GEOLOGICAL ENGINEERING, B.S.

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (http://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext) section of the Guide.

General Education

- Breadth—Humanities/Literature/Arts: 6 credits
- Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits
- Breadth—Social Studies: 3 credits
- Communication Part A & Part B *
- Ethnic Studies *
- Quantitative Reasoning Part A & Part B *

* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

Students must complete the College of Engineering Liberal Studies Requirements (http://guide.wisc.edu/undergraduate/engineering/#requirementstext).

Students are encouraged to download a GLE Undergraduate Handbook from the Current Students/Undergraduate page on the program website (http://www.engr.wisc.edu/geological-engineering/). The handbook has detailed curriculum information as well as other practical information for undergraduate students to supplement the information provided here.

Students completing the geological engineering degree are also eligible to earn an additional major in geology and geophysics with no additional coursework. Students must contact an advisor to complete the necessary paperwork to declare the additional geology and geophysics major.

SUMMARY OF REQUIREMENTS

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mathematics</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Engineering Principles and Professional Issues</td>
<td>11-14</td>
</tr>
<tr>
<td></td>
<td>Physical Science, Engineering Science, and Geoscience</td>
<td>44</td>
</tr>
</tbody>
</table>

Required Geological Engineering Courses 19
Technical Electives 15
Geological Engineering Design
Communication Skills 8-9
Liberal Studies Electives 16
Fundamentals of Engineering Exam

Total Credits 126-130

MATHMATICS

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>MATH 221</td>
<td>Calculus and Analytic Geometry 1</td>
<td>5</td>
</tr>
<tr>
<td>or MATH 217</td>
<td>Calculus with Algebra and Trigonometry II</td>
<td></td>
</tr>
<tr>
<td>or MATH 275</td>
<td>Topics in Calculus I</td>
<td></td>
</tr>
<tr>
<td>MATH 222</td>
<td>Calculus and Analytic Geometry 2</td>
<td>4</td>
</tr>
<tr>
<td>or MATH 276</td>
<td>Topics in Calculus II</td>
<td></td>
</tr>
<tr>
<td>MATH 234</td>
<td>Calculus—Functions of Several Variables</td>
<td>4</td>
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</table>

Total Credits 13

ENGINEERING PRINCIPLES AND PROFESSIONAL ISSUES

<table>
<thead>
<tr>
<th>Code</th>
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<tbody>
<tr>
<td>STAT 324</td>
<td>Introductory Applied Statistics for Engineers</td>
<td>3</td>
</tr>
<tr>
<td>or STAT 311</td>
<td>Introduction to Theory and Methods of Mathematical Statistics I</td>
<td></td>
</tr>
<tr>
<td>or I SY E 210</td>
<td>Introduction to Industrial Statistics</td>
<td></td>
</tr>
<tr>
<td>CIV ENGR/G L E 291</td>
<td>Problem Solving Using Computer Tools</td>
<td>4</td>
</tr>
<tr>
<td>I SY E 313</td>
<td>Engineering Economic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Select one:</td>
<td></td>
<td>1-4</td>
</tr>
<tr>
<td>E P D 690</td>
<td>Special Topics in Engineering Professional Development (Topic: Core Competence in Sustainability)</td>
<td></td>
</tr>
<tr>
<td>ENVIR ST 250</td>
<td>Introduction to Sustainability Science</td>
<td></td>
</tr>
<tr>
<td>ENVIR ST/ GEOG 339</td>
<td>Environmental Conservation</td>
<td></td>
</tr>
<tr>
<td>ENVIR ST/ PHILOS 441</td>
<td>Environmental Ethics</td>
<td></td>
</tr>
<tr>
<td>G L E 401</td>
<td>Special Topics in Geological Engineering (Topic: Ethics &amp; Professionalism - GLE)</td>
<td></td>
</tr>
<tr>
<td>INTEREGR 303</td>
<td>Applied Leadership Competencies in Engineering</td>
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</tr>
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Total Credits 11-14

PHYSICAL SCIENCE, ENGINEERING SCIENCE AND GEOSCIENCE

<table>
<thead>
<tr>
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<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>Select one of the following:</td>
<td></td>
<td>5-9</td>
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<tr>
<td>CHEM 109</td>
<td>Advanced General Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHEM 103</td>
<td>General Chemistry I</td>
<td></td>
</tr>
<tr>
<td>&amp; CHEM 104</td>
<td>and General Chemistry II</td>
<td></td>
</tr>
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</table>
PHYSICS 202  General Physics  5
   or PHYSICS 208  General Physics
E M A 201  Statics  3
E M A 202  Dynamics  3
   or M E 240  Dynamics
E M A 303  Mechanics of Materials  3
   or M E 306  Mechanics of Materials
CIV ENGR 310  Fluid Mechanics  3
GEOSCI 100  Introductory Geology: How the Earth Works  3
   or GEOSCI/ENVIR ST 106  Environmental Geology
GEOSCI 202  Introduction to Geologic Structures  4
GEOSCI 204  Geologic Evolution of the Earth  4
GEOSCI/G L E 360  Principles of Mineralogy  3
GEOSCI/G L E 370  Elementary Petrology  3
GEOSCI/G L E 431  Sedimentary & Stratigraphy Lab  1
GEOSCI/G L E 455  Structural Geology  4

Total Credits  44-48

REQUIRED GEOLOGICAL ENGINEERING COURSES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>G L E 171</td>
<td>Introduction to Geological Engineering</td>
<td>1</td>
</tr>
<tr>
<td>G L E/CIV ENGR 330</td>
<td>Soil Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>G L E/CIV ENGR/GEOSCI/M S &amp; E 474</td>
<td>Rock Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>G L E 479</td>
<td>Geological Engineering Design</td>
<td>4</td>
</tr>
<tr>
<td>G L E/GEOSCI 594</td>
<td>Introduction to Applied Geophysics</td>
<td>3</td>
</tr>
<tr>
<td>G L E/GEOSCI 595</td>
<td>Field Methods in Applied</td>
<td>1</td>
</tr>
<tr>
<td>G L E/GEOSCI 627</td>
<td>Engineering Geophysics</td>
<td>4</td>
</tr>
</tbody>
</table>

Total Credits  19

TECHNICAL ELECTIVES (15 CREDITS)

Students must take at least 15 credits in the Technical Electives category, of which 5-6 credits must be design-focused (noted as ‘D’ in the tracks below), including at least one design-focused course taken prior to G L E 479 Geological Engineering Design. If students take G L E/CIV ENGR 430 Introduction to Slope Stability and Earth Retention, G L E/CIV ENGR 432 Introduction to Shallow and Deep Foundation Systems and G L E/CIV ENGR 434 Introduction to Underground Openings Engineering, these combine to count as one design course. Additionally, if students take G L E/CIV ENGR 530 Seepage and Slopes, they can use G L E/CIV ENGR 432 and G L E/CIV ENGR 434 to count as one design credit; or, if students take G L E/CIV ENGR 532 Foundations, they can use G L E/CIV ENGR 430 and G L E/CIV ENGR 434 to count as one design credit. Students may take up to 6 credits of directed research credits as technical electives.

The technical electives are organized into five tracks, described below. Students may select courses within these tracks to focus coursework in a particular area. However, students must complete the technical electives requirement using courses listed in multiple tracks. Suggested technical electives and associated design-focused credits (noted as ‘D’ in the tracks below) for each track are included below. One credit of G L E 1 Cooperative Education Program can be used as a technical elective.

Energy, Minerals & Mining

Geological engineers possess knowledge and a skill set that serve society’s need to manage extraction of traditional energy and mineral resources in more sustainable and efficient ways, develop renewable energy systems such as solar and wind energy sites, and to lead in new technologies to limit carbon emissions through geological sequestration or to develop geothermal exchange fields and reservoirs.

Within this track, the 16 credits of liberal studies can be framed to match those of the Energy Institute certificate in Energy Sustainability (http://guide.wisc.edu/undergraduate/engineering/engineering-physics/engineering-energy-sustainability-certificate/).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BSE/ENVIR ST 367</td>
<td>Renewable Energy Systems</td>
<td>3</td>
</tr>
<tr>
<td>CBE 562</td>
<td>Special Topics in Chemical Engineering (Topic: Energy &amp; Sustainability)</td>
<td>1-3</td>
</tr>
<tr>
<td>CIV ENGR/ENVIR ST/GEOG 377</td>
<td>An Introduction to Geographic Information Systems</td>
<td>4</td>
</tr>
<tr>
<td>E M A 405</td>
<td>Practicum in Finite Elements</td>
<td>3</td>
</tr>
<tr>
<td>GEOSCI/ENVIR ST 411</td>
<td>Energy Resources</td>
<td>3</td>
</tr>
<tr>
<td>GEOSCI 457</td>
<td>Conducted Field Trip</td>
<td>2</td>
</tr>
<tr>
<td>GEOSCI 459</td>
<td>Field Geology</td>
<td>6</td>
</tr>
<tr>
<td>GEOSCI 515</td>
<td>Principles of Economic Geology</td>
<td>4</td>
</tr>
<tr>
<td>G L E 401</td>
<td>Special Topics in Geological Engineering (D) 1</td>
<td>1-3</td>
</tr>
<tr>
<td>G L E/CIV ENGR 430</td>
<td>Introduction to Slope Stability and Earth Retention (D)</td>
<td>1</td>
</tr>
<tr>
<td>G L E/CIV ENGR 434</td>
<td>Introduction to Underground Openings Engineering (D)</td>
<td>1</td>
</tr>
<tr>
<td>G L E/CIV ENGR 530</td>
<td>Seepage and Slopes (D)</td>
<td>3</td>
</tr>
<tr>
<td>G L E/CIV ENGR 535</td>
<td>Wind Energy Balance-of-Plant Design (D)</td>
<td>3</td>
</tr>
<tr>
<td>G L E 801</td>
<td>Special Topics in Geological Engineering (Topic: Geomechanics)</td>
<td>1-3</td>
</tr>
</tbody>
</table>

1 Only certain G L E 401 topics count as design courses.

Sustainability & Environment

Methods for quantifying the long-term effects of development, natural resource extraction, and environmental damage are often neglected or misapplied in cost-benefit life cycle analysis. This track intends to produce professionals capable of leading the field in sustainable design and construction. The Sustainability & Environment track focuses on quantification, design, and optimization in relation to the use of natural resources and construction materials/methods as well as minimizing the long-term impacts of these activities.

<table>
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<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>BSE/DS/LAND ARC 356</td>
<td>Sustainable Residential Construction</td>
<td>3</td>
</tr>
<tr>
<td>BSE/ENVIR ST 367</td>
<td>Renewable Energy Systems</td>
<td>3</td>
</tr>
</tbody>
</table>
increasing challenges to this resource. Development and sustainable land reclamation. Population growth and climate change are creating linked to mineral and energy resource production, waste management, Water is an essential resource for humans and ecosystems. Water is also economic costs associated with geohazards. necessary skills to perform analyses that minimize loss of life and tsunamis. The Geohazards track aims to provide students with the increase every year. These losses may result from various geohazards, such as volcanic eruptions, earthquakes, landslides, flooding and management of groundwater and surface water, including prevention and mitigation of water quality problems, require combined expertise in geoscience, hydrology, and water resources engineering offered through the Water track.

**Geohazards**
The number of fatalities and amount of economic loss due to geohazards increase every year. These losses may result from various geohazards, such as volcanic eruptions, earthquakes, landslides, flooding and tsunamis. The Geohazards track aims to provide students with the necessary skills to perform analyses that minimize loss of life and economic costs associated with geohazards.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>CIV ENGR/ENVIR ST/</td>
<td>An Introduction to Geographic Information Systems</td>
<td>4</td>
</tr>
<tr>
<td>GEOG 377</td>
<td>Coastal Engineering (D)</td>
<td>2-3</td>
</tr>
<tr>
<td>CIV ENGR 514</td>
<td>Practicum in Finite Elements</td>
<td>3</td>
</tr>
<tr>
<td>E M A 405</td>
<td>Field Geology</td>
<td>6</td>
</tr>
<tr>
<td>GEOSCI/GEOG</td>
<td>Geomorphology</td>
<td>3</td>
</tr>
<tr>
<td>GEOSCI/GEOG</td>
<td>Landforms-Topics and Regions</td>
<td>3</td>
</tr>
<tr>
<td>GEOSCI/G L E 350</td>
<td>Introduction to Geophysics: The Dynamic Earth</td>
<td>3</td>
</tr>
<tr>
<td>GEOSCI 459</td>
<td>Introduction to Slope Stability and Earth Retention (D)</td>
<td>1</td>
</tr>
<tr>
<td>GEOSCI/GEOG</td>
<td>Practicum in Finite Elements (Sustainable Construction)</td>
<td>3</td>
</tr>
<tr>
<td>GEOSCI/GEOG</td>
<td>Practical Applications of GPS Surveying</td>
<td>2</td>
</tr>
<tr>
<td>G L E/CIV ENGR 430</td>
<td>Seepage and Slopes (D)</td>
<td>3</td>
</tr>
<tr>
<td>G L E/CIV ENGR 735</td>
<td>Soil Dynamics (D)</td>
<td>3</td>
</tr>
</tbody>
</table>

**Water**
Water is an essential resource for humans and ecosystems. Water is also linked to mineral and energy resource production, waste management, and land reclamation. Population growth and climate change are creating increasing challenges to this resource. Development and sustainable...
Only certain GE 401 topics count as design courses.

**COMMUNICATION SKILLS**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
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<tbody>
<tr>
<td>ENGL 100</td>
<td>Introduction to College Composition</td>
<td>3</td>
</tr>
<tr>
<td>or COM ARTS 100</td>
<td>Introduction to Speech Composition</td>
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<tr>
<td>or LSC 100</td>
<td>Science and Storytelling</td>
<td></td>
</tr>
<tr>
<td>or ESL 118</td>
<td>Academic Writing II</td>
<td></td>
</tr>
<tr>
<td>E PD 275</td>
<td>Technical Presentations</td>
<td>2-3</td>
</tr>
<tr>
<td>or COM ARTS 105</td>
<td>Public Speaking</td>
<td></td>
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<tr>
<td>or COM ARTS 181</td>
<td>Elements of Speech-Honors Course</td>
<td></td>
</tr>
<tr>
<td>or COM ARTS 262</td>
<td>Theory and Practice of Argumentation and Debate</td>
<td></td>
</tr>
<tr>
<td>or COM ARTS 266</td>
<td>Theory and Practice of Group Discussion</td>
<td></td>
</tr>
<tr>
<td>INTEREGR 397</td>
<td>Engineering Communication (was EPD 397 before Fall 2020)</td>
<td>3</td>
</tr>
</tbody>
</table>

Total Credits: 8-9

**LIBERAL STUDIES (16 CREDITS)**

Students must complete the 16 credits of College of Engineering Liberal Studies Requirements (http://guide.wisc.edu/undergraduate/engineering/#requirementstext).

**FUNDAMENTALS OF ENGINEERING EXAM**

All students must take the Fundamentals of Engineering exam.

**HONORS IN RESEARCH**

Students in geological engineering that have completed at least two semesters on the Madison campus with a cumulative GPA of at least 3.5 may apply to participate in the Honors in Research program. Students may register for 1 to 3 credits per semester. A grade of P (Progress) will be assigned each semester until the student completes the honors in research program or drops out of the program, at which time a final grade is assigned (based on research progress and the written thesis, if completed). This becomes the grade for all credits taken in GE 489 Honors in Research.

A senior thesis worth 3 credits of GE 489 Honors in Research is required. The senior thesis is a written document reporting on a substantial piece of work that is prepared in the style of a graduate thesis. The thesis advisor determines the grade which the student receives for the thesis. A bound copy of the thesis must be submitted to the geological engineering office to complete the program.

The designation "Honors in Research" will be recorded on the student's transcript if the following criteria are met:

1. Satisfaction of requirements for an undergraduate degree in Geological Engineering.
2. A cumulative grade-point average of at least 3.3.
3. Completion of a total of at least 8 credits in GE 489 Honors in Research.
4. Completion of a senior honors thesis with a final grade of B or better.

Students interested in the Honors in Research program should contact their advisor or the GE chair for more information. Applications to the program are to be submitted to the GE chair with a supporting letter from the student's academic and thesis advisors. Decisions regarding acceptance are made by the GE chair.

**UNIVERSITY DEGREE REQUIREMENTS**

Total Degree

To receive a bachelor's degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.

Residency

Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. "In residence" means on the UW–Madison campus with an undergraduate degree classification. "In residence" credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.

Quality of Work

Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.