G E O L O G I C A L  E N G I N E E R I N G  (G L E)

G L E 1 — COOPERATIVE EDUCATION PROGRAM
1 credit.

Work experience which combines classroom theory with practical knowledge of operations to provide students with a background upon which to base a professional career in industry. Enroll Info: So st

Requisites: None

Course Designation: Workplace - Workplace Experience Course

Repeatable for Credit: Yes, unlimited number of completions

G L E 171 — INTRODUCTION TO GEOLOGICAL ENGINEERING
1 credit.

Comprehensive introduction to engineering applications of earth sciences. Exploitation and management of geologic resources; mitigation of geologic hazards such as landslides and earthquakes; abatement of environmental problems such as land and water pollution; design of surface and underground excavations; principal methods of geological engineering. Enroll Info: None

Requisites: None

Repeatable for Credit: No

Last Taught: Spring 2018

G L E/CIV ENGR 291 — PROBLEM SOLVING USING COMPUTER TOOLS
3 credits.

Introduction to engineering computations with emphasis on computer tools and computer based measurement, data collection, and processing. Tools will include computer aided drafting, spreadsheets, other engineering computation tools, and hardware and software for laboratory and spatial measurements. Enroll Info: EMA 202 or 304

Requisites: None

Repeatable for Credit: No

Last Taught: Spring 2018

G L E/CIV ENGR 330 — SOIL MECHANICS
4 credits.

Basic principles of soil mechanics and fundamentals of application in engineering practice; soil composition and texture; classification; permeability and seepage; consolidation; settlement; shear strength; lateral earth pressures; fundamentals of retaining structures, shallow and deep foundations, slope stability; sub-surface exploration; lab. Enroll Info: EMA 303 or 304 or con reg

Requisites: None

Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2018

G L E/GEOSCI 350 — INTRODUCTION TO GEOPHYSICS: THE DYNAMIC EARTH
3 credits.

Methods of geophysics applied to earth structure and plate tectonics. Principles of seismology, gravity, geodesy, magnetism and heat flow. Enroll Info: MATH 221

Requisites: None

Course Designation: Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2018

G L E/GEOSCI 360 — PRINCIPLES OF MINERALOGY
3 credits.

Minerals, their physical and chemical properties, crystallography, and geologic significance. Enroll Info: 1 sem college chem or concurrent registration

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Fall 2017

G L E/GEOSCI 370 — ELEMENTARY PETROLOGY
3 credits.

Igneous, sedimentary and metamorphic rocks, studied in hand sample and thin section. Enroll Info: GEOSCI/G L E 360

Requisites: None

Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req

Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

Repeatable for Credit: No

Last Taught: Spring 2018

G L E/ENVIR ST/F&W ECOL/GEOG/GEOSCI/LAND ARC 371 — INTRODUCTION TO ENVIRONMENTAL REMOTE SENSING
3 credits.

Introduction to the Earth as viewed from above, focusing on use of aerial photography and satellite imagery to study the environment. Includes physical processes of electromagnetic radiation, data types and sensing capabilities, methods for interpretation, analysis and mapping, and applications. Enroll Info: MATH 114 Sophomore standing

Requisites: None

Course Designation: Level - Intermediate

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Repeatable for Credit: No
G L E/ENVIR ST/F&W ECOL/GEOG/GEOSCI/LAND ARC 372 — INTERMEDIATE ENVIRONMENTAL REMOTE SENSING
3 credits.

Examines intermediate-level concepts in information extraction, data processing and radiative transfer relevant to remote sensing of the environment. Includes transforms, image correction, classification algorithms and change detection, with emphasis on applications for land use planning and natural resource management. Enroll Info: Envir St 301 or consent of instructor, sophomore standing
Requisites: None
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Spring 2015

G L E 401 — SPECIAL TOPICS IN GEOLOGICAL ENGINEERING
1-3 credits.

Course will focus on a variety of topics in the field of geological engineering. Enroll Info: Jr st
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Summer 2018

G L E/GEOSCI 431 — SEDIMENTARY & STRATIGRAPHY LAB
1 credit.

Field- and specimen-based laboratory course in Sedimentology Stratigraphy; emphasizes qualitative and quantitative description and interpretation of sediments and sedimentary deposits. Enroll Info: GEOSCI 204, GEOSCI/G L E 360, GEOSCI/G L E 370
Requisites: None
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

G L E/CIV ENGR/ENVIR ST/GEOSCI 444 — PRACTICAL APPLICATIONS OF GPS SURVEYING
2 credits.

Requisites: None
Course Designation: Breadth - Physical Sci. Counts toward the Natural Sci req
Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2017

G L E/GEOSCI 455 — STRUCTURAL GEOLOGY
4 credits.

Principles of rock deformation, structures in layered rocks, structural analysis, intrusive structures. Lab: three-dimensional problems involving structural concepts; field trip. Enroll Info: GEOSCI 202, 204, one term of physics. GEOSCI/G.L.E. 360 and 370 recommended or concurrent registration
Requisites: GEOSCI 202 & 204 & 360
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

G L E/GEOSCI/M S & E 474 — ROCK MECHANICS
3 credits.

Classification of rock masses, stress and strain in rock, elastic and time-dependent behavior of rock, state of stress in rock masses, failure mechanisms, lab testing, geological and engineering applications. Enroll Info: EMA 201 or 214, 304, or cons inst
Requisites: None
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

G L E/GEOSCI/M S & E 475 — ROCK MECHANICS APPLICATIONS TO ENVIRONMENTAL PROBLEMS
3 credits.

Classification of rock for specific engineering purposes, in situ testing, applications to surface mining and slope stability, applications to underground mining and excavations, applications to waste disposal and underground storage, applications to novel methods of in situ mining, applications to earthquakes. Enroll Info: MSE 474 or cons inst
Requisites: None
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2007

G L E 476 — FIELD METHODS IN GEOLOGICAL ENGINEERING
3 credits.

Methods of site investigations for the rational design of structures in rocks and soil. Field reconnaissance, exploratory drilling, in situ testing, during and post-excavation monitoring. Enroll Info: CEE 330 Geol Engr 474, or consent of instructor
Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Summer 2010
**G L E 478 — INTRODUCTION TO GEOLOGICAL ENGINEERING DESIGN**
1 credit.

Review of geological engineering design projects. Discussion of design processes, team approaches, and ethics in geological engineering practice. Preparation of a project proposal, data gathering and planning. Enroll Info: GLE 475 or senior standing in GLE, or cons inst

**Requisites:** None

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2010

**G L E 479 — GEOLOGICAL ENGINEERING DESIGN**
3 credits.

A practical problem in an area of geological engineering (such as development of a geologic resource or design of a structure in soil and/or rock) is selected and then the principles and processes of design and analysis are applied to the solution of the problem. Enroll Info: Sr st cons inst

**Requisites:** None

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Spring 2018

**G L E 489 — HONORS IN RESEARCH**
1-3 credits.

Undergraduate honors research projects supervised by faculty members. Not available for graduate credit. Enroll Info: Admission to the GLE honors in research program

**Requisites:** Consent of instructor

**Course Designation:** Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

Honors - Honors Only Courses (H)

**Repeatable for Credit:** No

**Last Taught:** Spring 2018

**G L E/CIV ENGR 530 — SEEPAGE AND SLOPES**
3 credits.


**Requisites:** None

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2017

**G L E/CIV ENGR 531 — RETAINING STRUCTURES**
3 credits.

Rigid and flexible earth retaining structures. Analysis and design of retaining walls, anchored bulkheads, braced cuts, tie back cuts, mechanically stabilized earth, and slurry trench walls. Lateral earth pressure due to soil, water, surcharge loads, etc., local and overall stability and the design of anchorage and bracing systems. Enroll Info: CIV ENGR/G L E 330; COMP SCI 310 or cons inst

**Requisites:** None

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2010

**G L E/CIV ENGR 532 — FOUNDATIONS**
3 credits.

Shallow and deep foundations. Analysis and design of footings, mats, piers and piles, and related fill and excavation operations. Consolidation settlement, time rate of settlement, stress distribution, elastic (immediate) settlement, load bearing capacity; methods to reduce settlements and increase shear strength; the selection of a foundation system. Enroll Info: CIV ENGR/G L E 330 COMP SCI 310 or cons inst

**Requisites:** None

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2010

**G L E/GEOSCI 537 — QUANTITATIVE METHODS FOR GEOSCIENCE**
3 credits.

MATLAB is a powerful, high-level programming language and integrated development environment (IDE) that is used across a broad variety of scientific disciplines for tasks including data visualization, modeling, and application development. The focus of this course will thus be on the active use of MATLAB for developing practical programming and data analysis skills that can be applied across a range of geoscience-relevant problems. Applications will include: data visualization and publishable figure development; automation of data processing; statistical and time-series analysis; image processing and mapping; and optimization. Additional topics may be guided by student interest. Enroll Info: None

**Requisites:** MATH 222 or graduate/professional standing

**Course Designation:** Level - Advanced

L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2017

**G L E/GEOSCI 594 — INTRODUCTION TO APPLIED GEOPHYSICS**
3 credits.

Survey of applied geophysics, including seismic refraction, seismic reflection, electrical resistivity, gravity, and magnetics methods. The course will cover the basic physics of each method and modeling techniques and field procedures. Enroll Info: 1 yr of college calc, 1 yr of college physics

**Requisites:** None

**Course Designation:** L&S Credit - Counts as Liberal Arts and Science credit in L&S

Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** No

**Last Taught:** Fall 2017
G L E/GEOSCI 595 — FIELD METHODS IN APPLIED AND ENGINEERING GEOPHYSICS
1 credit.

The application of geophysical field methods for delineating near-surface features and/or structures as applied to engineering, environmental and exploration problems. Enroll Info: 1 yr coll calc, 1 yr coll physics or EMA 201, 202 PHYSICS 202, prev or con reg in Geoscience 594

Requisites: None
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

G L E 597 — BOREHOLE GEOPHYSICS
3 credits.

Examines the use of borehole geophysical techniques to characterize geological materials, structures, and formation fluids in the region surrounding a well bore. Applications include formation evaluation for oil exploration, hydrologic, environmental, and mineral deposit characterization, and geoenvironmental analysis. Enroll Info: 1 yr coll calc, 1 yr coll physics or EMA 201, 202 PHYSICS 202, Geology 594

Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

G L E/CIV ENGR 612 — ECOHYDROLOGY
3 credits.

Mutual interactions between the hydrologic cycle and ecosystems, including hydrologic mechanisms that underlie ecological patterns and processes, movement of water and energy through the soil-plant-atmosphere continuum, application and development of models for simulating ecohydrologic processes, and case studies on ecohydrologic function and ecosystem services of varied environments. Enroll Info: None

Requisites: CIV ENGR 311, 415, or GEOSCI/G L E 627, or graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

G L E/GEOSCI 627 — HYDROGEOLOGY
3-4 credits.

Mathematical treatment of the physical principles governing the flow of groundwater; emphasis on well hydraulics and flow system analysis; problem sets and class projects. Enroll Info: Intro course in geol, Jr st MATH 221 or equiv

Requisites: None
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2017

G L E/GEOSCI 629 — CONTAMINANT HYDROGEOLOGY
3 credits.

Physical and chemical processes governing the transport of solutes in groundwater; application of hydrogeologic and geochemical theory and practice to the protection of aquifers from contamination; problem sets and group projects. Enroll Info: Geoscience 627 and college level chemistry or cons inst

Requisites: None
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2018

G L E/CIV ENGR 633 — WASTE GEOTECHNICS
3 credits.

The geotechnical aspects of waste disposal and storage. Critical aspects of geotechnical design, construction, and testing relevant to the performance of earthen structures used for the storage and disposal of wastes or the remediation of contaminated sites are discussed. Enroll Info: CIV ENGR/G L E 330 320 or cons inst

Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2010

G L E/CIV ENGR 635 — REMEDIATION GEOTECHNICS
3 credits.

Geotechnical practice for remediation of sites containing contaminated soil and groundwater is discussed. Topics include non-invasive and invasive subsurface exploration techniques, methods to monitor for the presence of contaminants in the saturated and unsaturated zones, and geotechnically-oriented remedial action technologies. Enroll Info: CIV ENGR 320 330

Requisites: None
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2015

G L E 699 — INDEPENDENT STUDY
1-3 credits.

Enroll Info: None
Requisites: Consent of instructor
Course Designation: Level - Advanced
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
**G L E/M S & E 705 — ADVANCED ROCK MECHANICS**  
3 credits.

Elastic, viscoelastic and plastic behavior of rock, crack phenomena and mechanisms of rock fracture, finite element solutions, dynamic rock mechanics, engineering and geological applications. Enroll Info: MSE 474, 475, or equiv. or cons inst  
**Requisites:** Graduate/professional standing  
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement  
**Repeatable for Credit:** No  
**Last Taught:** Spring 2004

**G L E/GEOSCI 724 — GROUNDWATER FLOW MODELING**  
3 credits.

An introduction to the principles of modeling groundwater flow systems, with emphasis on regional flow system analysis. Conceptual understanding of governing equations, and the use of finite difference techniques to solve such equations are stressed. Students develop their own codes and are introduced to packaged models, including those developed by the U. S. Geological Survey. Enroll Info: GEOSCI/G L E 627 or equivalent, calculus  
**Requisites:** Graduate/professional standing  
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement  
**Repeatable for Credit:** No  
**Last Taught:** Fall 2016

**G L E/CIV ENGR 730 — ENGINEERING PROPERTIES OF SOILS**  
3 credits.

Determination and interpretation of soil properties for engineering purposes; physio-chemical properties of soil-water systems, permeability and capillarity, compression characteristics of soils, measurement of soil properties in the triaxial test, properties of frozen soils and permafrost. Enroll Info: CIV ENGR/G L E 330  
**Requisites:** Graduate/professional standing  
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement  
**Repeatable for Credit:** No  
**Last Taught:** Fall 2017

**G L E/CIV ENGR 731 — PROPERTIES OF GEOSYNTHETICS**  
3 credits.

Properties and behavior of geosynthetics (plastics sheets and geotextiles used in geotechnical and geo-environmental construction) are discussed and measured in a laboratory setting. Students learn how to measure and quantify geomechanical and hydraulic behavior of geosynthetics which are used in design. Enroll Info: Grad st CIV ENGR/G L E 330, or cons inst  
**Requisites:** Graduate/professional standing  
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement  
**Repeatable for Credit:** No  
**Last Taught:** Fall 2008

**G L E/CIV ENGR 732 — UNSATURATED SOIL GEOENGINEERING**  
3 credits.

Engineering principles of unsaturated soils as they apply to geotechnical and geoenvironmental systems. Effect of soil water suction and stress on hydraulic conductivity, shear strength, and compressibility of soils in the context of geoenvironmental problems of flow and stability. Enroll Info: Grad st GLE 330 or cons inst  
**Requisites:** Graduate/professional standing  
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement  
**Repeatable for Credit:** No  
**Last Taught:** Spring 2017

**G L E/CIV ENGR 733 — PHYSICOCHEMICAL BASIS OF SOIL BEHAVIOR**  
3 credits.

Applications of physiochemical, mineralogical and environmental considerations to the engineering behavior of soils. Soil composition, formation, fabric, pore fluid chemistry and interaction of phases. The particulate nature of soils and the fabric-engineering property (volume change, strength, deformation and conduction) relationships. Enroll Info: CIV ENGR/G L E 330 or consent of instructor  
**Requisites:** Graduate/professional standing  
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement  
**Repeatable for Credit:** No  
**Last Taught:** Spring 2018

**G L E/CIV ENGR 735 — SOIL DYNAMICS**  
3 credits.

Geotechnical considerations of earthquake engineering and foundation vibrations. Seismic surveying; ground motion during earthquakes; determination of soil properties for ground response analysis; dynamic properties of soils; soil structure interaction effects; soil liquefaction; dynamic analysis of earth dams; settlements resulting from earthquakes, lateral earth pressures during earthquakes; foundation vibrations. Enroll Info: EMA 530, EMA 545 or cons inst  
**Requisites:** Graduate/professional standing  
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement  
**Repeatable for Credit:** No  
**Last Taught:** Spring 2018

**G L E 790 — MASTER’S RESEARCH OR THESIS**  
1-9 credits.

Enroll Info: Master’s candidates only  
**Requisites:** Graduate standing  
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement  
**Repeatable for Credit:** Yes, unlimited number of completions

**G L E 801 — SPECIAL TOPICS IN GEOLOGICAL ENGINEERING**  
1-3 credits.

Enroll Info: None  
**Requisites:** Graduate/professional standing  
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement  
**Repeatable for Credit:** Yes, unlimited number of completions  
**Last Taught:** Fall 2017
**GLE 890 — PRE-DISSERTATOR’S RESEARCH**
1-9 credits.

Enroll Info: For post-master’s, pre-dissertator students

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

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**GLE 900 — SEMINAR**
1 credit.

Enroll Info: None

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

**Last Taught:** Spring 2018

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**GLE 990 — RESEARCH AND THESIS**
1-9 credits.

Enroll Info: For students with dissertator status only

**Requisites:** Graduate/professional standing

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions

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**GLE 999 — INDEPENDENT WORK**
1-3 credits.

Enroll Info: None

**Requisites:** Consent of instructor

**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement

**Repeatable for Credit:** Yes, unlimited number of completions