the impacts and response of humans to coastal change.
Prerequisites: (PH 211 with D- or better or PH 211H with D- or better) and (PH 212 [D-] or PH 212H [D-]) and GEO 322 [D-]
Recommended: MTH 251 and MTH 252

GEO 440. ECONOMIC GEOLOGY. (4 Credits)
Principles of the origin, distribution, and importance of metallic mineral deposits formed by magmatic, hydrothermal, and sedimentary processes. Lec/lab.
Prerequisites: GEO 315 with D- or better
Recommended: GEO 340

GEO 461. GEOLOGY OF EARTHQUAKES. (3 Credits)
Tectonics of the present day as based on surface geology, geodesy, seismicity, and crustal structure; description of active faults and folds; use of neotectonics in evaluation of earthquake hazard. Field trip(s) may be required; transportation fee charged. Offered alternate years.
Prerequisites: GEO 340 with D- or better

GEO 463. GEOPHYSICS AND TECTONICS. (4 Credits)
Geophysical observations as constraints on geologic interpretation. Lec/lab. (Writing Intensive Course)
Attributes: CWIC – Core, Skills, WIC
Recommended: MTH 251 and (PH 202 or PH 212)

GEO 481. GLACIAL GEOLOGY. (4 Credits)
Mass balance of glaciers, physics of glacial flow, processes of glacial erosion and deposition, glacial meltwater, glacial isostasy and eustasy, and Quaternary stratigraphy. Field trip(s) may be required; transportation fee charged. Lec/lab. Offered alternate years.
Recommended: GEO 202

GEO 482. INTRODUCTION TO BIOGEOCHEMISTRY. (3 Credits)
Interdisciplinary course, applying concepts from chemistry, physics, biology and geology to Earth systems including terrestrial, ocean and freshwater environments; water and energy cycles; carbon, nitrogen, phosphorus and sulfur cycles; biogeochemical cycles through Earth history.
Prerequisites: MTH 111 with D- or better and (CH 121 with D- or better and CH 122 [D-]) or (CH 231 [D-] and CH 261 [D-] and CH 232 [D-] and CH 262 [D-])

GEO 486. QUATERNARY PALEOClimAtOLOGY. (3 Credits)
Introduction to geochronology, climate proxies, climate forcing, and climate modeling applied to paleoclimatic problems. Emphasis on Quaternary climate history.
Prerequisites: (GEO 202 with D- or better or GEO 203 with D- or better) and (CH 122 [D-] or CH 222 [D-] or (CH 232 [D-] or CH 232H [D-]) and (CH 262 [D-] or CH 262H [D-] or CH 272 [D-]))
Recommended: PH 201 or PH 211

GEO 487. HYDROGEOLOGY. (4 Credits)
Prerequisites: MTH 252 with D- or better or MTH 252H with D- or better
Recommended: GEO 202

GEO 488. QUATERNARY STRATIGRAPHY OF NORTH AMERICA. (3 Credits)
Stratigraphic principles applied to Quaternary deposits. Survey Quaternary dating methods. Proxy records of glaciation and climate change. Quaternary stratigraphy of North America, emphasizing stratigraphic records of ice sheets, glaciers, and pluvial lakes. Offered alternate years.
Recommended: GEO 481 or GEO 581

GEO 495. ADVANCED FIELD GEOLOGY. (6 Credits)
Six-week summer program in central Oregon. Collect field data to make geological maps, cross-sections, columns, and reports. Fee charged.
Prerequisites: GEO 295 with C- or better and GEO 315 [C-] and GEO 340 [C-] and GEO 370 [C-]

GEO 497. FIELD MAPPING OF ORE DEPOSITS. (3 Credits)
Eight-day field trip over spring vacation to a mineral district in the western United States, emphasizing detailed mapping of outcrops, trenches, and underground workings. Students prepare final maps and a report suitable for presentation to management or publication during spring term. Transportation fee charged. Not offered every year.
Recommended: (GEO 440 or GEO 540) and GEO 495

GEO 499. SPECIAL TOPICS. (0-16 Credits)
This course is repeatable for 16 credits.

GEO 500. FIELD TRIPS. (1-16 Credits)
Participation in group field trips that are not a part of any other course. Transportation fee is charged. Students may prepare guides for trips. Faculty sponsor must be prearranged. Graded P/N.
This course is repeatable for 48 credits.

GEO 501. RESEARCH. (1-16 Credits)
Independent, original research subjects guided by faculty conferences and resulting in a brief written report. Faculty sponsor must be prearranged.
This course is repeatable for 24 credits.

GEO 503. THESIS. (1-16 Credits)
Independent, original study that culminates in a senior thesis. Faculty sponsor must be prearranged.
This course is repeatable for 999 credits.

GEO 505. READING AND CONFERENCE. (1-16 Credits)
Independent reading in specialized topics guided by and discussed in faculty conferences. Faculty sponsor must be prearranged.
This course is repeatable for 16 credits.

GEO 507. SEMINAR. (1-16 Credits)
Graded P/N.
This course is repeatable for 48 credits.

GEO 508. WORKSHOP. (1-16 Credits)
This course is repeatable for 24 credits.

GEO 510. INTERNSHIP. (1-15 Credits)
Pre-career professional experience under joint faculty and employer supervision. May not be used to meet minimum credit hour requirements for graduate degrees in geosciences. Graded P/N.
This course is repeatable for 16 credits.
Recommended: 12 credits of upper-division geosciences.
GEO 512. IGNEOUS PETROLOGY. (4 Credits)
Petrogenesis of igneous rocks. Petrographic analysis using polarizing microscopes. Field trip may be required, transportation fee charged. Lec/lab.
Recommended: GEO 315 and GEO 415

GEO 516. INTERPRETATION OF GEOLOGIC MAPS. (3 Credits)
Development of skills in formulating geologic problems, using geologic maps, and developing solutions by the scientific method.
Recommended: GEO 495

GEO 518. GEOSCIENCE COMMUNICATION. (3 Credits)
Professional development of the skills of technical editing and writing for geoscientists. Practice the craft of presentation development and delivery, and the broader issues of problem development, and manuscript and proposal writing specific to geoscience graduate students.

GEO 527. VOLCANOLOGY. (4 Credits)
A survey of volcanoes: their distribution, forms, composition, eruptive products, eruptive styles, and associated phenomena. Field trip may be required; transportation fee charged. Offered alternate years. Lec/lab.
Recommended: GEO 315

GEO 530. GEOCHEMISTRY. (4 Credits)
Principles of geochemistry applied to problems of earth science. Field trip(s) may be required; transportation fee charged. Lec/rec.
Recommended: GEO 315 and ((CH 121 and CH 122) or ((CH 231 or CH 231H) and (CH 261 or CH 261H) and (CH 232 or CH 232H) and (CH 262 or CH 262H))

GEO 531. ENVIRONMENTAL GEOCHEMISTRY. (3 Credits)
An introduction to natural processes at and near the earth’s surface, as well as an examination of the impact of human activities on the natural environment. Study includes discussion of the sources, transformations, transport, and fate of contaminants. Field trip(s) required; transportation fee charged.
Recommended: (CH 121 and CH 122 and CH 123) or ((CH 231 or CH 231H) and (CH 261 or CH 261H) and (CH 232 or CH 232H) and (CH 262 or CH 262H))

GEO 532. APPLIED GEOMORPHOLOGY. (3 Credits)
Effect of landform processes upon human activity; consequences of resource management strategies on erosional balance within landscape; identification of mitigation of natural hazards; role of geomorphic process studies in environmental planning. Taught as seminar, themes TBA. Field trip(s) may be required; transportation fee charged.
Equivalent to: GEOG 549
Recommended: GEO 322

GEO 533. COASTAL GEOMORPHOLOGY. (3 Credits)
Morphodynamic approach to coastal landforms, processes and evolution including the impacts and response of humans to coastal change.
Recommended: MTH 251 and MTH 252 and PH 211 and PH 212 and GEO 322

GEO 535. GEOCHEMICAL ANALYSIS TECHNIQUES. (3 Credits)
An introduction to the theory, techniques and instrumentation used for the chemical analysis of earth materials, with emphasis on analysis of solid earth material samples (predominantly, but not restricted to, rocks). Includes discussions of laboratory safety, relevant statistical approaches, basic physical and chemical principles of analysis, sample preparation techniques and data processing and reporting. Course also includes a large component of hands-on experience with instrumentation available in-house in the College of Earth, Ocean, and Atmospheric Sciences. Lec/lab.
Prerequisites: GEO 530 with C or better

GEO 536. STRUCTURAL AND NEOTECTONIC FIELD METHODS. (3 Credits)
Field-intensive mapping experience emphasizing a topical issue in active tectonics, neotectonics, earthquake geology, or structural geology. One-week field trip required; transportation fee charged. Weekly discussions during quarter. Offered alternate years.
Recommended: GEO 495

GEO 537. TECTONIC GEOMORPHOLOGY. (3 Credits)
Exploration of linkages between patterns of erosion, crustal deformation, and landscape evolution from geomorphic, geologic, geophysical, and modeling perspectives. Field trip required; transportation fee charged. Offered alternate years.
Recommended: GEO 322 and GEO 340

GEO 540. ECONOMIC GEOLOGY. (4 Credits)
Principles of the origin, distribution, and importance of metallic mineral deposits formed by magmatic, hydrothermal, and sedimentary processes. Lec/lab.
Recommended: GEO 315 and GEO 340

GEO 550. COASTAL HAZARDS: PROCESSES, RESPONSE, AND ADAPTATION. (3 Credits)
Coastal hazards and the associated risks they pose to rapidly expanding coastal communities. Examination of coastal hazards from a transdisciplinary perspective including the physical processes, the coastal response, and coastal adaptation/management options for dealing with the hazards. Emphasizes probabilistic and other user-inspired approaches for assessing coastal vulnerability to the various hazards.
Recommended: College-level calculus, physics and geology

GEO 561. GEOLOGY OF EARTHQUAKES. (3 Credits)
Tectonics of the present day as based on surface geology, geodesy, seismicity, and crustal structure; description of active faults and folds; use of neotectonics in evaluation of earthquake hazard. Field trip(s) may be required; transportation fee charged. Offered alternate years.
Recommended: GEO 340

GEO 563. GEOPHYSICS AND TECTONICS. (4 Credits)
Geophysical observations as constraints on geologic interpretation. Lec/lab.
Recommended: MTH 251 and (PH 202 or PH 212)

GEO 581. GLACIAL GEOLOGY. (4 Credits)
Mass balance of glaciers, physics of glacial flow, processes of glacial erosion and deposition, glacial meltwater, glacial isostasy and eustasy, and Quaternary stratigraphy. Field trip(s) may be required; transportation fee charged. Lec/lab. Offered alternate years.
Recommended: GEO 202

GEO 586. QUATERNARY PALEOCLIMATOLOGY. (3 Credits)
Introduction to geochronology, climate proxies, climate forcing, and climate modeling applied to paleoclimate problems. Emphasis on Quaternary climate history.
Recommended: ((GEO 202 or GEO 203) and (CH 122 or CH 222 or (CH 232 and CH 262)) and (CH 232H and CH 262H)) and (PH 201 or PH 211)

GEO 588. QUATERNARY STRATIGRAPHY OF NORTH AMERICA. (3 Credits)
Stratigraphic principles applied to Quaternary deposits. Survey Quaternary dating methods. Proxy records of glaciation and climate change. Quaternary stratigraphy of North America, emphasizing stratigraphic records of ice sheets, glaciers, and pluvial lakes. Offered alternate years.
Recommended: GEO 481 or GEO 581
GEO 597. FIELD MAPPING OF ORE DEPOSITS. (3 Credits)
Eight-day field trip over spring vacation to a mineral district in the western United States, emphasizing detailed mapping of outcrops, trenches, and underground workings. Students prepare final maps and a report suitable for presentation to management or publication during spring term. Transportation fee charged. Not offered every year. 
Recommended: (GEO 440 or GEO 540) and GEO 495

GEO 599. SPECIAL TOPICS. (0-16 Credits)
This course is repeatable for 24 credits.

GEO 600. FIELD TRIPS. (1-16 Credits)
Participation in group field trips that are not part of any other course. Transportation fee charged. Students may prepare guide for trips. Faculty sponsors must be arranged. Graded P/N. 
This course is repeatable for 84 credits.

GEO 601. RESEARCH. (1-16 Credits)
This course is repeatable for 36 credits.

GEO 603. THESIS. (1-16 Credits)
This course is repeatable for 999 credits.

GEO 605. READING AND CONFERENCE. (1-16 Credits)
This course is repeatable for 16 credits.

GEO 606. PROJECTS. (1-16 Credits)
This course is repeatable for 84 credits.

GEO 607. SEMINAR. (1-16 Credits)
Graded P/N. 
This course is repeatable for 48 credits.

GEO 608. WORKSHOP. (1-16 Credits)
This course is repeatable for 24 credits.

GEO 622. IGNEOUS PETROLOGY. (3 Credits)
Controls on the distribution of major and trace elements; theory, applications, and examples. Field trip(s) may be required; transportation fee charged. Offered alternate years. 
Recommended: GEO 412 or GEO 512

GEO 633. GEOCHRONOLOGY AND ISOTOPE GEOLOGY. (3 Credits)
Measurements of cosmic and geologic time by radioactive decay. Use of radiogenic and stable isotopic tracers in geology. Offered alternate years.

GEO 666. STABLE ISOTOPE GEOCHEMISTRY. (3 Credits)
Study of the principles governing terrestrial stable isotope distributions, with application to geologic, oceanographic, atmospheric and planetary processes. The primary focus is on isotopes of the light elements such as oxygen, hydrogen, carbon and sulfur, but may include other isotope systems, including Sr/Nd isotopes as geochemical tracers, noble gases, and metal isotopes (eg. Mo, Cu, Fe).

GEO 684. GLOBAL BIOGEOCHEMICAL CYCLES. (4 Credits)
An in-depth treatment of global biogeochemical cycles, focusing on cycles of carbon, oxygen, nitrogen, phosphorus, and sulfur in the atmosphere, hydrosphere, and lithosphere. CROSSLISTED as SOIL 684. 
Equivalent to: SOIL 684
Recommended: One year of college-level physics and chemistry, including introductory biology. One year of graduate course work in soil, earth, ocean, atmospheric, or forest science

GEO 691. MASS AND HEAT TRANSPORT IN THE ENVIRONMENT. (4 Credits)
Quantitative treatment of processes affecting transport in lakes, streams, and groundwater: advection; diffusion; dispersion. Lec/lab. Offered alternate years. 
Recommended: (GEO 487 or CE 412) or equivalent and MTH 256

GEO 694. TOPICS IN ORE GENESIS. (1-3 Credits)
In-depth examination of published research on selected mineral deposits to build an understanding of environments and processes of ore formation. Offered alternate years. 
This course is repeatable for 6 credits.

GEO 699. SPECIAL TOPICS. (1-16 Credits)
This course is repeatable for 24 credits.