College:
Natural and Health Sciences

Degree and Programs Offered:
Bachelor of Science
Major - Geosciences
Minor - Geosciences

Student Organizations/Clubs:
Geosciences Club; Sigma Gamma Epsilon.

Career Possibilities
Students in the Geosciences Department select between two concentrations: environmental geosciences or earth science, depending on their career goals.

The environmental geosciences concentration will prepare students for employment in private sector and various governmental agencies. Students completing this concentration will also have appropriate course work to be eligible for the certification exam as a professional geologist and/or professional hydrogeologist in Wisconsin. The expertise in hydrogeology and contaminant fate and transport afforded by this concentration can lead to employment as an environmental geoscientist in a variety of governmental and private organizations. Students interested in taking certification exams as professional soil scientists in Wisconsin may choose electives in soil science. Graduates with this background may work with governmental and private agencies in such applied fields as water resource management, soil conservation, and land-use planning.

The earth science concentration is extraordinarily flexible, as 15 credits of support courses are built into the major. These courses will be selected by the students and their advisers in order to develop a focal point related to their geosciences curriculum. The 15 credits are part of the major; therefore, a student electing to complete a minor cannot use these credits for that minor. Typical uses for the support courses include preparation for teacher licensure, law school, M.B.A. or M.P.A. programs.

Department Overview
The department's primary activities center around providing UW-Parkside students with a high-quality major program that will enable them to satisfy their specialized employment objectives. Toward this end, the Geosciences Department provides a core curriculum plus concentrations in environmental geosciences and earth science. Students electing the first concentration may choose to fulfill curricular requirements preparatory to professional certification by the state of Wisconsin as a geologist, hydrogeologist, or soil scientist. The earth science concentration provides a broad and flexible foundation for students with wide-ranging interests in the sciences, education, and the liberal arts. Furthermore, upper-level courses are intensively hands-on, enabling students to generate and analyze real-time data while gaining experience with innovative methods and instrumentation used by environmental professionals. The department has installed and maintains a network of ground water monitoring wells on campus and at other university properties in the community. These sites will serve students as hands-on learning sites, through which they can provide environmental quality assessment data that will assist surrounding communities in recognizing and interpreting long-term effects of land use changes.

It is the purpose of the Geosciences Department to become a key resource for environmental earth-system science at UW-Parkside, and in Kenosha and Racine counties. To this end, the department fosters faculty, student, and staff involvement and investment in local and regional environmental issues. Geosciences faculty are also taking leadership roles in the establishment of the Root River Environmental Education Community Center (REC) in Racine, and the Center for Environmental Education and Research (CEDAR) in Kenosha.

The Geosciences Department encourages and supports research and publication by students in cooperation with faculty. The department also supports a program of student research projects on local environmental problems as part of the introductory and advanced courses. The department encourages and aids advanced students to attend professional society meetings at national, regional, and local levels. Departmental faculty members are actively engaged in research and continue to seek and obtain research support from appropriate federal, state, University of Wisconsin System, and campus sources.

Preparation for Graduate School
The environmental geosciences curriculum provides a strong background in mathematics and the physical sciences that prepares students for graduate work in the natural and environmental sciences. The earth science concentration—with an appropriate support course plan—is good preparation for advanced degree programs in law, public administration, education, and library science. The Geosciences Department has established an articulation agreement with the School of Freshwater Sciences, University of Wisconsin – Milwaukee for a 3+2 program to earn a B.S. from UW-Parkside and an M.S. or M.A. from School of Freshwater Sciences, UW-Milwaukee.
Program Level Outcomes
1. To prepare students for professional certification and employment in areas of environmental and earth sciences. The program satisfies requirements for Wisconsin Professional Geologist and Professional Hydrogeologist.
2. To assist with the preparation of K-12 teachers in the areas of earth and environmental sciences and broad field science.
3. To promote scientific literacy on the campus and in the community, particularly with respect to principles and issues involving environmental awareness, quality, and protection.
4. To contribute fundamental scientific research that enhances environmental quality and quality-of-life for members of the regional, state, local and campus communities.
5. Contribute to the diversity of the university community by working toward the goals of Plan 2012.

Requirements for the Geosciences Major

The geosciences major requires a selection of core courses and courses in a concentration. Students select between two concentrations: environmental geosciences or earth science.

A. Required Core Courses (26 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOS 102</td>
<td>Origin and History of the Earth</td>
<td>4 cr</td>
</tr>
<tr>
<td>GEOS 104</td>
<td>Introductory Geology Laboratory</td>
<td>2 cr</td>
</tr>
<tr>
<td>GEOS 200</td>
<td>Minerals and Rocks</td>
<td>4 cr</td>
</tr>
<tr>
<td>GEOS 330</td>
<td>Environmental Geology</td>
<td>4 cr</td>
</tr>
<tr>
<td>GEOS 355</td>
<td>Stratigraphy and Sedimentation</td>
<td>4 cr</td>
</tr>
<tr>
<td>GEOS 445</td>
<td>Environmental Sampling, Monitoring, and Assessment</td>
<td>4 cr</td>
</tr>
<tr>
<td>GEOS 495</td>
<td>Senior Seminar</td>
<td>1 cr</td>
</tr>
<tr>
<td>GEOS 496</td>
<td>Geoscience Applications</td>
<td>3 cr</td>
</tr>
</tbody>
</table>

B. Concentration Courses (45-51 credits)

1. Requirements for Environmental Geosciences Concentration (48-51 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOS 101</td>
<td>Introductory Geology</td>
<td>3 cr</td>
</tr>
<tr>
<td>GEOS 106</td>
<td>Great Lakes Water Resources</td>
<td>3 cr</td>
</tr>
<tr>
<td>OR</td>
<td>Fundamentals of Global Climate Change</td>
<td>3 cr</td>
</tr>
<tr>
<td>GEOS 331</td>
<td>Introduction to Geochemistry</td>
<td>3 cr</td>
</tr>
<tr>
<td>GEOS 345</td>
<td>Geophysics</td>
<td>3 cr</td>
</tr>
<tr>
<td>GEOS 361</td>
<td>Hydrogeology</td>
<td>3 cr</td>
</tr>
<tr>
<td>GEOS 431</td>
<td>Aqueous and Contaminant Geochemistry</td>
<td>4 cr</td>
</tr>
<tr>
<td>GEOS 470</td>
<td>Remediation Science and Technology</td>
<td>3 cr</td>
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<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOS 440</td>
<td>Contaminants in Terrestrial Systems</td>
<td>3 cr</td>
</tr>
<tr>
<td>GEOS 465</td>
<td>Applied Hydrogeology</td>
<td>4 cr</td>
</tr>
<tr>
<td>MATH 112</td>
<td>College Algebra II</td>
<td>3 cr</td>
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</table>

AND

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 113</td>
<td>Trigonometry</td>
<td>3 cr</td>
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<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH 114</td>
<td>College Algebra II w/Trigonometry</td>
<td>5 cr</td>
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<td>OR</td>
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<tr>
<td>MATH 221</td>
<td>Calculus &amp; Analytic Geometry I</td>
<td>5 cr</td>
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<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOS 295</td>
<td>Mathematics for Geosciences</td>
<td>3 cr</td>
</tr>
<tr>
<td>CHEM 101</td>
<td>General Chemistry I</td>
<td>5 cr</td>
</tr>
<tr>
<td>CHEM 102</td>
<td>General Chemistry II</td>
<td>5 cr</td>
</tr>
<tr>
<td>PHYS 101</td>
<td>Principles of Physics</td>
<td>4 cr</td>
</tr>
</tbody>
</table>

2. Requirements for the Earth Science Concentration (45 credits)

a. Required Courses (33 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOS 100</td>
<td>Earth in Perspective</td>
<td>3 cr</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GEOS 101</td>
<td>Introductory Geology: An Earth Resources Approach</td>
<td>3 cr</td>
</tr>
<tr>
<td>GEOS 103</td>
<td>Environmental Science: Global Climate Change</td>
<td>3 cr</td>
</tr>
<tr>
<td>GEOS 106</td>
<td>Great Lakes Water Resources</td>
<td>3 cr</td>
</tr>
<tr>
<td>GEOS 109</td>
<td>Fundamentals of Global Climate Change</td>
<td>3 cr</td>
</tr>
<tr>
<td>GEOS 207</td>
<td>Field Methods</td>
<td>2 cr</td>
</tr>
<tr>
<td>GEOS 301</td>
<td>Geomorphology</td>
<td>4 cr</td>
</tr>
<tr>
<td>GEOS 320</td>
<td>Soils, Weathering and Surficial Processes</td>
<td>4 cr</td>
</tr>
<tr>
<td>GEOS 420</td>
<td>Glacial Geology</td>
<td>4 cr</td>
</tr>
<tr>
<td>ENV 335</td>
<td>Energy</td>
<td>4 cr</td>
</tr>
<tr>
<td>MATH 102</td>
<td>Survey of Mathematics</td>
<td>3 cr</td>
</tr>
<tr>
<td>OR</td>
<td>(or higher)</td>
<td></td>
</tr>
<tr>
<td>CHEM 100</td>
<td>The World of Chemistry</td>
<td>3 cr</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 109</td>
<td>Environmental Chemistry</td>
<td>3 cr</td>
</tr>
</tbody>
</table>

b. Elective Courses (12 credits)

Supporting courses must be 300 and above.

Requirements for the Geosciences Minor

The geosciences minor offers students who are majoring in other academic disciplines, either in science or non-science areas, the opportunity to acquire an appreciation and basic knowledge of geosciences. This may enhance and add flexibility regarding career opportunities.

Students must complete a minimum of 19 credits in geosciences as follows:

A. Required Courses (13 credits)

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GEOS 101</td>
<td>Introductory Geology</td>
<td>3 cr</td>
</tr>
<tr>
<td>OR</td>
<td>(or acceptable substitute)</td>
<td></td>
</tr>
<tr>
<td>GEOS 102</td>
<td>Origin and History of the Earth</td>
<td>4 cr</td>
</tr>
<tr>
<td>GEOS 104</td>
<td>Introductory Geology Laboratory</td>
<td>2 cr</td>
</tr>
<tr>
<td>GEOS 200</td>
<td>Minerals and Rocks</td>
<td>4 cr</td>
</tr>
</tbody>
</table>

B. Elective Courses (6 credits)

Six additional geosciences credits; 3 of the 6 credits must be upper level (300/400).
Courses in Geosciences (GEOS)

100  Earth in Perspective ......................................................... 3 cr
Prereq: None. Freq: Fall.
Surveys the physical environment, including Earth's place in space, atmospheric processes, the oceans, and the solid earth; humanity's place in the system. Three-hour lecture.

101  Introductory Geology .......................................................... 3 cr
Prereq: None. Freq: Fall.
Explores the origin, age, and structure of the Earth; mountain building, volcanism, and continental drift; earth materials; rocks, minerals, and mineral and fossil fuel resources. Field trips. Three-hour lecture.

102  Origin and History of the Earth .............................................. 4 cr
Prereq: A 3-credit college level geosciences course. Freq: Spring.
Investigates the origin of the solar system and Earth; age of the Earth; origin of the oceans, atmosphere and life; geologic and life history. Labs focus on gaining experience with fossils, maps, dating techniques, and data analysis. Field trips. Three-hour lecture, three-hour lab.

103  Environmental Science: An Earth Resources Approach .......... 3 cr
Prereq: None. Freq: Fall.
Interactions between earth system processes and human activities: geologic hazards, water quality, pollution, land use, energy, mineral resources. Uses the physical earth to enable student consideration of the settings and values that produce environmental quality.

104  Introductory Geology Laboratory ........................................ 2 cr
Prereq: GEOS 101 (or acceptable substitute). Freq: Spring.
Rock, mineral, and fossil identification; topographic and geologic map interpretation; aerial photographs; hydrology, soils, and environmental geology. Field trips. Six-hour lab.

105  Oceanography ................................................................. 3 cr
Prereq: None. Freq: Spring.
Origin of ocean basins; nature of seawater; ocean circulation; waves and tides; life in the sea; marine resources. Course specifically intended for non-majors. Three-hour lecture.

106  Great Lakes Water Resources ............................................. 3 cr
Prereq: None. Freq: Spring.

108  Dirt Appreciation: Soils for Survival .................................... 3 cr
Prereq: None. Freq: Occasionally.
Provides an understanding of the critical role of soils in determining and maintaining environmental quality. Also introduces the scientific foundations for using soil surveys in land-use planning. Three-hour lecture.

109  Fundamentals of Global Climate Change ......................... 3 cr
Prereq: None. Freq: Fall.
Surveys the current state of climate science including Earth’s energy budget, the atmosphere, the greenhouse effect, ocean circulation, climate feedbacks, climate modeling and Earth’s past climate. Also considers uncertainty in projections of future climate and solutions involving carbon sequestration, carbon-trade markets and energy efficiency. Three-hour lecture. Cross-listed with INTS 109.

200  Minerals and Rocks .......................................................... 4 cr
Prereq: GEOS 104 or consent of instructor. Freq: Fall.
Internal order of crystals; physical, chemical, and optical properties of minerals; mineral identification; mineral associations and the classification of igneous, metamorphic, and sedimentary rocks; ore deposits. Field trips. Three-hour lecture, three-hour lab.

207  Field Methods ............................................................... 2 cr
Prereq: GEOS 101, 104. Freq: Spring (odd years).
Field methods used in geologic study, including occurrence and contact relations of geologic bodies, geologic mapping, rock, soil and water sampling. Field trips.

290  Special Topics in Geosciences ........................................... 1-4 cr
Prereq: Consent of instructor. Freq: Occasionally.
Selected topics in the geosciences will be examined.

295  Mathematics for Geosciences .......................................... 3 cr
Prereq: MATH 112 and 113, or MATH 114. Freq: Winter.
Introduces applied differential and integral calculus of single- and multi-variable functions, vector analysis, and differential equations. Provides students with a solid knowledge of applied mathematics in all areas of the physical sciences with emphasis on geosciences.

300  Petrology ...................................................................... 3 cr
Prereq: GEOS 102, 200. Freq: Occasionally.
Origins of igneous, sedimentary, and metamorphic rocks. Review of hand, sample and microscopic description; chemical analysis; nature and origin of magma; phase equilibria; magmatic series and differentiation; deposit and diagenesis of sediments; metamorphism. Field trips. Two-hour lecture; four-hour lab.

301  Geomorphology ............................................................. 4 cr
Prereq: GEOS 102, 200; or consent of instructor. Freq: Fall (odd years).
Analyzes and describes landforms; emphasis on genesis, surficial processes, and relation to geologic structure. Includes some regional treatment of landscapes. Field trips. Three-hour lecture; three-hour lab.

309  Paleontology ................................................................. 3 cr
Prereq: GEOS 102 or BIOS 102 or consent of instructor. Freq: Occasionally.
Principles, practices, and procedures applied to important fossil invertebrate groups; generalized discussion of plants and vertebrates; elements of biostratigraphy; paleoenvironmental interpretations. Field trips. Two-hour lecture; four-hour lab.

310  Structural Geology .......................................................... 3 cr
Prereq: GEOS 102, 200; or consent of instructor. Freq: Occasionally.
Formation and description of folds, faults, joints, and foliation; tectonic processes; structures related to intrusive and extrusive igneous rocks; interpretation of geologic maps; field techniques. Field trips. Two-hour lecture; three-hour lab.

320  Soils, Weathering, and Surficial Processes ......................... 4 cr
Presentation of soils as natural entities in a process-based context. Methods and terminology of soil description and classification. Evaluation of environmental capacity of soils on a quantitative basis. Three-hour lecture; three-hour lab.

330  Environmental Geology ................................................... 4 cr
Prereq: GEOS 104. Freq: Spring.
Application of basic geologic concepts to environmental problems; emphasis on geologic hazards, waste disposal, urban planning, resource policy issues, and environmental trends and programs. Field trips. Three-hour lecture; three-hour lab.

331  Introduction to Geochemistry ........................................... 3 cr
Prereq: CHEM 102 or equivalent. Freq: Spring (even years).
Chemical principles and their application to various geologic environments; chemical weathering, geochemical prospecting; phase equilibria; geochronology. Field trip.

345  Geophysics ................................................................. 3 cr
Prereq: GEOS 102, MATH 114; or consent of instructor. Freq: Spring (odd years).
Surface and subsurface geophysics; principles and procedures of magnetics, gravity, seismonology, electromagnetics, ground penetrating radar; applications in hydrogeology, petroleum and mineral exploration, environmental and water resource investigations. Field trips. Three-hour lecture.

355  Stratigraphy and Sedimentation ....................................... 4 cr
Prereq: GEOS 104, 200; or consent of instructor. Freq: Spring.
Explores the sedimentary rock record, correlation, nomenclature, paleotectonics, subsurface techniques, sedimentary processes and environments, recent sediments. Field trips. Three-hour lecture; three-hour lab.
361 Hydrogeology .......................... 3 cr  
Prereq: GEOS 200; MATH 114 or MATH 112 and 113; or consent of instructor.  
Freq: Spring (even years).  
Examines surface water hydrogeology; runoff and stream flow; ground water hydrogeology; distribution of ground water, aquifer properties, local and regional ground water flow, geology of ground water occurrence; aqueous chemistry, and water quality. Field trips. Three-hour lecture.

370 Field Studies in Regional Geology .................................. 1-4 cr  
Prereq: GEOS 102 and consent of instructor.  
Freq: Occasional summers.  
Intensive study of the geology of selected regions. Application of field methods. Based upon a field trip of up to several weeks duration to a selected region. May be repeated for credit. Additional fees required.

390 Special Topics ........................................... 1-4 cr  
Prereq: None.  Freq: Occasionally.  
Selected topics in the geosciences will be examined. May be repeated for credit with different topic.

420 Glacial Geology ............................................ 4 cr  
Prereq: GEOS 104, 200; or consent of instructor.  Freq: Spring (even years).  
Explores regimen and flow of glaciers; glacial erosion and deposition; glacial landforms; Pleistocene history in glaciated and nonglaciated regions; stratigraphy and chronology of Pleistocene deposits in the Midwest and Great Lakes. Field trips. Three-hour lecture; three-hour lab.

431 Aqueous and Contaminant Geochemistry .......................... 4 cr  
Prereq: GEOS 331 or equivalent.  Freq: Spring (odd years).  
Solution chemistry; aqueous chemical speciation, organic chemistry; contaminant-sediment interaction; contaminant fate and transport. Field trip. Three-hour lecture; three-hour lab.

440 Contaminants in Terrestrial Systems .................................. 3 cr  
Prereq: GEOS 331.  Freq: Occasionally.  
Sources, transport, and fate of major environmental contaminants; natural and anthropogenic processes affecting contaminant mobility and bioavailability; cycling of contaminants through terrestrial ecosystems and the vadose zone. Three-hour lecture.

445 Environmental Sampling, Monitoring, and Assessment .......... 4 cr  
Prereq: GEOS 330.  Freq: Fall.  
Explains EPA-referenced field and laboratory methods for evaluating contaminant levels in terrestrial and ground water systems. Students learn and practice sampling and monitoring techniques and gain experience with chromatographic and spectroscopic techniques. Three-hour lecture; three-hour lab.

465 Applied Hydrogeology ........................................... 4 cr  
Prereq: GEOS 361.  Freq: Fall (even years).  
Mass transport in vadose and saturated zones; origin and behavior of inorganic and organic contaminants; investigative techniques; ground water models; site remediation; ground water resource development and management; water law. Field trips. Three-hour lecture, three-hour lab.

470 Remediation Science and Technology .............................. 3 cr  
Prereq: GEOS 331, 361.  Freq: Spring (odd years).  
Investigates methods and techniques for reducing, removing or immobilizing metals and radionuclides, including natural attenuation, in situ stabilization, phytoremediation and bioremediation. Three-hour lecture.

490 Special Topics in Geosciences ........................................ 1-4 cr  
Prereq: Consent of instructor.  Freq: Occasionally.  
Intensive treatment of specialized areas in the geosciences.

495 Senior Seminar .................................................. 1 cr  
Prereq: Senior standing, GEOS 355.  Freq: Spring.  
Individual student preparations and detailed oral and written presentations, in professional-style format, on knowledge of specialized topics acquired through library, laboratory, and/or field research. May be repeated for credit.

496 Geoscience Applications ....................................... 3 cr  
Prereq: Senior standing, GEOS 355; or consent of instructor.  
Freq: Fall.  
Course in which students apply their knowledge in service to the community. Project may involve teamwork on environmental assessment, land-use planning, etc., or individual internships with corporate or governmental agencies. Culminates in report/recommendation based on investigations.

497 Senior Thesis ...................................................... 1-2 cr  
Prereq: Senior standing and consent of instructor.  Freq: Fall, Spring.  
Familiarization with the processes of research and scientific writing based upon laboratory, field, and literature study; oral defense of the thesis. Course may be repeated for a maximum of 4 credits.

499 Independent Study ..................................................... 1-2 cr  
Prereq: Consent of instructor and department chair.  Freq: Fall, Spring.  
Individual investigation of selected problems in the geosciences. Allows students to pursue independent field, laboratory, or library research interests under supervision of faculty members. Maximum 6 credits.

Graduate Courses

570 Field Studies in Regional Geology .................................. 1-4 cr  
Prereq: Consent of instructor and department chair.  
Freq: Occasional summers.  
Intensive study of the geology of selected regions. Application of field methods. Based upon a field trip of up to several weeks duration to a selected region. May be repeated for credit. Additional fees required.

690 Special Topics in Geosciences ........................................ 1-4 cr  
Prereq: None.  Freq: Occasionally.  
Intensive treatment of specialized areas in the geosciences.