

issues. This course should be completed prior to enrolling in ENVT 350.

ENVT/GEOS 104: Conservation of Natural Resources
 ENVT/RELI 239: Environment and Culture
 IHON 281: Energy, Resources and Pollution
 IHON 282: Population, Hunger, and Poverty
 IHON 283: Conservation and Sustainable Development

2. The Environment and Science

Eight semester hours

Students select two courses (from two different departments) from the following that examine the scientific foundations of environmental issues:

BIOL 116: Introductory Ecology
 BIOL 425: Marine Biology*
 BIOL 333: Comparative Ecology of Latin America*
 BIOL 424: Ecology*
 BIOL 427: Conservation Biology and Management*
 CHEM 104: Environmental Chemistry#
 GEOS 332: Geomorphology*
 GEOS 334: Hydrogeology*

3. The Environment and Society

Four semester hours

Students select one course from the following that pursue the study of institutions where environmental perspectives and policies are applied and how these have changed over time:

ECON 111: Principles of Microeconomics: Global and Environmental
 ECON 311: Energy and Natural Resource Economics*
 ECON 313: Environmental Economics*
 ECON 315: Investigating Environmental & Economic Change in Europe*
 HIST 370: Environmental History of the U.S.
 POLI 346: Environmental Politics and Policy

4. The Environment and Sensibility

Four semester hours

Students select one course from the following that examine the ways in which nature shapes and is shaped by human consciousness and perception:

ENGL 234: Environmental Literature
 PHIL 230: Philosophy, Animals and the Environment
 RELI 365: Christian Moral Issues
 (“Christian Ecological Ethics” only)
 RELI 393: Topics in Comparative Religions
 (“Native Traditions in Pacific Northwest” only)

5. Environmental Methods of Investigation, ENVT 350

(Four semester hours)

ENVT 350: Environmental Methods of Investigation

To view *Environmental Studies (ENVT)* courses, go to the *PLU Directory of Approved Courses* on page 181.

French

To view curriculum and course requirements, please go to *Department of Languages & Literature, page 75*
 To view *French (FREN)* courses, go to the *PLU Directory of Approved Courses* on page 181.

Geosciences

253.535.7563

www.nsci.plu.edu/geos

geos@plu.edu

The geosciences are distinct from other natural sciences. The study of the earth is interdisciplinary and historical, bringing knowledge from many other fields to help solve problems. Geoscientists investigate continents, oceans, and the atmosphere, and emphasize both the processes that have changed and are changing the earth through time and the results of those processes, such as rocks and sediments. Our fast-rising human population is dependent upon the earth for food, water, shelter and energy and mineral resources.

Study in the geosciences requires creativity and the ability to integrate. Geologists observe processes and products in the field and in the laboratory, merge diverse data, develop reasoning skills that apply through geologic time and create and interpret maps. The field goes beyond pure research science, and includes applied topics like the relationships of natural events such as earthquakes and volcanoes with human societies. The Department of Geosciences recognizes that it is no longer sufficient just to have knowledge of the facts of the field; successful students must have quantitative skills and be able to communicate clearly through writing and speaking. Laboratory experiences are an integral part of all courses. Many courses involve the use of microscopes, including the department’s scanning electron microscope. Computers are used in most courses to help students understand fundamental phenomena, obtain current information, and communicate results. Field trips are included in many courses.

Pacific Lutheran University is located at the leading edge of western North America, in the Puget Lowland, between the dramatic scenery of the Olympic Mountains and the Cascade Range. Pierce County has diverse geology, which is reflected in elevations that range from sea level to more than 14,000 feet.

Geosciences graduates who elect to work after completing a PLU degree are employed by the U.S. Geological Survey, natural resource companies, governmental agencies, and private-sector geotechnical and environmental consulting firms. Graduates who combine geosciences with education are employed in primary and secondary education.

Careers in geosciences often require post-graduate degrees. Many B.S. majors have been successful at major research graduate schools.

Faculty: Foley, Chair; Benham, Davis, McKenney, Todd., Whitman.

DEGREE OFFERINGS

The **Bachelor of Science degree** is intended as a pre-professional degree, for students interested in graduate school or working in geosciences. The Bachelor of Arts degree is the minimum preparation appropriate for the field and is best

combined with other degree programs, such as majors in social sciences or the minor in Environmental Studies.

The department strongly recommends that all students complete MATH 140 or higher before enrolling in 300-level and higher courses in geosciences. The department also strongly encourages students to complete the Chemistry and Physics requirements as early as possible. Students should also note that upper-division courses are offered on a two-year cycle. Early declaration of majors or minors in geosciences will facilitate development of individual programs and avoid scheduling conflicts.

All courses taken for the major must be completed with a grade of C- or higher.

BACHELOR OF ARTS MAJOR

32 semester hours in following Geosciences courses:

- GEOS 201
- Plus at least two lower-division from GEOS 101, 102, 103, 104, 105, 106, or 107
- Eight semester hours from GEOS 324, 325, 326, 327, 329
- Eight semester hours from GEOS 328, 330, 331, 332, 334, 335, 350
- One semester hour of GEOS 390
- One semester hour of GEOS 498
- Two semester hours of GEOS 499
- Required Supporting non-geoscience course: CHEM 104 or CHEM 115
- **Recommended: Geologic Field Experience**
Minimum of four semester hours
Students completing the B.A. degree in Geosciences are recommended to take a departmentally approved field camp from another college or university. Students would normally take this during the summer, after their junior year or after their senior year depending upon their level of preparation. This field experience may be a traditional field geology course or a field-based course in Hydrology, Environmental Geology or Geophysics, etc. Students must have approval of the department chair before enrolling in the Field Experience.
- Options reflect a student's interests and are discussed with an advisor

BACHELOR OF SCIENCE MAJOR

42 to 44 semester hours in following Geosciences courses:

- One from GEOS 101, 102, 103, 104, 105, 106 or 107
- GEOS 201, 324, 325, 326, 327, 329, and 335
- Eight semester hours from GEOS 328, 330, 331, 332, 334 or 350
- One semester hour of GEOS 390
- One semester hour of GEOS 498
- Two semester hours of GEOS 499
- **Required: Geologic Field Experience**
Minimum of four semester hours
Students completing the B.S. degree in Geosciences required to take a departmentally approved field camp from another college or university. Students would normally take this during the summer, after their junior year or after their senior year depending upon their level of preparation. This

field experience may be a traditional field geology course or a field-based course in Hydrology, Environmental Geology or Geophysics, etc. Students must have approval of the department chair before enrolling in the Field Experience.

- **Necessary supporting courses**

Minimum 26 semester hours, to include:

- CHEM 115 and 116
- PHYS 125, 126 (with 135, 136 labs) **or** PHYS 153, 154 (with 163, 164 labs)
- MATH 151 and either MATH 152 **or** CSCE 120
- Recommended:** BIOL 323 and additional courses are recommended when paleontology is a major interest

BACHELOR OF ARTS IN EDUCATION

See Department of Instructional Development and Leadership on page 65.

MINOR

20 semester hours of courses

- All courses for the minor must be completed with grade of C or higher.
- **Required:** GEOS 201 and at least three upper-division Geosciences courses (a minimum of eight upper-division semester hours).

DEPARTMENTAL HONORS

In recognition of outstanding work the designation with Departmental Honors may be granted to Bachelor of Science graduates by a vote of the faculty of the Department of Geosciences, based upon the student's performance in these areas:

- **Course work:** The grade point average in geoscience courses must be at least 3.50.
- **Written work:** From the time a student declares a major in geosciences, copies of outstanding work (e.g., laboratory reports, poster presentations, written reports) will be kept for later summary evaluation.
- **Oral communication:** Students must evidence ability to communicate effectively as indicated by the sum of their participation in class discussions, seminars, help sessions, and teaching assistantship work.
- **Other activities:** Positive considerations for honors include involvement in the department, doing independent research, geoscience-related employment, and participation in professional organizations.

To view Geosciences (GEOS) courses, go to the PLU Directory of Approved Courses beginning on page 182.

German

To view curriculum and course requirements, please go to Department of Languages & Literature, page 75.

To view German (GERM) courses, go to the PLU Directory of Approved Courses on page 183.

Geosciences (GEOS)

<i>Term</i>	<i>Courses</i>
Fall	GEOS 326, 327, 330, 332, 335, 498
January Term	GEOS 328, 331
Spring	GEOS 201, 324, 325, 329, 334, 350, 499
Alternate Years	GEOS 324, 325, 326, 327, 328, 329, 330, 331, 332, 334, 335, 350

GEOS 101: Our Changing Planet – NS, SM

Exploration of earth systems, including cycles in and connections among the lithosphere, hydrosphere, atmosphere and biosphere. Discussion of changes in and human impacts to these systems that have taken place through time. Includes labs and field trips. (4)

GEOS 102: General Oceanography – NS, SM

Oceanography and its relationship to other fields; physical, chemical, biological, climactic, and geological aspects of the sea. Includes labs and field trips. (4)

GEOS 103: Earthquakes, Volcanoes, and Geologic Hazards – NS, SM

Study of the geologic environment and its relationship to humans, with emphasis on geologic features and processes that create hazards when encroached upon by human activity, including earthquakes, volcanic eruptions, landslides and avalanches, and solutions to problems created by these hazards. Includes labs and field trips. (4)

GEOS 104: Conservation of Natural Resources – NS, SM

Principles and problems of public and private stewardship of our resources with special reference to the Pacific Northwest. Includes labs and field trips. Cross-listed with ENVT 104. (4)

GEOS 105: Meteorology – NS, SM

A full, balanced, and up-to-date coverage of the basic principles of meteorology. Examination of the impacts of severe weather on humans and the environment. Includes labs. (4)

GEOS 106: Geology of National Parks - NS

Study of the significant geologic features, processes, and history as illustrated by selected National Parks. Relationship between human history and geology and the impact of geology on our lives will be included. (4)

GEOS 107: Global Climate Change - NS

A survey of current climate change research. Students will develop and apply a fundamental understanding of earth systems through evaluation of geologic and other scientific evidence for long- and short-term climate change. (4)

GEOS 201: Geologic Principles – NS, SM

A survey of geologic processes as they apply to the evolution of the North American continent, including the interaction of humans with their geologic environment. Students participate actively in classes that integrate laboratory and field study of rocks, minerals, fossils, maps and environmental aspects of geology and emphasize developing basic skills of geologic

inquiry. This course meets state education certification requirements for content in physical and historical geology. Includes labs and field trips. (4)

GEOS 324: Igneous Petrology

Applied and theoretical study of the genesis, nature, and distribution of igneous rocks, at microscopic to global scales. Includes labs. **Prerequisites:** GEOS 201, 326, or consent of instructor. (2)

GEOS 325: Structural Geology

The form and spatial relationships of various rock masses and an introduction to rock deformation; consideration of basic processes to understand mountain building and continental formation; laboratory emphasizes practical techniques which enable students to analyze regional structural patterns. Includes labs. **Prerequisite:** GEOS 201 or consent of instructor. (4)

GEOS 326: Optical Mineralogy

Theory and practice of mineral studies using the petrographic microscope, including immersion oil techniques, production of thin sections, and determination of minerals by means of their optical properties. Includes labs. **Prerequisite:** GEOS 201 or consent of instructor. (2)

GEOS 327: Stratigraphy and Sedimentation

Formational principles of surface-accumulated rocks, and their incorporation in the stratigraphic record. This subject is basic to field mapping and structural interpretation. Includes labs. **Prerequisite:** GEOS 201 or consent of instructor. (4)

GEOS 328: Paleontology, NS, SM

A systematic study of the fossil record, combining principles of evolutionary development, paleohabitats and preservation, with practical experience of specimen identification. Includes labs. **Prerequisite:** GEOS 201 or consent of instructor. (4)

GEOS 329: Metamorphic Petrology

Consideration of the mineralogical and textural changes that rocks undergo during orogenic episodes, including physical-chemical parameters of the environment as deduced from experimental studies. Includes labs. **Prerequisites:** GEOS 201, 326 or consent of instructor. (2)

GEOS 330: Maps: Images of the Earth

Maps as a basic tool for communicating spatial information. An introduction to cartographic principles, processes and problems, with emphasis on selection, presentation and interpretation of information. Includes discussions of topographic maps, Global Positioning Systems, digital maps, remotely sensed images and aerial photographs. Includes labs. **Prerequisite:** Previous science (geosciences preferred) or consent of instructor. (4)

GEOS 331: Maps: Computer-aided Mapping and Analysis

Computer-based Geographic Information Systems, digital maps, and data sources. The creation, interpretation, and analysis of digital maps from multiple data sources. Analysis of spatial information from sciences, social sciences, and humanities using sets of digital maps. Includes labs. **Prerequisite:** Previous science (geoscience preferred), math or

computer science course or consent of instructor. GEOS 330 or familiarity with maps recommended. (4)

GEOS 332: Geomorphology

Study of the processes that shape the Earth's surface with emphasis on the effects of rock type, geologic structure, and climate on the formation and evolution of landforms. Includes labs. **Prerequisite:** GEOS 201 or consent of instructor. (4)

GEOS 334: Hydrogeology

Study of the hydrologic cycle, investigating surface and groundwater flow, resource evaluation and development, wells, water quality and geothermal resources. Emphasis on water problems in the Puget Sound area, with additional examples from diverse geologic environments. Includes labs. **Prerequisite:** GEOS 201 or consent of instructor. (4)

GEOS 335: Geophysics

Study of the physical nature of the earth, its properties and processes, employing techniques from seismology, heat flow, gravity, magnetism, and electrical conductivity. Emphasis on understanding the earth's formation, structure, and plate tectonics processes as well as geophysical exploration techniques. Includes labs. **Prerequisites:** GEOS 201, one semester of calculus, physics (high-school-level or above), or consent of instructor. (4)

GEOS 350: Marine Geology

Study of the 70% of the earth beneath the oceans, focusing on the extensive discoveries of the past few decades. Emphasis on marine sediments, sedimentary processes, plate tectonic processes, and the historical geology of the oceans. Includes labs. **Prerequisite:** GEOS 102, or 201, or consent of instructor. (4)

GEOS 390: Field Trip

Field and on-campus study of major geologic sites in western U.S. Trips take place during spring break or at end of spring semester. **Prerequisite:** GEOS 201 or consent of instructor. 300- level geology courses preferred. (1)

GEOS 491: Independent Studies

Investigations or research in areas of special interest not covered by regular courses. Requires regular supervision by a faculty member. (1-4)

GEOS 495: Internship (1 to 12)

GEOS 497: Research

Experimental or theoretical investigation, in close cooperation with a faculty member. Open to upper-division students. (1-4)

GEOS 498: Seminar

Discussion of professional papers and introduction to directed research for the Capstone project. Required of all majors in their senior year. December graduates should complete the sequence (GEOS 498-499) in their final full year. (1)

GEOS 499: Capstone: Seminar – SR

Culminating experience applying geological methods and theory through original literature or field or laboratory research

under the guidance of a faculty mentor, with written and oral presentation of results. Required of all majors in their senior year. **Prerequisite:** GEOS 498. (2)

German (GERM)

GERM 101,102: Elementary German

Basic skills of oral and written communication in classroom and laboratory practice. Use of materials reflecting contemporary German life. (4, 4)

GERM 201, 202: Intermediate German – C

Continued practice in oral and written communication in classroom and laboratory. Use of materials which reflect contemporary life as well as the German cultural heritage. (4, 4)

GERM 231, 331: Language, Art and Culture in the New Germany

This interdisciplinary course based in Cologne, Germany, combines German language instruction and an authentic home stay experience with language immersion and close cultural study of the three main German-speaking countries, Germany, Austria and Switzerland. (4, 4)

GERM 301, 302: Composition and Conversation – C

Intensive review of grammar with emphasis on idiomatic usage; use of contemporary authors as models of style. Conversation on topics of student interest.

Prerequisite: GERM 202 or equivalent. (4, 4)

GERM 321: German Civilization to 1750 – C

From the Middle Ages to the Enlightenment. A survey of German culture and its expression in creative works of art, music and literature, with particular emphasis on Martin Luther and the Protestant Reformation.

Prerequisite: GERM 202. (4)

GERM 322: German Civilization Since 1750 – C

From the Enlightenment to the present. This survey covers representative works and trends in German politics, philosophy, literature, art and music, with emphasis on the Age of Goethe and Beethoven. **Prerequisite:** GERM 202. (4)

GERM 421: German Literature From the Enlightenment to Realism – C, LT

Representative works of German literature from about 1750 to 1890, including Sturm and Drang, Classicism and Romanticism. Readings will include such authors as Goethe, Schiller, Büchner, and Keller. **Prerequisite:** GERM 302. (4)

GERM 422: 20th Century German Literature – C, LT

Representative works from Naturalism to the present, including Expressionism and Socialist Realism. Works from both east and west, and will include such authors as Brecht, Kafka, Thomas Mann, Rilke, and Seghers. **Prerequisite:** GERM 302. (4)

GERM 499: Capstone: Senior Project – SR (4)