

Geology

Charles A. Dana Professor Westerman; Charles A. Dana Professor Dunn (Chair); Assistant Professor Koteas; Lecturer Grigg

Norwich University, in the middle of the Green Mountain State, is ideally situated for direct and field intensive studies of our natural environment. The Bachelor of Science in Geology degree program is designed to take advantage of our physical location. Courses are presented by faculty who are both respected teachers and active researchers in New England, Europe, and the western U.S.

The Geology degree provides a broad background in the physical sciences with a strong focus on geology and its pivotal role in understanding our environment. In addition, students often use free electives to develop an additional specialization. Graduates in Geology are prepared for a variety of possible careers in industry, consulting, state and federal surveys, the military, and teaching, or to enter graduate school.

The program emphasizes experiential learning through field studies and outdoor education. Courses include real projects and original research

participation. The program is enriched through department field trips across New England, eastern Canada, and the western United States. All Geology majors take a pair of capstone courses involving an original research project and a seminar designed to synthesize their education and tie scientific thought to issues in society.

The department is equipped for analysis of ground and surface water, soil, sediment, and rock. Equipment enables terrestrial and lake coring, collection of hydro-geochemical data, determination of sediment characteristics, subsurface studies, geological mapping, and more.

Analytical tools include X-ray diffractometer, scanning electron microscope, and inductively coupled plasma spectrophotometer. We also have a range of geophysical exploration equipment, including a gravity meter, seismograph, magnetometer, and ground penetrating radar.

All Geology courses except GL 251 , GL 260 , GL 450 , and GL 451 are designed to meet the General Education requirements by providing a basic level of literacy in current scientific knowledge and theories, and developing an appreciation of the natural world.

B. S. in Geology – Curriculum Map

First Year			
Fall	Credits	Spring	Credits
GL 110 Introduction to Geology	4	GL 156 Introduction to Earth Evolution	4
EN 101 Composition and Literature I	3	EN 102 Composition and Literature II	3
MA 107 Precalculus Mathematics	4	MA 108 Applied Calculus	4
CH 103 General Chemistry I	4	CH 104 General Chemistry II	4
	15		15
Second Year			
Fall	Credits	Spring	Credits
GL 2XX Elective ¹	4	GL 2XX Elective ¹	4
EN 201 World Literature I	3	EN 202 World Literature II	3
PS 201 General Physics I	4	PS 202 General Physics II	4
Social Science Elective	3	Arts & Humanities Elective	3
Elective	3-4	Elective	3-4
GL 251 Sophomore Seminar in Geology	1		
	18-19		17-18
Third Year			
Fall	Credits	Spring	Credits
GL 2XX Elective ¹	4	GL 2XX Elective ¹	3-4
Tech Elective ²	3-4	Tech Elective ²	3-4
History Elective ³	3	Ethics Elective ⁴	3
MA 232 Elementary Statistics	3	Elective	3-4
Elective	3-4	Elective	3-4
	16-18		15-19

Fourth Year			
Fall	Credits	Spring	Credits
GL 2XX Elective ¹	3-4	GL 2XX Elective ¹	4
GL 450 Directed Study in Geology	4	GL 451 Geology Seminar	3
Tech Elective ²	3-4	Tech Elective ²	3-4
Elective	3-4	Elective	3-4
Elective	3-4	Elective	3-4
	16-20		16-19
Total Credits: 128-143			

¹ These six electives must include Sedimentation (GL 257), Structural Geology (GL 262), and Mineralogy (GL 263).

² Technical Electives for this degree include Science, Mathematics (above MA 103 College Algebra I), Engineering or Information Systems (above IS 120 Business Applications & Problem Solving Techniques) courses.

³ Except HI 209 Historical Methods.

⁴ PH 323 Environmental Ethics strongly recommended.

Geology Minor

Students must complete six geology courses with at least four at the 18-24 200 level or higher.

Courses

GL 110 Introduction to Geology 4 Credits

An introduction to Earth's internal and external physical processes, its materials and landforms, and the connection between natural phenomena and humans. Topics include: minerals, rocks, water and natural resources; plate tectonics, mountain building, volcanism, earthquakes, slope failure and related hazards; rivers and flood management; erosion, soil degradation, desertification and sustainable agriculture; sea-level rise, coastal and wetland erosion and shore zone management. Discussion of human interaction with the Earth will range from local policy to global economic decisions. Offered fall and spring semesters. Classroom 3 hours, laboratory 2 hours.

GL 111 Oceanography 4 Credits

A basic survey of the physical, chemical, and geologic character of the world's oceans. Topics include patterns of energy exchange, chemical cycles, geological environments within the sea, and evolution of ocean basins. Classroom 3 hours, laboratory 2 hours. Offered spring semester only.

GL 156 Introduction to Earth Evolution 4 Credits

The course introduces the 4600 million year history of the evolution of Earth and life. Data and scientific theories for earth history are presented for major events including; the birth of the planet; plate tectonics and evolution of continents, mountains and ocean basins; evolution of the atmosphere and oceans; long-term climate change; and the evolution of life and mass extinction events. The lab focuses on the rock record, fossil life, and dating methods as they pertain to Earth history. Classroom 3 hours, laboratory 2 hours. Offered spring semester only.

GL 199 Geology Elective 4 Credits

GL 251 Sophomore Seminar in Geology 1 Credit

This course introduces the fundamentals of scientific investigation and communication. A research project introduces the Scientific Method, while reading and comprehension of scientific literature is coupled with instruction in and application of technical and scientific writing. Other forms of scientific communication, including poster and oral presentations, are addressed. Students learn the appropriate techniques for displaying and interpreting scientific data. Students may not earn credit for both ES 251 and GL 251. Offered Fall semester.

GL 253 Geomorphology 4 Credits

A course on the origin and evolution of Earth's surface features by geological processes acting upon various earth materials and geological structures. Classroom 2 hours, laboratory and/or field work 4 hours. Prerequisite: GL 110. Offered spring of even-numbered years.

GL 255 Hydrogeology 3 Credits

This course provides examination of the basic principles of groundwater, including its occurrence, flow and development, the assessment and remediation of groundwater contamination, and the protection of groundwater as a natural resource. Offered spring semester. Classroom: 3 hours. Prerequisites: MA 107, and EG 109 or GL 110 or GL 156.

GL 257 Sedimentation 4 Credits

A course that provides the analysis and interpretation of sedimentary rocks, sedimentary processes and environments of deposition. Classroom 2 hours, laboratory and/or field work 4 hours. Prerequisite: GL 110, GL 111 or GL 156. Offered fall of even-numbered years.

GL 258 Stratigraphy and Tectonics 4 Credits

An introduction to the fundamentals of stratigraphy and tectonics. Plate tectonic theory is investigated, from its inception to the present. Stratigraphic concepts are presented, at the general level and in light of tectonics, with focus on Vermont and regional stratigraphy and tectonic history. Classroom 3 hours, laboratory 3 hours. Prerequisite: GL 110. Offered Spring of odd-numbered years.

GL 260 Projects in Geology 1-4 Credit

A course that provides a geological field or laboratory project on a topic chosen by mutual consent of the student and the instructor. A written report is required. Prerequisites: GL 110, GL 111 or GL 156 and permission of the instructor.

GL 261 Field Geology 4 Credits

A study of the techniques used in the measurement of large and small scale geologic structures. Emphasis is placed on field recognition of features such as bedding, cleavage, folds, faults and their use in geologic mapping. Classroom 2 hours, laboratory 4 hours. Prerequisite: GL 110 or GL156 or permission of the instructor. Offered fall of even-numbered years.

GL 262 Structural Geology 4 Credits

A course that provides the analysis and interpretation of patterns in the structural features of the Earth's crust. Topics include the genesis of tectonic features, analysis of strain in rocks, the interpretation of multiply-deformed rocks, and modeling of faults and fractures. Classroom 3 hours, laboratory 3 hours. Prerequisite: GL 261 or permission of the instructor. Offered spring of odd-numbered years.

GL 263 Mineralogy 4 Credits

Introductory crystallography and crystal chemistry are used to explain the properties of minerals. Each of the major mineral groups is studied in the laboratory with a focus on developing competency in the identification of the ore minerals and the rock-forming minerals. Development of an understanding of mineral associations is emphasized and field trips allow opportunity to improve these skills. Classroom 2 hours, laboratory 4 hours. Prerequisite: GL 110 or GL 156 or permission of the instructor. Offered fall of odd-numbered years.

GL 264 Petrology 4 Credits

Following an introduction to optical identification of the rock-forming minerals using the polarizing microscope, the mineralogy and textures of common rocks are studied by means of thin sections. The genesis of these rocks is explained through a study of the physical and chemical systems they represent. Classroom 2 hours, laboratory 4 hours. Prerequisite: GL 263. Offered spring of even-numbered years.

GL 265 Glacial Geology and Paleoclimate 4 Credits

The first half of this course covers glaciology and glacial deposits and landforms, with a strong focus on field investigation. The second half of the course presents the data and hypotheses on Quaternary climate change, including traditional glacial chronology and marine and ice core data and resultant chronology. Global climate change, both past and present, is a central theme of the course. Classroom 3 hours, laboratory 3 hours. Prerequisite: GL 110. Offered Fall of odd-numbered years.

GL 450 Directed Study in Geology 4 Credits

A capstone course in which there is preparation of a geological report based on a project of original research involving field, laboratory, or library study or some combination of these. Conference schedules will be determined by the nature of the project and the student's schedule. Prerequisite: permission of the instructor. Offered fall semesters as needed. Student cannot receive credit for this course and ES 450.

GL 451 Geology Seminar 3 Credits

A capstone course for fourth-year students designed to review advanced geological concepts in a seminar format. The course also includes oral and poster presentations of senior research projects, and examination of codes of ethics in the geological sciences. Prerequisite: Senior Geology major or permission of the instructor. Offered spring semester as needed. Student cannot receive credit for this course and ES 451.

GL 499 Geo Res 4 Credits