GEOL 101 Physical Geology (3 credits)
General Education: Natural and Applied Sciences
The earth, its composition, structure, and natural processes. Three lectures and 2 hours of lab per week; one 1-day field trip.

GEOL 101L Physical Geology Lab (1 credit)
General Education: Natural and Applied Sciences
The earth, its composition, structure, and natural processes. Three lectures and 2 hours of lab per week; one 1-day field trip.

GEOL 102 Historical Geology (3 credits)
General Education: Natural and Applied Sciences
Evolution of the physical earth, plants, and animals; techniques used in interpretation of geologic history. Includes one 1-day field trip.
Coreqs: GEOL 102L or permission

GEOL 102L Historical Geology Lab (1 credit)
General Education: Natural and Applied Sciences
Evolution of the physical earth, plants, and animals; techniques used in interpretation of geologic history.

GEOL 111 Physical Geology for Science Majors (3 credits)
Introductory course in earth science for geology and other science majors. Three lectures and one 2-hour lab per week; two 1-day field trips.

GEOL 111L Physical Geology for Science Majors Lab (1 credit)
Credit arranged

GEOL 200 (s) Seminar (1 credit)
Credit arranged

GEOL 203 (s) Workshop (1-16 credits)
Credit arranged

GEOL 204 (s) Special Topics (1-16 credits)
Credit arranged

GEOL 212 Dinosaurs and Prehistoric Life (4 credits)

GEOL 226 Crime Scene Science (3 credits)
Introduction to the use of geological and mineralogical materials and techniques within the criminal/civil justice system. Topics will include the origin and description of minerals, rocks, soils and sands, fossils, industrial materials, and pollen, the history of forensic science, instrumental & forensic laboratory techniques, and the legal aspects of scientific evidence. Two lectures and one 2-hour lab per week; one 1-day field trip. Typically Offered: Fall.
Prereqs: One of the following: GEOL 101/101L, GEOL 111/111L, CHEM 101/101L, CHEM 111/111L; or Permission Cooperative: open to WSU degree-seeking students.

GEOL 249 Mineralogy and Optical Mineralogy (4 credits)
Principles of crystallography, crystal chemistry, and crystal structure; mineral identification; principles of optical mineralogy and use of the polarized light microscope. Three lectures and one 2-hour lab per week; two 1-day field trips.
Prereqs: GEOL 111/GEOL 111L or GEOL 101/GEOL 101L, and CHEM 111/ CHEM 111L

GEOL 299 (s) Directed Study (1-16 credits)
Credit arranged

GEOL 302 Field Geology Methods (3 credits)
Introduction to field mapping and field techniques; mapping sedimentary sequences and tectonic structures; Professional ethics, report preparation, project budgeting, and safety planning. Accident and health insurance required. Single- and multiple-day field trips with camping required. Typically Offered: Summer.
Prereqs: GEOL 101/GEOL 101L or GEOL 111/GEOL 111L or GEOL 102/ GEOL 102L or GEOG 100/100L Cooperative: open to WSU degree-seeking students.

GEOL 309 Ground Water Hydrology (3 credits)
Occurrence, movement, and properties of subsurface water; introduction to groundwater geology and hydrology.
Prereqs: GEOL 101/GEOL 101L or GEOL 111, and MATH 130 or MATH 143 with a grade of 'C' or better

GEOL 324 Principles of Stratigraphy and Sedimentation (4 credits)
Interrelationship of sedimentation and stratigraphy and processes and factors influencing genesis of sedimentary rocks. Topics include weathering, fluid flows, sediment mechanics, depositional environments, stratigraphic logging and field data collection, sedimentary lithofacies, provenance, and application of principles of interpretation of stratigraphic record. Two lectures and one 4-hour lab per week; two 1-day field trips; One 5-day field trip.
Prereqs: GEOL 102/GEOL 102L and MATH 143 with a grade of 'C' or better

GEOL 326 Igneous and Metamorphic Petrology (4 credits)
Hard rock petrology plus megascopic and microscopic petrography of igneous and metamorphic rocks. Two lectures and two 2-hour labs per week; two 1-day or one 2-day field trips.
Prereqs: GEOL 249 and MATH 143 with a grade of 'C' or better

GEOL 335 Geomorphology (3 credits)
Classification, recognition, origin, and significance of land forms; landform analysis in interpretation of geologic structure and history. One 2-day field trip.
Prereqs: GEOL 101/GEOL 101L or GEOL 102/GEOL 102L or GEOL 111/ GEOL 111L, or GEOG 100/GEOG 100L; and MATH 143 with a grade of ‘C’ or better; or Permission

GEOL 344 Earthquakes (3 credits)
The geology of earthquakes including the cause of fault rupture, seismic waves, focal mechanisms, and earthquakes associated with all fault types in a variety of tectonic settings; methods of identifying paleo-earthquakes in the geologic record, and the assessment of seismic risk in active fault environments.
Prereqs: GEOL 101 and GEOL 101L or GEOL 111 and GEOL 111L or GEOG 100 or ENVS 101; and MATH 143 with a grade of ‘C’ or better

GEOL 345 Structural Geology (4 credits)
Investigation of deformed rocks; mechanics of brittle and continuum failure, stress and strain relations, characterization, description, classification of folded and fractured rocks. Three hours of lecture and one 2-hour 45-minute lab per week; one week-long mandatory field trip. (Spring only)
Prereqs: MATH 143 with a grade of ‘C’ or better; and one semester high-school trigonometry or MATH 144; and GEOL 101/GEOL 101L or GEOL 111/GEOL 111L; and PHYS 111/PHYS 111L or PHYS 211/ PHYS 211L

GEOL 361 Geology and the Environment (3 credits)
Environmental consequences of development of geologic resources; including issues of waste disposal, pollution and human health, and climate change.
Prereqs: GEOL 101 and GEOL 101L or GEOL 111 and GEOL 111L or GEOG 100 or ENVS 101; and MATH 143 with a grade of ‘C’ or better
GEOL 375 Geology of National Parks (3 credits)
Primarily for non-geology majors who want to acquire a better knowledge of geologic concepts and processes through study of geology of national parks. One 6-day field trip.
**Prereqs:** GEOL 101/GEOL 101L, GEOL 102/GEOL 102L, GEOL 111/GEOL 111L, or GEOG 100/GEOG 100L; and MATH 143 with a grade of 'C' or better

GEOL 398 (s) Internship (1-16 credits)
Credit arranged

GEOL 400 (s) Seminar (1 credit, max arranged)
Participation in departmental colloquium.
**Prereqs:** MATH 143 with a grade of 'C' or better

GEOL 403 (s) Workshop (1-16 credits)
Credit arranged

GEOL 404 (s) Special Topics (1-16 credits)
Credit arranged

GEOL 405 (s) Professional Development (1-16 credits)
Credit arranged

GEOL 407 Basin Analysis (3 credits)
Joint-listed with GEOL 507
Formation mechanisms and characteristics of sedimentary basins. Modern concepts of tectonics and sedimentary basin analysis, including tectonics of subsidence, detrital mineral provenance, thermal histories, and facies models. Lithofacies distributions and structural styles in a variety of basin types with specific examples from around the world. Additional paper required for graduate credit. One 2-day and one 5-day field trip. Cooperative: open to WSU degree-seeking students. (Spring only)
**Prereqs:** GEOL 324 and MATH 143 with a grade of C or better

GEOL 410 Groundwater Field Methods (3 credits)
Joint-listed with GEOL 508
Field methods and professional practice in groundwater hydrology. Basic field techniques used in groundwater investigations, including measuring and interpreting depth to water in wells, slug testing, and aquifer pumping tests. Professional skills complementary to field investigations, including logistics, project budgeting, and safety planning. Students are required to participate in a significant amount of work in the field, including performance of a field-based final project. For graduate credit, students must complete a resource evaluation using data gathered in the final project. Cooperative: open to WSU degree-seeking students.

GEOL 422 Principles of Geophysics (4 credits)
Outline of geophysical methods for geological investigations. One 1-day field trip. Course includes 3 hours of lecture and one 2-hour lab per week.
**Prereqs:** MATH 143 with a grade of 'C' or better

GEOL 423 Principles of Geochemistry (3 credits)
Physiochemical principles applied to geologic processes. Topics covered include atmospheric geochemistry, environmental geochemistry, aqueous geochemistry, crystal chemistry, radiogenic and stable isotopes. These topics provide an overview of the principles of physics and chemistry that define geochemistry and its use to understand Earth's geology. The objective of this course is to learn how geochemical processes control the distribution of elements from the core of the Earth to the atmosphere. Includes one 3-day field trip.
**Prereqs:** GEOL 249

GEOL 424 (s) Advanced Topics in Sedimentary Rocks (3 credits)
Joint-listed with GEOL 520
Modern concepts of tectonic sedimentology, depositional environments, facies models, and application of analytical techniques to stratigraphic sequences. GEOL 520 students will have an additional research project. One 5-day field trip. Cooperative: open to WSU degree-seeking students. Typically Offered: Spring.
**Prereqs:** GEOL 324.

GEOL 428 Geostatistics (3 credits)
Cross-listed with GEOE 428
Joint-listed with GEOL 534
Applications of random variables and probability in geologic and engineering studies; regression, regionalized variables, spatial correlation, variograms, kriging, and simulation. Recommended Preparation: STAT 301. Cooperative: open to WSU degree-seeking students.

GEOL 431 Chemical Hydrogeology (3 credits)
Joint-listed with GEOL 531
An exploration of low temperature, aqueous geochemistry principles through examination of atmospheric, geologic, and biologic influences on water chemistry in surface and near-surface hydrologic environments. For graduate credit, students are required to complete an additional independent research paper or presentation. Recommended preparation: GEOL 423.
**Prereqs:** CHEM 111/CHEM 111L

GEOL 433 Geodynamics (4 credits)
Joint-listed with GEOL 533
This class focuses on the processes and mechanisms that cause motions within and on the surface of the Earth and other planets. Topics to be covered include plate boundary deformation, plate flexure, planetary heat transfer, convection in the mantle and core, melting and melt transport, magma dynamics, and large-scale lithospheric deformation. For graduate credit, students will be expected to complete a research project and report. Course includes 3 hours of lecture and one 3-hour lab per week. Offered fall semester. Recommended Preparation: Math 175 or equivalent. Cooperative: open to WSU degree-seeking students.
**Prereqs:** MATH 143 with a grade of 'C' or better; and MATH 170 or equivalent

GEOL 435 Glaciology and the Dynamic Frozen Earth (3 credits)
Joint-listed with GEOL 535
This course examines the physical processes that govern the frozen components of the Earth system. Idaho's changing snowpack, thinning Arctic sea ice, and accelerating glaciers are all evidence of the Earth's dynamic and rapidly changing frozen surface. These landscapes play critical roles in the climate system. Thinning and retreat of glaciers and ice sheets is on track to raise global sea level by up to a meter within student lifetimes. This course covers the mechanics and energy budgets of the frozen earth. Upon completion of this course, students will be able to describe the ways by which glaciers increase or decrease their flow, the controls on the growth and loss of sea ice, the importance of permafrost environments to the climate and landscape evolution, and how ice preserves a record of past global temperatures. Additional work required for graduate credit. Cooperative: open to WSU degree-seeking students.
**Prereqs:** MATH 160 or MATH 170
GEOL 447 Geochronology and Thermochronology (3 credits)
Joint-listed with GEOL 547
Constraining the timing, rate, and pace of earth processes and events is crucial for geoscience research. This course covers the fundamentals of radiometric dating methods for geologic materials and recent developments in the fields of geochronology and thermochronology. Discussions will focus on principles and assumptions of each technique, novel applications, and interpretation of complex datasets. Additional work required for graduate credit. Typically Offered: Varies.
Prereqs: GEOL 101 or GEOL 111 or Permission Cooperative: open to WSU degree-seeking students.

GEOL 462 Petroleum Systems and Stratigraphic Concepts (3 credits)
Joint-listed with GEOL 562
Learn the play elements for a petroleum system and the science behind the discovery, analytical work, extraction, and economics; learn how to use cutting-edge software used in industry to do well log and 3D seismic interpretation using key stratigraphic concepts, and subsurface geologic mapping and interpretation. One 2 to 4 day field trip. Both undergraduate and graduate students will used real geophysical well logs, historic data, and seismic data for their class project. Additional project work is required for graduate credit. Graduate students will be responsible for delving into larger projects and will be expected to exhibit a greater understanding of the implications of their work. Typically Offered: Fall (Even Years).
Prereqs: none Cooperative: open to WSU degree-seeking students.

GEOL 467 Volcanology (3 credits)
Joint-listed with GEOL 567
Eruption mechanisms, volcanic processes and landforms, and volcanic deposits. Additional projects/assignments required for graduate credit. Two lectures and one 2-hour lab per week; seven days of field trips.
Prereqs: MATH 143 with a grade of 'C' or better

GEOL 471 Ore Deposits and Exploration (3 credits)
Joint-listed with GEOL 572
The geologic origin of metallic ore deposits and the methods used to search for them. Taught in alternating years. One 1-day and one 3-day field trip. For graduate credit, graduate students must complete a research paper describing some aspect of ore deposit formation. Typically Offered: Varies.
Prereqs: GEOL 249 and MATH 143 with a grade of 'C' or better

GEOL 474 Stable Isotopes in the Environment (3 credits)
Joint-listed with GEOL 584
Learn the theory and application of stable isotopes to a range of topics in earth sciences, environmental science, and related disciplines. Topics include the kinetic and equilibrium fractionation of stable isotopes in natural systems, the processes that drive those fractionations, and the use of isotope mass spectrometry to measure and understand those processes. Students will work with and interpret real datasets. Additional work is required for graduate credit. Cooperative: open to WSU degree-seeking students. Typically Offered: Spring.
Prereqs: GEOL 101 or GEOL 102 or GEOL 111; CHEM 111.

GEOL 489 Virtual Field Camp (3 credits)
Advanced field problems and methods; interpretation of field data, preparation of reports based on geological observations and interpretations. Virtual Field camp provides the necessary support for students with physical challenges to meet the requirements of the BS degree in geology. Typically Offered: Summer.
Prereqs: GEOL 290, GEOL 345, and MATH 143 with a grade of 'C' or better
Cooperative: open to WSU degree-seeking students.

GEOL 490 Geology Field Camp (3 credits)
General Education: Senior Experience.
Prereqs: GEOL 345; and MATH 143 with a grade of 'C' or better
Cooperative: open to WSU degree-seeking students.

GEOL 498 Senior Thesis (1-4 credits, max 4)
Completion of original research and report. Course is taken over two semesters; first semester is graded IP until completion of second semester.
Prereqs: MATH 143 with a grade of 'C' or better and Senior standing and Permission

GEOL 499 (s) Directed Study (1-16 credits)
Credit arranged
Prereqs: MATH 143 with a grade of 'C' or better

GEOL 500 Master's Research and Thesis (1-16 credits)
Credit arranged

GEOL 501 (s) Seminar (1 credit, max arranged)
Participation in departmental colloquium.

GEOL 502 (s) Directed Study (1-16 credits)
Credit arranged

GEOL 503 (s) Workshop (1-16 credits)
Credit arranged

GEOL 504 (s) Special Topics (1-16 credits)
Credit arranged

GEOL 505 (s) Professional Development (1-16 credits)
Credit arranged

GEOL 507 Basin Analysis (3 credits)
Joint-listed with GEOL 407
Formation mechanisms and characteristics of sedimentary basins. Modern concepts of tectonics and sedimentary basin analysis, including tectonics of subsidence, detrital mineral provenance, thermal histories, and facies models. Lithofacies distributions and structural styles in a variety of basin types with specific examples from around the world. Additional paper required for graduate credit. One 2-day and one 5-day field trip. Cooperative: open to WSU degree-seeking students. (Spring only)
Prereqs: GEOL 324 and MATH 143 with a grade of C or better

GEOL 508 Groundwater Field Methods (3 credits)
Joint-listed with GEOL 410
Field methods and professional practice in groundwater hydrology. Basic field techniques used in groundwater investigations, including measuring and interpreting depth to water in wells, slug testing, and aquifer pumping tests. Professional skills complementary to field investigations, including logistics, project budgeting, and safety planning. Students are required to participate in a significant amount of work in the field, including performance of a field-based final project. For graduate credit, students must complete a resource evaluation using data gathered in the final project. Cooperative: open to WSU degree-seeking students.

GEOL 510 (s) Geosystems (3 credits, max 6)
Interdisciplinary core graduate course in earth sciences. Course will involve multiple instructors and modules framed around a common theme. Specific focus may vary from year to year. Cooperative: open to WSU degree-seeking students.
GEOL 520 (s) Advanced Topics in Sedimentary Rocks (3 credits, max 3)
Joint-listed with GEOL 520
Modern concepts of tectonic sedimentology, depositional environments, facies models, and application of analytical techniques to stratigraphic sequences. GEOL 520 students will have an additional research project. One 5-day field trip. Cooperative: open to WSU degree-seeking students. Typically Offered: Spring.
Prereqs: GEOL 324.

GEOL 531 Chemical Hydrogeology (3 credits)
Joint-listed with GEOL 431
An exploration of low temperature, aqueous geochemistry principles through examination of atmospheric, geologic, and biologic influences on water chemistry in surface and near-surface hydrologic environments. For graduate credit, students are required to complete an additional independent research paper or presentation. Recommended preparation: GEOL 423.
Prereqs: CHEM 111/CHEM 111L

GEOL 533 Geodynamics (4 credits)
Joint-listed with GEOL 433
This class focuses on the processes and mechanisms that cause motions within and on the surface of the Earth and other objects. Topics to be covered include plate boundary deformation, plate flexure, planetary heat transfer, convection in the mantle and core, melting and melt transport, magma dynamics, and large-scale lithospheric deformation. For graduate credit students will be expected to complete a research project and report. Course includes 3 hours of lecture and one 3-hour lab per week. Offered fall semester. Recommended Preparation: Math 175 or equivalent. Cooperative: open to WSU degree-seeking students.
Prereqs: MATH 143 with a grade of 'C' or better; and MATH 170 or equivalent

GEOL 534 Geostatistics (3 credits)
Joint-listed with GEOL 428 and GEOE 428
Applications of random variables and probability in geologic and engineering studies; regression, regionalized variables, spatial correlation, variograms, kriging, and simulation. Recommended Preparation: STAT 301. Cooperative: open to WSU degree-seeking students.

GEOL 535 Glaciology and the Dynamic Frozen Earth (3 credits)
Joint-listed with GEOL 435
This course examines the physical processes that govern the frozen components of the Earth system. Idaho's changing snowpack, thinning Arctic sea ice, and accelerating glaciers are all evidence of the Earth's dynamic and rapidly changing frozen surface. These landscapes play critical roles in the climate system. Thinning and retreat of glaciers and ice sheets is on track to raise global sea level by up to a meter within student lifetimes. This course covers the mechanics and energy budgets of the frozen earth. Upon completion of this course, students will be able to describe the ways by which glaciers increase or decrease their flow, the controls on the growth and loss of sea ice, the importance of permafrost environments to the climate and landscape evolution, and how ice preserves a record of past global temperatures. Additional work required for graduate credit. Cooperative: open to WSU degree-seeking students.
Prereqs: MATH 160 or MATH 170

GEOL 547 Geochronology and Thermochronology (3 credits)
Joint-listed with GEOL 447
Constraining the timing, rate, and pace of earth processes and events is crucial for geoscience research. This course covers the fundamentals of radiometric dating methods for geologic materials and recent developments in the fields of geochronology and thermochronology. Discussions will focus on principles and assumptions of each technique, novel applications, and interpretation of complex datasets. Additional work required for graduate credit. Typically Offered: Varies. Cooperative: open to WSU degree-seeking students.

GEOL 549 Principles of Electron Microscopy (3 credits)
Theory and principles of scanning and transmission electron microscopy as an investigative tool; includes physical principles of electron microscopy, operation and maintenance of the electron microscope, specimen preparation, and digital image capture. Lab section involves hands-on use of SEM and TEM. Students registering are required to complete a research project. One 1, 5-hour lecture and one 2-hour lab per week. Cooperative: open to WSU degree-seeking students. Typically Offered: Fall.

GEOL 562 Petroleum Systems and Stratigraphic Concepts (3 credits)
Joint-listed with GEOL 462
Learn the play elements for a petroleum system and the science behind the discovery, analytical work, extraction, and economics; learn how to use cutting-edge software used in industry to do well log and 3D seismic interpretation using key stratigraphic concepts, and subsurface geologic mapping and interpretation. One 2 to 4 day field trip. Both undergraduate and graduate students will used real geophysical well logs, historic data, and seismic data for their class project. Additional project work is required for graduate credit. Graduate students will be responsible for delving into larger projects and will be expected to exhibit a greater understanding of the implications of their work. Typically Offered: Fall (Even Years). Cooperative: open to WSU degree-seeking students.

GEOL 567 Volcanology (3 credits)
Joint-listed with GEOL 467
Eruption mechanisms, volcanic processes and landforms, and volcanic deposits. Additional projects/assignments required for graduate credit. Two lectures and one 2-hour lab per week; seven days of field trips. Cooperative: open to WSU degree-seeking students.

GEOL 572 Ore Deposits and Exploration (3 credits)
Joint-listed with GEOL 471
The geologic origin of metallic ore deposits and the methods used to search for them. Taught in alternating years. One 1-day and one 3-day field trip. For graduate credit, graduate students must complete a research paper describing some aspect of ore deposit formation. Typically Offered: Varies. Cooperative: open to WSU degree-seeking students.

GEOL 584 Stable Isotopes in the Environment (3 credits)
Joint-listed with GEOL 474
Learn the theory and application of stable isotopes to a range of topics in earth sciences, environmental science, and related disciplines. Topics include the kinetic and equilibrium fractionation of stable isotopes in natural systems, the processes that drive those fractionations, and the use of isotope mass spectrometry to measure and understand those processes. Students will work with and interpret real datasets. Additional work is required for graduate credit. Cooperative: open to WSU degree-seeking students. Typically Offered: Spring.
Prereqs: GEOL 101 or GEOL 102 or GEOL 111; CHEM 111.
GEOL 598 (s) Internship (1-16 credits)
Credit arranged

GEOL 599 (s) Research (1-16 credits)
Credit arranged Research not directly related to a thesis or dissertation.
Prereqs: Permission

GEOL 600 Doctoral Research and Dissertation (1-45 credits)
Credit arranged