

GEOLOGY *College of Science, Health & Engineering*

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BA	BS	Minor

Faculty:

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UNDERGRADUATE PROGRAMS

Geology is the science of planet Earth. Geologists use elements of chemistry, physics, biology and mathematics in interpreting the evolution of the earth and its life forms. Applied geology addresses exploitation of earth resources, environmental quality and hazards and practical understanding of the planet on which we live.

Geology is a field-oriented science and our curriculum emphasizes field studies. However, geologists increasingly employ advanced chemical and physical analytic techniques and use computers to model natural systems. Eastern has specialized laboratory facilities for various sub-disciplines in geology. Extensive collections of minerals, rocks and fossils are available for study and research.

Nationwide, approximately half of recent geology graduates are employed in environmental fields while a third go on to graduate school. Most of the rest go into the petroleum industry, teaching, government or mining. The Geology Department has close relations with geotechnical/environmental consulting firms, government agencies and mining companies in the Pacific Northwest. These relationships help to place students and graduates in jobs.

Students should decide on a geology major early to ensure timely graduation with the many credits needed in the Bachelor of Science program. For the BS in Geology, ENGL 205 *Introduction to Technical Communication*, is desirable. Substitutions of courses in the Geology major must be approved by the department. Most graduate schools require a full year of calculus.

An opportunity exists to earn a double major with a BS in both Geology and Environmental Science. (See catalog section on Environmental Science.)

General Admissions Requirements for Geology: High school students planning to major in Geology should take two years of algebra, one year of geometry/trigonometry and one year of chemistry and physics. They are also encouraged to take four years of English. The ability to express ideas and concepts clearly and concisely, both orally and in written form, is fundamental to all sciences.

Entering freshmen and transfer students electing to major in Geology should contact the Department for advising as soon as possible. Failure to do so may result in an additional year to finish the BS program. Especially important for beginning students is early completion of the chemistry sequence.

Grade Requirement:

2.50 cumulative average

2.0 in required supporting and geology classes

Required courses in the following programs of study may have prerequisites.

Reference the course description section for clarification.

BACHELOR OF ARTS (BA)

STUDENT LEARNING OUTCOMES – STUDENTS WILL:

- develop effective skills in oral and written communication in order to be successful in the field of geology;
- understand basic principles of the history and development of the earth through time;
- learn and demonstrate the proper use of computer, laboratory, and field equipment used in geology.

GEOLOGY MAJOR (65-72 CREDITS)

The Bachelor of Arts serves students interested in geology-oriented fields which do not require the full range of professional training. Employment opportunities include such varied possibilities as park naturalist, urban and regional planner or geological technician.

Note: two years of a single high school foreign language or one year of a single college level foreign language is required.

Required Courses (31–37 credits)

- GEOL 120 Physical Geology–The Solid Earth (5)
- GEOL 121 Physical Geology–Surficial Processes (5)
- GEOL 122 Historical Geology (5)
- GEOL 311 Earth Materials (4)
- GEOL 312 Crystallography and Optical Mineralogy (4)
- GEOL 313 Igneous and Metamorphic Petrology (4)
- GEOL 490 Senior Capstone: Geology Field Camp (10)
 - or GEOL 490 Senior Capstone: Water and the West (4)
 - or GEOL 491 Senior Thesis (4)

Required Supporting Courses (10 credits)

- CHEM 151 General Chemistry (5)
- CHEM 152 General Chemistry (5)

Choose one from the following (4–5 credits)

- BIOL 171 Biology I (4)
- GEOG 328 Geographic Information Systems I (5)
- GEOG 410 Geomorphology (5)
- MATH 161 Calculus I (5)
- MATH 380 Elementary Probability and Statistics (5)
- PHYS 131 Introductory Physics I (4)
 - and PHYS 161 Mechanics Lab (1)

Electives (20 credits)

- GEOL 220 Environmental Geology (4)
- GEOL 330 Structural Geology I (4)
- GEOL 331 Structural Geology II (4)
- GEOL 360 Geologic Hazards (4)
- GEOL 408 Invertebrate Paleontology (4)
- GEOL 411 Sedimentology and Stratigraphy (4)
- GEOL 470 Hydrogeology (4)
- Geology field course (up to 5 credits)

Required program credits

Required supporting credits

Elective credits

Minimum total credits for above major

31–37 credits

14–15 credits

20 credits

65 credits

BACHELOR OF SCIENCE (BS)

STUDENT LEARNING OUTCOMES – STUDENTS WILL:

- develop effective oral and written communication skills necessary for employment in the various fields of geology;
- develop critical thinking skills to solve geological problems encountered in the various fields of geology;
- understand and be able to use the tools and equipment available to professional geologists to solve geological problems;
- have a solid understanding of geologic principles and processes that operate in the complex systems of the earth.

GEOLOGY MAJOR (105–108 CREDITS)

The Bachelor of Science program prepares students for careers as professional geologists, provides the basis for admission to graduate school and prepares students seeking registration and licensing as professional geologists. Some courses in the BS degree will also count as Natural Science **GECRs** and satisfy the university proficiency in mathematics requirement.

Required Courses (53 credits)

- GEOL 120 Physical Geology–The Solid Earth (5)
- GEOL 121 Physical Geology–Surficial Processes (5)
- GEOL 122 Historical Geology (5)
- GEOL 311 Earth Materials (4)
- GEOL 312 Crystallography and Optical Mineralogy (4)
- GEOL 313 Igneous and Metamorphic Petrology (4)
- GEOL 330 Structural Geology I (4)
- GEOL 331 Structural Geology II (4)
- GEOL 408 Invertebrate Paleontology (4)
- GEOL 411 Sedimentology and Stratigraphy (4)
- GEOL 490 Senior Capstone: Geology Field Camp (10)

Required Supporting Courses (28 credits)

- CHEM 151 General Chemistry (5)
- CHEM 152 General Chemistry (5)
- CHEM 153 General Chemistry (5)
- GEOG 323 GIS for Environmental Science (3)
- MATH 161 Calculus I (5)
- MATH 162 Calculus II (5)
- or MATH 380 Elementary Probability and Statistics (5)

Choose one of the following sequences (12–15 credits)

- PHYS 151 General Physics I (4)
- PHYS 152 General Physics II (4)
- PHYS 153 General Physics III (4)
- PHYS 161 Mechanics Lab (1)
- PHYS 162 Heat and Optics Lab (1)
- PHYS 163 Instrumentation Lab I (1)
- or
- PHYS 131 Introductory Physics I (4)
- PHYS 132 Introductory Physics II (4)
- PHYS 133 Introductory Physics III (4)
- PHYS 161 Mechanics Lab (1)
- PHYS 162 Heat and Optics Lab (1)
- PHYS 163 Instrumentation Lab I (1)

or

- BIOL 171 Biology I (4)
- BIOL 172 Biology II (4)
- BIOL 173 Biology III (4)

Electives (12 credits)

Select credits from Geology courses, 8 of which must be upper-division.

Required program credits

53 credits

Required supporting credits

40–43 credits

Elective credits

12 credits

Minimum total credits for above major

105 credits

MINOR

GEOLOGY MINOR (23–24 CREDITS)

Required Courses

- GEOL 120 Physical Geology–The Solid Earth (5)
- GEOL 121 Physical Geology–Surficial Processes (5)
- GEOL 122 Historical Geology (5)
- GEOL 311 Earth Materials (4)
- Geology elective (4–5)

Total credits for above minor

23 credits

Geology Courses

Terms offered: fall, winter, spring, summer (FWSU). If no terms are indicated check with the department or EagleNET.

GEOL 100 Discovering Geology (5) FWSU [satisfies the **GECR** for natural sciences, geology.]

This course explores the interactions between human beings and their geological environment. The earth is a dynamic planet affected by sudden, violent events such as volcanic eruptions, earthquakes and floods, as well as by slower processes operating over long time spans that create, move and destroy continents and oceans. Other topics include study of energy, mineral and water resources and their importance to modern society. Topics are presented at a level intended for non-science majors. Satisfies lab science requirement at most universities.

GEOL 115 Investigating Earth Science (5) [satisfies the **GECR** for natural sciences, geology.]

Prerequisite: pre-university basic skills in mathematics.
For students planning to teach elementary school. Includes inquiry-based earth science investigations that support science instruction outlined in the National Science Education Standards and Washington Essential Academic Learning Requirements. (Cross-listed GEOG 115)

GEOL 120 Physical Geology–The Solid Earth (5) *FW*

[The completion of **GEOL 120** counts as one course for the **GECR** in natural sciences, geology; the completion of **GEOL 120** and **121** counts as two courses for the **GECR** for natural sciences, geology.]

Prerequisites: two semesters of high school chemistry, **MATH 104B** or equivalent.

Introduction to physical geology for students interested in earth and environmental science. This course covers the origin of the earth, its internal structure and minerals, rocks and volcanoes. Earthquakes, mountains and continental drift are discussed in the context of plate tectonics. The formation of mineral deposits is also covered. Weekly laboratories and one field trip are required.

GEOL 121 Physical Geology–Surficial Processes (5) *WS*

[The completion of **GEOL 121** counts as one course for the **GECR** in natural sciences, geology; the completion of **GEOL 120** and **121** counts as two courses for the **GECR** for natural sciences, geology.]

Prerequisites: computer literacy, **MATH 104B** or equivalent.
Introduction to physical geology for students majoring in geology, earth science or environmental science. This course emphasizes the quantitative analysis of processes that shape the earth's surface (gravity, wind, water and ice) including weathering and erosion, the creation of sediments and sedimentary rocks and the development of landforms. Energy resources and the concept of earth systems are also explored. Weekly laboratories and one field trip are required.

GEOL 122 Historical Geology (5) S

Prerequisite: **GEOL 121**.

Introduction to earth history for students majoring in geology, earth science or environmental science. This course covers the diversity of life, catastrophic extinctions and the effect of biologic change on the environment. The basic principles of stratigraphy, use of stable isotopes to interpret sedimentary environments and the stratigraphic and tectonic history of the earth are also explored. Other topics include identification of the common fossil groups, survey of the fossil record in the context of geological evolution and practice using geologic maps. Weekly laboratories and one field trip are required.

GEOL 220 Environmental Geology (4) W

Prerequisite: **GEOL 100, 120 or 121**.

Relationship of human activities with earth materials and processes, water quality, atmospheric composition, waste disposal, natural resources, the importance of an interdisciplinary approach to environmental problems. Field trips emphasize local environmental problems. Laboratory.

GEOL 297 Workshops, Short Courses, Conferences (1-5)

At a lower division level.

GEOL 299 Special Studies (1-5) FWSU

Prerequisite: permission of the instructor, department chair and college dean.

Topics vary with interest of student and instructor.

GEOL 311 Earth Materials (4) F

Prerequisites: GEOL 120 and CHEM 151.

This course is an introduction to the materials that comprise the solid earth, including minerals, igneous, sedimentary and metamorphic rocks. The course includes discussions of their occurrence, associations and uses. Methods of identification are stressed during laboratory exercises.

GEOL 312 Crystallography and Optical Mineralogy (4) W

Prerequisite: GEOL 311.

This second course of a three-course series covers how to describe the external morphology of well-formed crystals using crystallographic techniques. In addition, the techniques of optical mineralogy using a petrographic microscope are introduced as a tool for identifying rock-forming (silicate) minerals.

GEOL 313 Igneous and Metamorphic Petrology (4) S

Prerequisites: GEOL 311 and 312

The third course in a series is a comprehensive study of the classification, description and origin of igneous and metamorphic rocks. Students will learn about the use of minerals in helping to interpret the geologic and tectonic significance of the rocks in which they are found. The course builds on skills learned in GEOL 311 and 312 and stresses hand sample and thin section descriptive techniques. Weekly laboratories as well as one weekend field trip are required. Additional field trips may be offered.

GEOL 330 Structural Geology I (4) W

Prerequisite: GEOL 120.

Analysis of the kinematics and mechanics of rock deformation and an introduction to geologic structures. Laboratory introduces the solution of structural geology problems, the map-based interpretation of geologic structures and the creation of geologic cross sections. Weekly laboratory exercises. Designed to be taken in series with GEOL 331.

GEOL 331 Structural Geology II (4) S

Prerequisite: GEOL 330.

Continuation of an introduction to geologic structures from GEOL 330 and an exploration of the plate tectonic setting of geologic structures. Introduction to the field study of geologic problems with weekly field trips that emphasize the collection and analysis of geologic field data to solve structural problems. Weekly field trips and laboratory exercises required.

GEOL 338 Discovering Women in Science (1)

The course uses several scientific themes to rediscover from the past and find in contemporary research, the women who have made significant contributions to science. (Cross-listed BIOL, CHEM, HIST, PHYS, PSYC, WMST 338)

GEOL 360 Geologic Hazards (4)

Prerequisite: GEOL 100 or 115 or 120 or 121, or GEOG 100 or 115.

Introduction to geologic hazards affecting humankind; emphasis on earthquakes, volcanism, floods and landslides. Applications to geological site engineering and city/regional planning.

GEOL 380 World Resources and Population (5) [satisfies international studies university graduation requirement]

Interaction between population and resource utilization. Renewable and non-renewable energy resources, food and water supply, soil erosion and degradation and deforestation will be related to population growth.

GEOL 390 Earth Science Teaching Methods (1) F

Prerequisite: GEOL 120, GEOL 121, GEOG 314, PHYS 121; EDUC 303 or permission of the instructor. SCED 390 co-requisite.

This course is designed for Earth Science majors planning to teach middle school, junior or senior high school. It includes the development of curriculum and the organization of teaching materials, techniques and evaluation. (Cross-listed GEOG 390)

GEOL 397 Workshops, Short Courses, Conferences (1-5)

GEOL 408 Invertebrate Paleontology (4) S

Prerequisites: GEOL 121, 122 or permission of the instructor.

Principles of paleontology including methods of description and analyses of invertebrate fossils. Emphasis on principles of morphology and evolutionary development of invertebrates and the use of invertebrate fossils in biostratigraphy and paleoecology. Laboratory.

GEOL 411 Sedimentology and Stratigraphy (4) F

Prerequisite: GEOL 122, 307 or 312, or permission of the instructor.

Study of the origin of sediments and sedimentary rocks for advanced geology majors. Description and interpretation of facies and environments of deposition and classification of clastic and chemical sedimentary rocks is emphasized. Stratigraphic principles, nomenclature and correlation is also treated. Lecture and weekly laboratory.

GEOL 425 Geology of Eastern Washington (4)

Prerequisite: GEOL 330 or permission of the instructor

Study of the local geology in lectures and a series of field trips. Includes field projects and techniques used during geologic mapping. Observing and recording geologic data in the field and presenting it in terms of a written report and a sketch geologic map of a site-specific area.

GEOL 455 Geology of the Colorado Plateau (4)

Prerequisite: GEOL 100 or permission of the instructor. Course fee.

This course is a week-long field study of the rocks and landforms of the Colorado Plateau region, specifically in Arches and Canyonlands National Parks. Geologic evolution and structural geology of the region will be discussed and the ancient sedimentary environments of deposition will be emphasized. A field trip will be held during the week of spring break.

GEOL 462 Principles of Geochemistry (5)

Prerequisites: GEOL 311, 312, 313 or permission of the instructor.

Abundance of elements in the solar system. Origin, chemical evolution and composition of the earth; distribution and migration of chemical elements; differentiation history of the earth into crust, mantle and core. Origin and evolution of the hydrosphere and atmosphere. Chemical processes involved in weathering of rocks, chemical sedimentation and diagenesis.

GEOL 463 Environmental Geochemistry (5)

Prerequisite: CHEM 152 or permission of the instructor.

Application of principles of geochemistry to environmental problems, including air and water pollution, water-rock interactions, weathering and soil formation. Origin, distribution and transport of inorganic contaminants in air, water, soils, sediments and plants. The behavior of trace elements in near surface environments.

GEOL 470 Hydrogeology (4)

Prerequisites: GEOL 120 or 121, MATH 106, or permission of the instructor.

Relationship between groundwater and geologic materials, emphasizing quantitative analysis and principles governing groundwater flow. Lecture and weekly lab.

GEOL 475 Engineering Geology: Soils (4) W

Prerequisites: GEOL 220, 313, 411 or 470 or permission of the instructor.

Engineering geology of soil and rock is closely related to geotechnical engineering. It includes the properties of soils and rock units related to hydraulic conductivity, compressibility, consolidation, fractures and stress.

GEOL 490 Senior Capstone: Field Camp (10)

Prerequisites: junior/senior standing and permission of the instructor.

[satisfies senior capstone university graduation requirement]

This course applies geologic principles to the solution of field problems in the Rocky Mountain fold and thrust belt. This four-week course of study includes geologic mapping, description of stratigraphic relationships, structural analysis, and GPS data collection. Maps, cross sections and a formal report of the field study are required. Location of the camp is Dillon, Montana. Course fee is to be determined.

GEOL 490 Senior Capstone: Water and the West (4)

[satisfies senior capstone university graduation requirement]

Prerequisites: junior/senior standing.

This course focuses on the relationships between human activities and water resources in the largely arid western United States. Topics include tectonic and meteorological controls on the distribution and quantity of water and the history of conflict over scarce surface and groundwater resources. Case studies involve examples from the western United States and other countries including dry-land irrigation in Israel, dam building in Egypt and China, and fishery loss in Mexico.

GEOL 491 Senior Thesis (4)

[satisfies senior capstone university graduation requirement]

Prerequisites: senior standing and permission of the instructor.

Directed research on a geological problem and organization of the results for oral and written presentation. End of program assessment will be required. May be used to fulfill the Senior Capstone requirement.

GEOL 495 Practicum (1-5) FWSU

Prerequisite: permission of the instructor, department chair and college dean.

Participation in supervised experiences involving acquisition of data or applications of knowledge to help solve geologic problems. Credits earned in this course are not applicable to degree requirements.

GEOL 496 Experimental Courses (1-5)

GEOL 497 Workshops, Short Courses, Conferences (1-5)

GEOL 498 Seminars (1-5)

GEOL 499 Directed Study (1-5) FWSU

Prerequisite: permission of the instructor, department chair and college dean.

Seminar in a selected field of geology to suit a student's need. (May be repeated for a total of 15 credits if a different study is undertaken each time.)

GERMAN

See MODERN LANGUAGES AND LITERATURES.