**GEOLOGY (GEOL)**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Gen Ed:</th>
<th>Description</th>
<th>Coreq/Prereq</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOL 101</td>
<td>Physical Geology</td>
<td>3</td>
<td>Natural and Applied Sciences</td>
<td>The earth, its composition, structure, and natural processes. Three lec and 2 hrs of lab a wk; one 1-day field trip.</td>
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<tr>
<td>GEOL 101L</td>
<td>Physical Geology Lab</td>
<td>1</td>
<td>Natural and Applied Sciences</td>
<td>The earth, its composition, structure, and natural processes. Three lec and 2 hrs of lab a wk; one 1-day field trip.</td>
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<tr>
<td>GEOL 102</td>
<td>Historical Geology</td>
<td>3</td>
<td>Natural and Applied Sciences</td>
<td>Evolution of the physical earth, plants, and animals; techniques used in interpretation of geologic history. Includes one 1-day field trip.</td>
<td>Coreq: GEOL 102L or permission.</td>
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<tr>
<td>GEOL 102L</td>
<td>Historical Geology Lab</td>
<td>1</td>
<td>Natural and Applied Sciences</td>
<td>Evolution of the physical earth, plants, and animals; techniques used in interpretation of geologic history.</td>
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<tr>
<td>GEOL 111</td>
<td>Physical Geology for Science Majors</td>
<td>4</td>
<td></td>
<td>Introductory course in earth science for geology and other science majors. Three lec and one 2-hr lab a wk; two 1-day field trips.</td>
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<tr>
<td>GEOL 111L</td>
<td>Physical Geology for Science Majors Lab</td>
<td>1</td>
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<tr>
<td>GEOL 200</td>
<td>(s) Seminar</td>
<td>Credit arranged.</td>
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<td>GEOL 203</td>
<td>(s) Workshop</td>
<td>Credit arranged.</td>
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<tr>
<td>GEOL 204</td>
<td>(s) Special Topics</td>
<td>Credit arranged.</td>
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<tr>
<td>GEOL 212</td>
<td>Principles of Paleontology</td>
<td>4</td>
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<td>Studies of morphology, classification of fossil groups, and utility of fossils in interpreting depositional environments and ages of sedimentary rocks. Three lec and one 2-hr lab a wk; one 1- to 2-day field trip. Recommended Preparation: GEOL 102.</td>
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<tr>
<td>GEOL 249</td>
<td>Mineralogy and Optical Mineralogy</td>
<td>4</td>
<td></td>
<td>Principles of crystallography, crystal chemistry, and crystal structure; mineral identification; principles of optical mineralogy and use of the polarized light microscope. Three lec and one 2-hr lab a wk; two 1-day field trips.</td>
<td>Prereq: GEOL 111/GEOL 111L or GEOL 101/GEOL 101L, and CHEM 111/ CHEM 111L.</td>
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**GEOL 290 Field Geology Methods**

3 credits
Introduction to field mapping and field techniques; introduction to measuring and interpreting sedimentary sequences and tectonic structures; preparation of reports based on field data collection, background reading, and analysis or multiple datasets. Accident and health insurance required. One 4-hr course meeting per week; two 1-day field trips; one 5-day field trip. (Spring only)

**Prereq:** GEOL 101/GEOL 101L or GEOL 111/GEOL 111L, or GEOL 102/GEOL 102L.

**GEOL 299 (s) Directed Study**

Credit arranged.

**GEOL 309 Ground Water Hydrology**

3 credits
Occurrence, movement, and properties of subsurface water; intro to ground water geology and hydrology.

**Prereq:** 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 lec and one 4-hr lab per week; two 1-day field trips; One 5-day field trip.

**Prereq:** 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 lec and two 2-hr labs a wk; two 1-day or one 2-day field trips.

**Prereq:** 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; land form analysis in interpretation of geologic structure and history. One 2-day field trip.

**Prereq:** 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 and Seismic Hazards**

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 hazard and risk in active fault environments. One 3-day field trip.

**Prereq:** GEOL 101/GEOL 101L or GEOL 111/GEOL 111L; 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-hr 45-min lab a wk; one 1-day field trip. (Spring only)
PreReq: 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; natural hazards and their impact on humans and the environment. Two 1-day field trips.
PreReq: GEOL 101/GEOL 101L or GEOL 111/GEOL 111L; and MATH 143 with a grade of 'C' or better.

GEOL 375 Geology of National Parks
2 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.
PreReq: 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
Credit arranged.

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

GEOL 403 (s) Workshop
Credit arranged.

GEOL 404 (s) Special Topics
Credit arranged.

GEOL 405 (s) Professional Development
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. For 500-level credit an additional paper is required. One 2-day and one 5-day field trip. Cooperative: open to WSU degree-seeking students. (Spring only)
PreReq: GEOL 324 and MATH 143 with a grade of C or better.

GEOL 410 Techniques of Groundwater Study
3 credits
Collection and analysis of field data for reconnaissance ground water studies. Two weekend field trips.
PreReq: MATH 143 with a grade of 'C' or better
PreReq or Coreq: GEOL 309.

GEOL 417 Advanced Paleontology
3 credits
Fossil assemblage analyses and report writing; marine faunal assemblage 1st half semester; nonmarine floral assemblage 2nd half semester. Three 2-hr labs a wk; one 1-day field trip.
PreReq: MATH 143 with a grade of 'C' or better and GEOL 212; or Permission.

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.
PreReq: MATH 143 with a grade of 'C' or better.

GEOL 423 Principles of Geochemistry
3 credits
Physicochemical 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 three-day field trip.
PreReq: 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.
PreReq: GEOL 324.

GEOL 426 Principles of Forensic Mineralogy and Geology
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 lec and one 2-hr labs a wk; one 1-day field trip.
PreReq: GEOL 101/GEOL 101L, or GEOL 111/GEOL 111L; and CHEM 111/CHM 111L; and MATH 143 with a grade of 'C' or better; or Permission.

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.
PreReq: CHEM 111/CHM 111L.
GEOL 432 Geologic Development of North America
3 credits
Joint-listed with GEOL 532.
Tectonic, magmatic, and sedimentary sequence studies of North American continent through time; concepts of metal and petroleum enrichment related to time and geological processes. Additional questions on two exams and written report of field trip reqd for grad cr. One 7-day field trip. GEOL 532 is a cooperative course available to WSU degree-seeking students.
Prereq: MATH 143 with a grade of 'C' or better.

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.
Prereq: 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 500-level credit. Cooperative: open to WSU degree-seeking students.
Prereq: MATH 160 or MATH 170.

GEOL 467 Volcanology
3 credits
Joint-listed with GEOL 567.
Eruption mechanisms, volcanic processes and landforms, and volcanic deposits. Additional projects/assignments reqd for grad cr. Two 2-hr lab a wk; seven days of field trips.
Prereq: MATH 143 with a grade of 'C' or better.

GEOL 490 Geology Field Camp
3 credits
Gen Ed: Senior Experience
Advanced field problems and methods; interpretation of field data, preparation of reports based on field observations and interpretations. Accident and health insurance required. Three week, off-campus. Cooperative: open to WSU degree-seeking students. (Summer only)
Prereq: GEOL 290 and GEOL 345; and MATH 143 with a grade of 'C' or better.

GEOL 497 (s) Practicum in Tutoring
1 credit, max 2
Tutorial services performed by advanced students under faculty supervision. Graded P/F.
Prereq: MATH 143 with a grade of ‘C’ or better and Permission of department.

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.
Prereq: MATH 143 with a grade of ‘C’ or better and Senior standing and Permission.

GEOL 499 (s) Directed Study
Credit arranged
Prereq: MATH 143 with a grade of ‘C’ or better.

GEOL 500 Master's Research and Thesis
Credit arranged.

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

GEOL 502 (s) Directed Study
Credit arranged.

GEOL 503 (s) Workshop
Credit arranged.

GEOL 504 (s) Special Topics
Credit arranged.

GEOL 505 (s) Professional Development
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. For 500-level credit an additional paper is required. One 2-day and one 5-day field trip. Cooperative: open to WSU degree-seeking students. (Spring only)
Prereq: GEOL 324 and MATH 143 with a grade of C or better.

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
Joint-listed with GEOL 424
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.
Prereq: 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.
Prereq: CHEM 111/CHEM 111L.

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Prereq: MATH 143 with a grade of ‘C’ or better.

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4 credits
Joint-listed with GEOL 433.
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Prereq: MATH 160 or MATH 170.

GEOL 542 Advanced Structural Geology
3 credits
Concepts of linear elastic fracture mechanics as applied to the classification, origin and evolution of all types of rock fractures; continuum theory in rock mechanics; rock strength and failure criteria; stress tensors; elastic theory. Two 1-day field trips. Cooperative: open to WSU degree-seeking students.
Prereq: GEOL 345.

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-hr lec and one 2-hr lab a wk. (Fall only)

GEOL 567 Volcanology
3 credits
Joint-listed with GEOL 467.
Eruption mechanisms, volcanic processes and landforms, and volcanic deposits. Additional projects/assignments reqd for grad cr. Two lec and one 2-hr lab a wk; seven days of field trips. Cooperative: open to WSU degree-seeking students.
Prereq: MATH 143 with a grade of ‘C’ or better.

GEOL 598 (s) Internship
Credit arranged.

GEOL 599 (s) Research
Credit arranged
Research not directly related to a thesis or dissertation. Prereq: Permission.

GEOL 600 Doctoral Research and Dissertation
Credit arranged.