Courses

**GEOL 5502 Geomorphology: 4 semester hours.**
Process-response approach to landforms and landscapes. Historical perspectives, endo- and exogenic processes, equilibrium and relict landforms. Emphasis on interrelations among various geologic sub-disciplines. Field trips, some lab exercises. LL at PC. PREREQ: GEOL 3315 or permission of instructor. COREQ: GEOL 5502L.

**GEOL 5502L Geomorphology Laboratory: 0 semester hours.**
Assignments to apply principles from GEOL 5502. LL at PC. COREQ: GEOL 5502.

**GEOL 5503 Principles of Geographical Information System: 3 semester hours.**
Study of GIS fundamentals, vector and raster models, introduction to GPS and Global Navigation Satellite Systems, basic spatial analysis, geodatabases, and metadata, databases, and meta data. Practical application of industry standard software. Requires competence in computer operating systems. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. COREQ: GEOL 5503L.

**GEOL 5503L Principles of GIS Laboratory: 0 semester hours.**
Computer lab assignments to apply principles from GEOL 5503. COREQ: GEOL 5503.

**GEOL 5504 Advanced Geographic Information Systems: 3 semester hours.**
Study of relational databases, including spatial analysis, and remote sensing. Practical application of industry standard software. Exercises include digitizing, querying, digital terrain modeling, and image processing. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. PREREQ: GEOL 5503 and GEOL 5503L or permission of instructor.

**GEOL 5505 Volcanology: 3 semester hours.**
Aspects of physical and chemical volcanology: types of volcanoes; interpretation of volcanic deposits; properties of magma; generation, rise, and storage of magma; volcanic hazards and prediction.

**GEOL 5506 Environmental Geology: 3 semester hours.**
Humans and the environment. Topics include: industrial exploitation of fossil fuels, energy sources, soils, water and other materials, environmental health, pollution, waste disposal, hazards, disasters, and land use.

**GEOL 5507 GPS Application in Research: 3 semester hours.**
Overview of satellite positioning systems usage. Topics include GPS and Global Navigation Satellite theory, basic mapping concepts, use of mapping grade receivers for GIS data collection. Sample design for data collection and spatial analysis in GIS. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. PREREQ: GEOL 4403 or GEOL 5503.

**GEOL 5508 GeoTechnology Seminar: 2 semester hours.**
GIS applications in natural and social sciences, ethical and legal issues, current status and recent advances in GeoTechnology. Lectures, discussion, readings.

**GEOL 5509 Remote Sensing: 3 semester hours.**
Fundamentals and applications of single frequency, multispectral, and hyperspectral, radar and lidar remote sensing for the sciences. Emphasis on acquiring, processing, integrating, and interpretation of imagery. Requires competence in computer operating systems. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. D

**GEOL 5510 Science in American Society: 2 semester hours.**
Observational basis of science; technology's historical influences on scientific developments; perceptions of science in contemporary America; tools/strategies for teaching science. Equivalent to PHYS 5510.

**GEOL 5511 Planetary Petrology: 3 semester hours.**
Chemistry, mineralogy, tectonic association and petrogenesis of the principal igneous and metamorphic rock types on Earth and other planetary bodies. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. PREREQ: GEOL 3314. D

**GEOL 5512 Petrology Lab: 2 semester hours.**
Microscopic identification of igneous and metamorphic minerals and rocks. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. COREQ: GEOL 5511.

**GEOL 5513Sedimentary Rocks in Thin Sections: 2 semester hours.**
A variety of terrigenous, volcaniclastic, and carbonate rocks will be studied. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. PREREQ: GEOL 5511.

**GEOL 5515 Quaternary Global Change: 3 semester hours.**
Use and interpretation of land forms, sediments, and fossil life in the understanding of Ice Age climatic cycles that influenced geological events, environment, and climates during the Quaternary Period. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. COREQ: GEOL 5515L. AF

**GEOL 5515L Quaternary Change Lab: 0 semester hours.**
Laboratory exercises, problem sets, and field trips investigating Quaternary geoscience. LL at PC. AF

**GEOL 5516 Global Environmental Change: 3 semester hours.**
Analysis of the causes and effects of both natural and human-induced environmental change. Integrates knowledge from other Earth Systems Science courses, and examines and analyzes relevant problems in global environmental change using scientific methods.

**GEOL 5517 Introduction to Soils and Critical Zone Processes: 3 semester hours.**
Introduction to soils with emphasis on soil formation and classification and the physical, chemical and biological properties of soils. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. PREREQ: CHEM 1112, CHEM 1112L, or permission of instructor. COREQ: GEOL 5517L. AF

**GEOL 5517L Introduction to Soils Laboratory: 1 semester hour.**
Assignments to apply GEOL 5517. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC PREREQ: CHEM 1112, CHEM 1112L, or permission of instructor. COREQ: GEOL 5517.

**GEOL 5520 Principles of Geochemistry: 3 semester hours.**
Chemistry of the earth; discussion of factors controlling abundance, distribution, and migration of chemical elements within the earth. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. PREREQ: GEOL 3313, CHEM 1112 and CHEM 1112L, or permission of instructor. D

**GEOL 5522 Planetary Geology: 3 semester hours.**
Formation of planetary bodies (planets, moons, asteroids, and comets), internal and surficial processes, tectonics, and planetary exploration. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. PREREQ: GEOL 2203 or permission of instructor. D

**GEOL 5527 Information Technology for GIS: 3 semester hours.**
Study of servers, networks, system administration, relational database design and management, spatial database engines, and serving maps on the internet. The course uses traditional lectures along with demonstrations and hands-on exercises.
The course introduces students to programming for GIS. Students will learn the fundamentals of coding (IO, logical forks, loops, language standards) and integration of GIS libraries (ex., arcpy, GDAL). Students will complete a project where they develop a GIS tool of their choice. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. PREREQ: MATH 1147 and GEOL 1100 or 1101, or permission of instructor.

**GEOL 5528 Programming for GIS: 3 semester hours.**

**GEOL 5530 Principles of Hydrogeology: 3 semester hours.**

Surface and groundwater occurrence, movement and recovery, water quality and pollution, well construction principles, and computer modeling. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. CL at PC. Prerequisite: MATH 1147 or both MATH 1143 and MATH 1144; and GEOL 2203 or permission of instructor. AS

**GEOL 5531 Geobiology and the History of Life: 4 semester hours.**

Principles of biology and geology applied to the study of fossil invertebrates; consideration is given to morphology, classification, evolution, paleoecology, and the stratigraphic significance of fossils. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. Corequisite: GEOL 5531L. AF

**GEOL 5531L Geobiology and History of Life Lab: 0 semester hours.** Assignments to apply principles from GEOL 5531. LL at PC. Corequisite: GEOL 5531. AF

**GEOL 5535 Vertebrate Paleontology: 4 semester hours.**


**GEOL 5539 Principles of Taphonomy: 3 semester hours.**

Effects of processes which modify organisms between death and the time the usually fossilized remains are studied. Emphasis on vertebrates. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. CL at PC. Equivalent to ANTH 5539 and BIOL 5539. Prerequisite: Permission of Instructor. D

**GEOL 5540 Ore Deposits: 3 semester hours.**

Nature, mode of occurrence, and origin of ores with each type related to a given rock association and as the product of a particular environment. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. CL at PC. Prerequisite: One of: GEOL 3314, GEOL 5522 (recommended), or GEOL 5521.

**GEOL 5545 Environmental and Engineering Geophysics: 4 semester hours.**

Geophysical applications to environmental and geological engineering problems. Includes seismic, gravity, magnetic, electrical, and electromagnetic methods (includes lab).

**GEOL 5550 Field Geology: 6 semester hours.**

Five-week summer field camp, applying standard geologic field instruments and geologic concepts to a series of field problems.

**GEOL 5551 Field Methods in Environmental Sciences: 3 semester hours.**

Practical application of field methods with an Earth systems focus. Students learn the techniques and concepts necessary to build water and carbon budgets for a small watershed. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LB at PC. Prerequisite: Permission of Instructor. D

**GEOL 5552 Sedimentation-Stratigraphy: 4 semester hours.**

Principles of sedimentation from source to diagenesis. The basis of stratigraphic nomenclature, classification, and correlation of rock units. Laboratory covers unconsolidated sediment, hand specimens, subsurface, and field techniques. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. LL at PC. Prerequisite: GEOL 3310 and ENGL 1102 or permission of instructor. Pre-OR-Corequisite: CHEM 1111 and CHEM 1111L. Corequisite: GEOL 5552L. F

**GEOL 5552L Sedimentation-Stratigraphy Laboratory: 0 semester hours.** Assignments to apply principles in GEOL 5552. Corequisite: GEOL 5552.

**GEOL 5554 Basic Engineering Geology: 3 semester hours.**

Geology applied to engineering projects; geotechnical problems in civil projects; site methods. Subsurface investigations including scope, logging, and in situ and geophysical methods. Equivalent to CE 5554.

**GEOL 5555 Geologic Data Methods: 3 semester hours.**

Classification of geotechnical projects. Geologic mapping for civil engineering purposes. Development of engineering geologic profiles. Pre-bid geotechnical investigations and field instrumentation for civil works projects. Equivalent to CE 5555.

**GEOL 5556 Geology of Idaho: 2 semester hours.**

Geologic provinces and plate tectonic history of Idaho. Topics include basement, Belt Supergroup, Phanerozoic passive margin, Cordilleran orogen, accreted terranes, terranes, Idaho batholith, Challis volcanics, Idaho mineral deposits, Basin and Range, Snake River and Pleistocene floods.

**GEOL 5558 Geology of North America: 3 semester hours.**

Regional stratigraphy and tectonics of North America emphasizing National Parks and the Intermountain West. Graduate students will do extensive additional reading in current literature. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. CL at PC. Prerequisite: GEOL 2201.

**GEOL 5565 Petroleum Geosciences: 3 semester hours.**

Occurrence of hydrocarbons, well logs, geophysical methods, generation and migration of petroleum, the reservoir, traps and seals, petroleum basins, unconventional petroleum resources. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. CL at PC. Prerequisite: GEOL 3310 or permission of instructor.

**GEOL 5571 Historical Geography of Idaho: 3 semester hours.**

Influences of geography and geology on Idaho's economic, political and cultural history. May be team taught and include field trips, discussion sections. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. Equivalent to HIST 5571 and POLS 5571.

**GEOL 5575 Essentials of Geomechanics: 3 semester hours.**

Essentials of rock fracture relevant to geological engineering including stress and strain, properties and classification of rock masses, rock fracture mechanisms. Equivalent to CE 5575.

**GEOL 5576 Engineering Geology Project: 1 semester hour.**

Team projects studying actual problems in engineering geology. Equivalent to CE 5576.

**GEOL 5580 Special Topics in GIS: 1-3 semester hours.**

Visual Basic programming for GIS. May be repeated.

**GEOL 5581 GeoTechnology Internship: 1-3 semester hours.**

Choose a project with either natural resource or municipal GIS emphasis and work with real-world data at the internship's off-campus location. Projects focus on using/creating geotechnical data. May be repeated.
GEOL 5583 Earthquake Engineering: 3 semester hours.
Mechanism and characterization of earthquakes; seismic risk analysis; site and structural response; applications from points of view of engineer and geologist. Equivalent to CE 5580.

GEOL 5590 Ecosystem Ecology and Global Change: 4 semester hours.
Examination of the structure and function of ecosystems and their responses to natural and anthropogenic changes emphasizing energy, water, carbon, and nitrogen cycling. Field trips. Specific, evaluated graduate-level activities and/or performances are identified in the course syllabus. CL at PC. Equivalent to BOIL 5590. PREREQ: BIOL 2209 or permission of instructor. PRE-OR-COREQ: CHEM 1111. S

GEOL 5591 Seminar: 1 semester hour.
Field trip or discussion of current geologic literature and geologic problems. May be repeated until 3 credits are earned. Graded S/U.

GEOL 5599 Experimental Course: 1-6 semester hours.
This is an experimental course. The course title and number of credits are noted by course section and announced in the class schedule by the scheduling department. Experimental courses may be offered no more than three times. May be repeated.

GEOL 6601 Advanced Physical Geology: 2 semester hours.
An advanced level course in physical geology required for all first year graduate students. A review of the principles of physical geology, and an overview of current hypotheses and research in the field.

GEOL 6602 Advanced Geomorphology: 3 semester hours.
Seminar in the treatment of theoretical concepts in classical and modern geomorphology.

GEOL 6603 Geologic Writing Seminar: 2 semester hours.
Review of quality geologic writing practices; extended field trip and introduction to regional geology. Topics include databases, abstracts, stratigraphic terminology, grant proposals, thesis prospecti, and use of reference library. Required for all Geosciences graduate students.

GEOL 6604 Watershed Modeling: 3 semester hours.
Use of geographic information systems and integrated simulation models to study the hydrologic cycle, water quality, agricultural and industrial impacts, environmental and related issues at the watershed scale.

GEOL 6607 Spatial Analysis: 3 semester hours.
This course focuses on advanced techniques for spatial data analysis covering issues in sampling, characterizing, visualizing, exploring and modeling spatial data. Techniques for point patterns, continuous data, area data, and spatial interaction data will be emphasized.

GEOL 6608 Geostatistics Spatial Data Analysis and Modeling: 3 semester hours.
Description, analysis and modeling of spatial data in the geosciences, emphasizing hands-on application of geostatistical software tools for spatial analysis and probabilistic modeling in petroleum and groundwater reservoirs, environmental remediation, and mining or any application involving spatially-varying data. PREREQ: GEOL 6607 or permission of instructor.

GEOL 6609 Advanced Image Processing: 1 semester hour.
An advanced-level course in image processing techniques, such as using transforms, filters, and classifiers for data derived in the visible, infrared, and microwave. Specific topics include preprocessing, endmember analysis, classification (including spectral unmixing), and accuracy assessment. Practical application of theory for graduate student theses and dissertations.

GEOL 6613 Idaho Water Resources Seminar: 1 semester hour.
This course is an interactive discussion focused on water science, issues, and policy across the state. The seminar is a joint effort of Idaho's universities and multiple institutes, agencies and firms.

GEOL 6615 Neutron Activation Analysis: 4 semester hours.
Theory and use of neutron activation methods for quantitative chemical analysis of natural and synthetic materials. Applications in geologic systems will be emphasized. Equivalent to CHEM 6615 and PHYS 6615.

GEOL 6617 Environmental Geochemistry: 3 semester hours.
Geochemistry of environmental systems. Emphasis given to low-temperature water-rock interactions, including sorption processes, retardation, reaction kinetics and reaction-mass transport modeling. Equivalent to CHEM 6617.

GEOL 6618 Applied Geophysics: 3 semester hours.
Geologic interpretation of reflection seismic, refraction seismic, gravity, magnetic, and ground penetrating radar data.

GEOL 6621 Advanced Structural Geology: 3 semester hours.
Current aspects of structural geology or tectonics. May focus on regional structures, tectonic theories, orogenge mechanics, global tectonic model(s), or topics of special interest in structural geology.

GEOL 6622 Orogenic Belts of the World: 3 semester hours.
Interdisciplinary analysis of Alpine and Cordilleran-type mountain belts including their infrastructure, tectonic evolution, and mechanisms of formation.

GEOL 6623 Tectonics and Sedimentation: 3 semester hours.
Sedimentary basin analysis and mechanisms of subsidence. Extensional, compressional and strike slip tectonics as related to depositional systems, facies architecture, and provenance.

GEOL 6625 Quantitative Geochemistry Lab: 3 semester hours.
Practical application of theory involving use and operation of instrumental techniques. Equivalent to CHEM 6625.

GEOL 6628 Advanced GIS Programming: 3 semester hours.
Course focuses on advanced topics in GIS programming, particularly processing efficiency for large problems. Students will learn the fundamentals of parallel processing for spatial problem solving, including use of shared and/or distributed memory systems. PREREQ: GEOL 5503, GEOL 5528, and permission of instructor.

GEOL 6630 Advanced Hydrogeology: 3 semester hours.
Advanced topics in hydrogeology, including precipitation and stream flow, soil moisture, principles and modeling of groundwater flow, migration of wastes in both saturated and unsaturated zones, design and impact of production wells, water chemistry.

GEOL 6631 Sedimentology: 3 semester hours.
Provenance, dispersal, and environments of deposition; emphasis on various aspects of surface equilibria.

GEOL 6641 Advanced Petrology: 3 semester hours.
Selected topics in igneous and/or metamorphic petrology, regional and/or global aspects of current interest, including relationship to major advances in other areas of solid earth sciences.

GEOL 6646 The Sedimentary Record: 3 semester hours.
Earth history as revealed in sedimentary facies, provenance, chemical and isotopic excursions. Methods of analysis including sequence stratigraphy, geochronology, biogeochemistry, chemostatigraphy.

GEOL 6648 Research Problems: 1-6 semester hours.
Independent research on non-thesis subject matter, subject to approval of the staff before results receive credit. Course may be repeated until 10 credits are earned.

GEOL 6649 Pre-Thesis: 1-6 semester hours.
Preparation and development of a prospectus for a thesis or dissertation project. May be repeated. Graded S/U. Credits are not counted in the program graduation credit requirement.
**GEOL 6650 Thesis: 1-9 semester hours.**
Ordinarily a field problem with supporting laboratory work undertaken by
the student with approval of the geology graduate faculty, and after a thesis
prospectus has been accepted. May be repeated. Graded S/U.

**GEOL 6684 Graduate Teaching Practicum: 1-2 semester hours.**
Supervised teaching in an undergraduate laboratory. Graded S/U. May be
repeated. Credits are not counted in the program graduation credit requirement.

**GEOL 6699 Experimental Course: 1-6 semester hours.**
This is an experimental course. The course title and number of credits are
noted by course section and announced in the class schedule by the scheduling
department. Experimental courses may be offered no more than three times. May
be repeated.

**GEOL 8850 Doctoral Dissertation: 1-16 semester hours.**
Ph.D. in Engineering and Applied Science. Research toward and completion of
the dissertation. Variable credit. May be repeated. Graded S/U.