

GEOLOGICAL ENGINEERING, BS

REQUIREMENTS

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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/#requirementsforundergraduestudytext>) section of the *Guide*.

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|-------------------|--|
| General Education | <ul style="list-style-type: none"> • 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 * |
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* 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 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.

The following curriculum applies to students admitted to the geological engineering degree program.

SUMMARY OF REQUIREMENTS

| Code | Title | Credits |
|---|-------|---------|
| Mathematics | | 13 |
| Engineering Principles and Professional Issues | | 11-14 |
| Physical Science, Engineering Science, and Geoscience | | 44 |
| Required Geological Engineering Courses | | 19 |
| Technical Electives | | 15 |

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| Geological Engineering Design | |
| Communication Skills | 8-9 |
| Liberal Studies Electives | 16 |
| Fundamentals of Engineering Exam | |
| Total Credits | 126-130 |

MATHEMATICS

| Code | Title | Credits |
|----------------------|---|-----------|
| MATH 221 | Calculus and Analytic Geometry I | 5 |
| or MATH 217 | Calculus with Algebra and Trigonometry II | |
| MATH 222 | Calculus and Analytic Geometry 2 | 4 |
| MATH 234 | Calculus--Functions of Several Variables | 4 |
| Total Credits | | 13 |

ENGINEERING PRINCIPLES AND PROFESSIONAL ISSUES

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

Total Credits 11-14

PHYSICAL SCIENCE, ENGINEERING SCIENCE AND GEOSCIENCE

| Code | Title | Credits |
|------------------------------|---|---------|
| Select one of the following: | | 5-9 |
| CHEM 109 | Advanced General Chemistry | |
| CHEM 103 & CHEM 104 | General Chemistry I and General Chemistry II | |
| PHYSICS 202 | General Physics | 5 |
| or PHYSICS 208 | General Physics | |
| E M A 201 | Statics (C grade or better) | 3 |
| E M A 202 | Dynamics | 3 |
| E M A 303 | Mechanics of Materials | 3 |
| CIV ENGR 310 | Fluid Mechanics | 3 |

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|----------------------------|---|--------------|
| 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

| Code | Title | Credits |
|---|---|-----------|
| G L E 171 | Introduction to Geological Engineering | 1 |
| or INTEREGR 170 | Design Practicum | |
| G L E/CIV ENGR 291 | Problem Solving Using Computer Tools | 4 |
| G L E/ CIV ENGR 330 | Soil Mechanics | 3 |
| G L E/CIV ENGR/ GEOSCI/ M S & E 474 | Rock Mechanics | 3 |
| G L E 479 | Geological Engineering Design | 4 |
| G L E/GEOSCI 594 | Introduction to Applied Geophysics | 3 |
| G L E/GEOSCI 595 | Field Methods in Applied and Engineering Geophysics | 1 |
| G L E/GEOSCI 627 | Hydrogeology | 4 |
| Total Credits | | 23 |

TECHNICAL ELECTIVES (15 CREDITS)

Students must take a minimum 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.

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 may 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.

Students may take up to 6 credits of directed research credits as technical electives. In addition, one credit of G L E 1 Cooperative Education Program can be used as 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/>).

| Code | Title | Credits |
|------------------------------------|---|---------|
| BSE/ENVIR ST 367 | Renewable Energy Systems | 3 |
| CBE 562 | Special Topics in Chemical Engineering (Topic: Energy & Sustainability) | 1-3 |
| CIV ENGR/ ENVIR ST/ GEOG 377 | An Introduction to Geographic Information Systems | 4 |
| E M A 405 | Practicum in Finite Elements | 3 |
| GEOSCI/ ENVIR ST 411 | Energy Resources | 3 |
| GEOSCI 457 | Conducted Field Trip | 2 |
| GEOSCI 459 | Field Geology | 6 |
| GEOSCI 515 | Principles of Economic Geology | 4 |
| G L E 401 | Special Topics in Geological Engineering (D) ¹ | 1-3 |
| G L E/ CIV ENGR 430 | Introduction to Slope Stability and Earth Retention (D) | 1 |
| G L E/ CIV ENGR 434 | Introduction to Underground Openings Engineering (D) | 1 |
| G L E/ CIV ENGR 530 | Seepage and Slopes (D) | 3 |
| G L E/ CIV ENGR 535 | Wind Energy Balance-of-Plant Design (D) | 3 |
| G L E/GEOSCI 757 | Advanced Rock Mechanics | 3 |
| G L E 801 | Special Topics in Geological Engineering (Topic: Geomechanics) | 1-3 |

¹ Only certain G L E 401 topics count as design courses. Please consult with your academic advisor for details.

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.

| Code | Title | Credits |
|------------------|---|---------|
| BSE/ENVIR ST 367 | Renewable Energy Systems | 3 |
| CBE 562 | Special Topics in Chemical Engineering (Topic: Energy & Sustainability) | 1-3 |

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|-----------------------|--|-----|
| CIV ENGR 320 | Environmental Engineering | 3 |
| CIV ENGR/G L E 421 | Environmental Sustainability Engineering | 3 |
| CIV ENGR 427 | Solid and Hazardous Wastes Engineering (D) | 3 |
| CIV ENGR 522 | Hazardous Waste Management | 3 |
| CIV ENGR 619 | Special Topics in Hydrology | 1-3 |
| CIV ENGR 649 | Special Topics in Structural Engineering (Topic: Sustainable Construction) | 1-3 |
| GEOSCI/ENVIR ST 411 | Energy Resources | 3 |
| GEOSCI/G L E 629 | Contaminant Hydrogeology (D) | 3 |
| G L E 401 | Special Topics in Geological Engineering (D) ¹ | 1-3 |
| G L E/CIV ENGR 635 | Remediation Geotechnics (D) | 3 |
| G L E/CIV ENGR 732 | Unsaturated Soil Geoengineering | 3 |
| SOIL SCI 321 | Soils and Environmental Chemistry | 3 |
| SOIL SCI/ENVIR ST 324 | Soils and Environmental Quality | 3 |

¹ Only certain G L E 401 Special Topics in Geological Engineering topics count as design courses. Please consult with your academic advisor for details.

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.

| Code | Title | Credits |
|-------------------------------------|---|---------|
| CIV ENGR/ENVIR ST/ GEOG 377 | An Introduction to Geographic Information Systems | 4 |
| CIV ENGR 514 | Coastal Engineering (D) | 2-3 |
| E M A 405 | Practicum in Finite Elements | 3 |
| GEOSCI/GEOG 320 | Geomorphology | 3 |
| GEOSCI/GEOG 326 | Landforms-Topics and Regions | 3 |
| GEOSCI/G L E 350 | Introduction to Geophysics: The Dynamic Earth | 3 |
| GEOSCI 459 | Field Geology | 6 |
| G L E/CIV ENGR 430 | Introduction to Slope Stability and Earth Retention (D) | 1 |
| G L E/CIV ENGR/ENVIR ST/ GEOSCI 444 | Practical Applications of GPS Surveying | 2 |
| G L E/CIV ENGR 530 | Seepage and Slopes (D) | 3 |
| G L E/CIV ENGR 735 | Soil Dynamics (D) | 3 |

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 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.

| Code | Title | Credits |
|--------------------|---|---------|
| CIV ENGR 311 | Hydroscience | 3 |
| CIV ENGR 412 | Groundwater Hydraulics | 3 |
| CIV ENGR 414 | Hydrologic Design (D) | 3 |
| CIV ENGR 415 | Hydrology | 3 |
| CIV ENGR 500 | Water Chemistry | 3 |
| CIV ENGR 618 | Special Topics in Hydraulics and Fluid Mechanics (D) ¹ | 1-3 |
| CIV ENGR 619 | Special Topics in Hydrology | 1-3 |
| GEOSCI/GEOG 320 | Geomorphology | 3 |
| GEOSCI/GEOG 326 | Landforms-Topics and Regions | 3 |
| GEOSCI/GEOG 420 | Glacial and Pleistocene Geology | 3 |
| GEOSCI 430 | Sedimentology and Stratigraphy | 3 |
| GEOSCI/G L E 629 | Contaminant Hydrogeology (D) | 3 |
| G L E 401 | Special Topics in Geological Engineering (D) ² | 1-3 |
| G L E/CIV ENGR 430 | Introduction to Slope Stability and Earth Retention (D) | 1 |
| G L E/CIV ENGR 511 | Mixing and Transport in the Environment | 3 |
| G L E/CIV ENGR 530 | Seepage and Slopes (D) | 3 |
| G L E/CIV ENGR 732 | Unsaturated Soil Geoengineering | 3 |

¹ Must take one of these topics: "Waterfront & Coastal Planning" or "Lake & River Rehabilitation."

² Only certain G L E 401 Special Topics in Geological Engineering topics count as design courses. Please consult with your academic advisor for details.

Infrastructure

There are many challenges that need to be overcome to address the aging infrastructure of this country as well as to develop cost effective solutions for new infrastructure in developing nations. The Infrastructure track is developed to provide students a background that enables them to perform engineering calculations to design, construct, assess the current condition (level of safety), and develop repair and retrofit solutions for civil engineering structures resting on, or constructed in, soil or rock.

| Code | Title | Credits |
|-----------------|--|---------|
| CIV ENGR 649 | Special Topics in Structural Engineering (Topic: Sustainable Construction) | 1-3 |
| E M A 405 | Practicum in Finite Elements | 3 |
| GEOSCI/GEOG 320 | Geomorphology | 3 |
| GEOSCI/GEOG 420 | Glacial and Pleistocene Geology | 3 |
| GEOSCI 430 | Sedimentology and Stratigraphy | 3 |

| | | |
|--|---|-----|
| G L E 401 | Special Topics in Geological Engineering (D) ¹ | 1-3 |
| G L E/ CIV ENGR 430 | Introduction to Slope Stability and Earth Retention (D) | 1 |
| G L E/ CIV ENGR 432 | Introduction to Shallow and Deep Foundation Systems (D) | 1 |
| G L E/ CIV ENGR 434 | Introduction to Underground Openings Engineering (D) | 1 |
| G L E/CIV ENGR/ ENVIR ST/ GEOSCI 444 | Practical Applications of GPS Surveying | 2 |
| G L E/ CIV ENGR 530 | Seepage and Slopes (D) | 3 |
| G L E/ CIV ENGR 532 | Foundations (D) | 3 |
| G L E/ CIV ENGR 535 | Wind Energy Balance-of-Plant Design (D) | 3 |
| G L E/ CIV ENGR 730 | Engineering Properties of Soils | 3 |
| G L E/ CIV ENGR 735 | Soil Dynamics (D) | 3 |

¹ Only certain G L E 401 topics count as design courses. Please consult with your academic advisor for details.

COMMUNICATION SKILLS

| Code | Title | Credits |
|----------------------|---|------------|
| ENGL 100 | Introduction to College Composition | 3 |
| or COM ARTS 100 | Introduction to Speech Composition | |
| or LSC 100 | Science and Storytelling | |
| or ESL 118 | Academic Writing II | |
| E P D 275 | Technical Presentations | 2-3 |
| or COM ARTS 105 | Public Speaking | |
| or COM ARTS 181 | Elements of Speech-Honors Course | |
| or COM ARTS 262 | Theory and Practice of Argumentation and Debate | |
| or COM ARTS 266 | Theory and Practice of Group Discussion | |
| INTEREGR 397 | Engineering Communication | 3 |
| 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 G L E 489 Honors in Research.

A senior thesis worth 3 credits of G L E 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 G L E 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 G L E director for more information. Applications to the program are to be submitted to the G L E director with a supporting letter from the student's academic and thesis advisors. Decisions regarding acceptance are made by the G L E director.

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. |