

## **Earth Science Course Catalog Descriptions**

### **ES 104, 105, 106 Earth System Science (5 each)**

This three-term sequence of courses integrates the critical concepts of chemistry, physics, and geology in the context of the Earth as a system. ES 104: Focus on the Solar System, the processes driven by the interior of Earth, including plate tectonics, earthquakes, and volcanism, and introduction to study of Earth materials. ES 105: Focus on physical and chemical processes occurring at the surface of Earth with an emphasis on energy in the Earth system. ES 106: Focus on human impacts to the Earth system, including chemical and physical aspects of water pollution, oceanography, air pollution, meteorology, and global climate change. Not open to students who have taken more advanced course in the corresponding subject matter. All three courses require three hours of lecture and one two-hour laboratory per week.

### **ES 201, 202, 203 Principles of Geology (4 each)**

Introductory geology sequence that focuses on physical and historical geology. ES 201 emphasizes Earth's internal processes with topics including plate tectonics, minerals, igneous rocks and processes, volcanism, metamorphism and metamorphic rocks, rock deformation and geologic structures, and earthquakes. ES 202 emphasizes Earth surface processes with topics including sedimentary rocks, sedimentary processes, rock weathering, mass wasting, river systems, groundwater, glaciers, deserts, and coastal processes. ES 203 explores the origin and dynamics of the Earth's interior, surface, ocean, atmospheric, and biological systems and critically evaluates topics including the age of the earth and the origin of life. Three lectures and one two-hour laboratory. No prerequisite.

### **ES 301 GeoTechniques: Quantitative Applications (1)**

Class focuses on quantitative techniques in geology, applied mathematics, basic statistics, software applications, and field technology. One three-hour session per week. Additional field trips outside of scheduled class time may be required. PREREQ: Introductory Geology course, or consent of instructor. May be taken concurrently with introductory geology course.

### **ES 302 GeoTechniques: Geology in the Field(1)**

Introduction to the methods and techniques of geological observation and interpretation, with an emphasis on understanding earth processes in the field and reconstructing the physical history of the earth; the stratigraphic, petrologic, and structural relations of rocks; geological illustration and report writing. One three-hour lab; required weekend field trips. PREREQ: ES 203 (may be taken concurrently) or consent of instructor.

### **ES 303 GeoTechniques: Petrographic Microscopy (1)**

This class introduces the basic techniques for using a petrographic microscope to describe, identify, and interpret Earth materials in thin section. Course integrates field observations, microscopic investigations of rocks and minerals, and digital image analysis to solve geologic problems. One three-hour lab per week. Additional field trips outside of scheduled class time may be required. PREREQ: ES 201, or consent of instructor.

### **ES 321 Structural Geology (4)**

Introduction to mapping, analysis, and interpretation of folds, faults, lineations, foliations, and other structures exhibited by rocks. Emphasis is on the basic techniques of analyzing geologic structures associated in space and time and interpreting the structural history of the lithosphere. Four hours of lecture and active learning per week; required field trip. PREREQ: ES 201, or consent of instructor.

### **ES 322 Geomorphology and Aerial Photo Interpretation (4)**

A study of the physical and chemical processes operating at the earth's surface and their resulting landforms. Topics include weathering processes, soils, mass wasting, river systems, glacial phenomena, tectonic landscapes, volcanic areas, and coastal regions. Analytical techniques include interpretation of aerial photographs, map analysis, and quantitative approaches to geologic problem solving. Four hours of lecture and active learning per week. Supplemental field trips are incorporated as needed. PREREQ: ES 201, ES 202, or consent of instructor.

### **ES 331 Introduction to Oceanography (3)**

An introduction to physical oceanography with topics including seafloor tectonics, ocean basin physiography, sediment production and transport, physical properties of sea water, chemistry of sea water, air-sea interaction, ocean circulation, tides, waves, and coastal processes. Concepts of physics, chemistry, geology, and mathematics (through algebra) are incorporated to supplement topical discussions of ocean processes. Three hours of lecture and active learning per week.

### **ES 351 Geology for Educators (3)**

Lab intensive course emphasizing fundamental principles of geology, including topics in rocks and minerals, plate tectonics, constructive and destructive earth surface processes, geological hazards, and hydrology, which form the Oregon Science Benchmark Standards in Earth Science. Two hours of lecture and one two-hour laboratory per week. Cannot be used as an upper-division elective for students majoring in Earth Science.

**ES 390 Basic Meteorology (3)**

An introductory study of atmospheric processes and meteorologic phenomena. Topics include structure of the atmosphere, heat transfer, air pressure, precipitation, circulation, data collection, and weather forecasting. Three hours of lecture and active learning per week.

**ES 392 Sedimentary Geology (4)**

Description and interpretation of sedimentary lithology, textures, and structures, primarily at the hand sample and outcrop scale. The principles of transport/depositional processes, sedimentary environments, use of facies models. Four hours of lecture and active learning. One required weekend field trip. PREREQ: ES 203 and ES 302 or consent of instructor.

**ES 401 Research (1-15)**

Terms and hours to be arranged.

**ES 406 Special Individual Studies (1-15)**

Terms and hours to be arranged.

**ES 407 Senior Seminar (1)**

Students conduct in-depth study and research on a broad-ranging topic in the Earth Sciences. Assessment is based primarily on a formal presentation, which each student gives on their topic, and on student participation in weekly meetings in which the class discusses the Earth Science topic. Two hours per week. PREREQ: Senior standing in Earth Science.

**ES 408/508 Workshop (1-15)**

Terms and hours to be arranged.

**ES 431/531 Paleobiology (4)**

The evolution of terrestrial and marine ecosystems interpreted from the fossil record; the application of paleontological data to resolving problems in earth history. Offered alternate years. Four hours of lecture and active learning. PREREQ: a beginning biology course or consent of instructor. RECOMMENDED: ES 203.

**ES 450/550 Introduction to Petrology (4)**

Focus on the textures, compositions, and genetic associations of diverse suites of rock types. Study of the structure, chemistry, physical properties, and occurrences of rock-forming minerals

augments the rock study. Emphasis is on the integration of hand sample study, petrographic microscopy, and digital image analysis to solve geologic problems. Four hours of lecture and active learning per week. PREREQ: ES 201 and ES 303, or consent of instructor.

#### **ES 453/553 Geology of the Pacific Northwest (4)**

An introduction to the geology, geological history, tectonic evolution, geological resources, and landscape development of Western North America, with an emphasis on the geology of Oregon. Four hours of lecture and active learning. PREREQ: A general geology course or consent of instructor.

#### **ES 454/554 Volcanology (3)**

Study of the processes and products of volcanism. Focus is on rock types, structures, field relations, tectonic settings, conditions of origin, and geologic history of volcanism with specific emphasis on the Pacific Northwest. Three hours of lecture and active learning per week; supplemental field trips will be incorporated as needed. Offered in alternating years. PREREQ: Introductory geology course, or consent of instructor.

#### **ES 458/558 Field Studies in Geology (1-9)**

Field excursions to study geology at classic localities in the Pacific Northwest and beyond. Terms and hours to be arranged.

#### **ES 460/560 Energy and Mineral Resources (3)**

Focus on the geology of energy and mineral resources in terms of their description, occurrence, origin, and distribution. Also consider extraction, treatment, uses, and reserves of mineral and energy resources; the historical, economic, and social issues involved with certain resources; and the environmental implications of the use and exploitation of resources. Three hours of lecture and active learning per week. Offered in alternating years. PREREQ: Introductory geology course, or consent of instructor.

#### **ES 473/573 Environmental Geology (4)**

The study of contemporary environmental issues as related to geologic systems. Topics include geologic hazards, land use, groundwater-surface water-soil contamination, remediation technologies, environmental planning, habitat restoration, applied analytical techniques, and consulting practice. Four hours of lecture and active learning per week. Supplemental field trips will be incorporated as needed. PREREQ: ES 201, ES 202, or consent of instructor.

**ES 476/576 Hydrology (3)**

Investigation of near-surface hydrologic systems of the Earth. Topics include the hydrologic cycle, water budgets, introductory fluid dynamics, groundwater systems, watershed analysis, water quality, and water resource evaluation. Three hours of lecture and active learning per week. Supplemental field trips will be incorporated as needed. Offered in alternating years. PREREQ: ES 201, ES 202, or consent of instructor.

**ES 491/591 Stratigraphy and Depositional Systems (3)**

This course is designed for both Earth Science majors and general interest audiences. The course offers an overview of clastic depositional environments and sequences, including continental, marine marginal, and deep marine settings. Concepts and applications of facies and stratigraphic modeling will be explored, with an emphasis on natural resource exploration and recovery. Examination of tectonic controls on the nature and distribution of facies and paleoenvironments of sedimentary basins in tectonically active settings. Offered in alternating years. Three hours of lecture and active learning. PREREQ: a general geology course or consent of instructor; RECOMMENDED: ES 392.

**ES 492/592 GIS Applications in Earth Science (3)**

Focus on the application of Geographic Information Systems to relevant problems in the Earth Sciences. Emphasis is placed on the use of computer technology in analyzing spatial and temporal relationships of geologic systems. Students will learn techniques in digital map compilation, digital image processing, and analysis of complex data sets. Three hours of lecture and active learning per week. Offered in alternating years. PREREQ: ES 201 or ES 202 and CS 161, or consent of instructor.

**ES 501M Research (1-15)**

Terms and hours to be arranged.

**ES 503M Thesis or Field Study (1-15)**

Terms and hours to be arranged.

**ES 506M Special Individual Studies (1-15)**

Terms and hours to be arranged.

**ES 555M Glacial Geology (3)**

A study of glacial processes and products including those associated with alpine, continental, and

periglacial settings. Work with topographic maps, aerial photographs, and examples of glaciation in the Pacific Northwest. Appropriate term paper or project required.

**ES 556M Geology of North America (3)**

Study of the geologic structure, evolution, and geomorphology of the North American continent. Two lectures and one two-hour laboratory. PREREQ: Consent of instructor. Offered summers only.