GEOLOGICAL ENGINEERING (G LE)

G LE 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

Last Taught: Spring 2020

G LE 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 2020

G LE/CIV ENGR 291 — PROBLEM SOLVING USING COMPUTER TOOLS
4 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: None

Requisites: E M A 202 or M E 240 or member of Engineering Guest Students

Repeatable for Credit: No

Last Taught: Spring 2020

G LE/CIV ENGR 330 — SOIL MECHANICS
3 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 and retaining structures, shallow and deep foundations, slope stability; subsurface exploration; laboratory characterization of physical and engineering properties of soils. Enroll Info: None

Requisites: E M A 303 or M E 306, graduate/professional standing, or member of Engineering Guest Students

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

Repeatable for Credit: No

Last Taught: Spring 2020

G LE/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 2020

G LE/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 2019

G LE/GEOSCI 370 — ELEMENTARY PETROLOGY
3 credits.

Igneous, sedimentary and metamorphic rocks, studied in hand sample and thin section. Enroll Info: GEOSCI/G LE 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 2020

G LE/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

Last Taught: Fall 2019
**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: Spring 2020

**G L E/CIV ENGR 421 — ENVIRONMENTAL SUSTAINABILITY ENGINEERING**
3 credits.
Uses the three paradigms of sustainability (environmental, social, and economic) for strategic environmental initiatives in an engineering setting. Proactive environmental management opportunities, including practices of pollution prevention, industrial ecology, and design for the environment. A systems approach to manufacturing, examining the life cycle of products, incorporating total cost accounting, extended producer responsibility, and design for end-of-life. Enroll Info: None
Requisites: (MATH 217, 221, or 275) and (CHEM 104 or 109); or graduate/professional standing or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2019

**G L E/CIV ENGR 430 — INTRODUCTION TO SLOPE STABILITY AND EARTH RETENTION**
1 credit.
Introduction to theory and approaches commonly used in geotechnical engineering practice for design and analysis of slopes and earth retaining structures. Enroll Info: None
Requisites: CIV ENGR/G L E 330, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

**G L E/CIV ENGR 431 — SEDIMENTARY & STRATIGRAPHY LAB**
1 credit.
Field- and specimen-based laboratory course in Sedimentology and 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 2019

**G L E/CIV ENGR 432 — INTRODUCTION TO SHALLOW AND DEEP FOUNDATION SYSTEMS**
1 credit.
Introduction to theory and approaches commonly used in geotechnical engineering practice for design and analysis of slopes and earth retaining structures. Enroll Info: None
Requisites: CIV ENGR/G L E 330, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

**G L E/CIV ENGR 434 — INTRODUCTION TO UNDERGROUND OPENINGS ENGINEERING**
1 credit.
Subsurface stress; rock failure criteria; openings in competent rock; openings in layered rocks; plastic behavior around openings in weak rock; stereographic projections and stereonet; block theory; rock bolts; stabilization methods and design. Enroll Info: None
Requisites: CIV ENGR/G L E 330 and concurrent enrollment in GEOSCI/G L E/M S & E 474, graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

**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 2019
**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 2020

**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 2020

**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 2020

**G L E/CIV ENGR 511 — MIXING AND TRANSPORT IN THE ENVIRONMENT**
3 credits.

Application of fluid mechanics to understand the mixing and transport of contaminants, pollutants, and other solutes in the environment. Introduction to chemical and biochemical transformation processes as well as boundary interactions at the air-water and sediment-water interfaces. Transport phenomena: diffusive processes, advective processes, turbulent diffusion, and shear flow dispersion. Introduction to both analytical and computational solutions with applications to mixing and transport in rivers, lakes, the atmosphere, and coastal waters. Enroll Info: None
Requisites: (CIV ENGR/G L E 291, COMP SCI 220, or E C E 203) and (CIV ENGR 310 or M E 363), or graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2020

**G L E/CIV ENGR 520 — REACTIVE PROCESSES FOR SUSTAINABLE ENERGY AND RESOURCE PRODUCTION**
3 credits.

Key scientific concepts related to fossil and renewable energy resources. Apply the fundamentals of thermodynamics and chemical kinetics at solid interfaces to better understand the science behind using fossil and renewable energy resources. Evaluate the impacts of existing and emerging energy technologies on the environment. Enroll Info: None
Requisites: Senior standing, (MATH 211, 217, 221, or 275), (CHEM 103, 104, or 109), and CIV ENGR 320, or Graduate/professional standing, or member of Engineering Guest Students
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

**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 2019

**G L E/CIV ENGR 549 — 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 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 2018

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 2018

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: 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 2018

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 2019

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
Last Taught: Spring 2012

G L E/CIV ENGR 612 — ECOCYDROLOGY
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 (or CIV ENGR 315 prior to Spring 2018)
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Spring 2020

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 2019
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 2020

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: Fall 2019

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
Last Taught: Fall 2019

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 2019

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: Spring 2020

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 geoengineering problems of flow and stability. Enroll Info: Grad st Civ Engr/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 2019

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 liquifaction; dynamic analysis of earth dams; settlements resulting from earthquakes, lateral earth pressures during earthquakes; foundation vibrations. Enroll Info: Civ Engr/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/GEOSCI 747 — TECTONOPHYSICS
3 credits.
Elasticity and flexure of the earth's lithosphere, heat conduction, mantle convection, earthquake mechanisms, rock rheology, and fluid migration in the earth's crust; integration of geophysical observations, laboratory experiments, and theoretical models. Enroll Info: None
Requisites: Graduate/professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
Last Taught: Fall 2018

G L E 790 — MASTER'S RESEARCH OR THESIS
1-9 credits.
Enroll Info: Master's candidates only
Requisites: Graduate Students Only
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2020

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 2019

G L E 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
Last Taught: Spring 2020

G L E 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 2020

G L E 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
Last Taught: Fall 2019

G L E 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
Last Taught: Spring 2020