GEOLOGICAL ENGINEERING 
(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.
Requisites: So st
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.
Requisites: None
Repeatable for Credit: No

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.
Requisites: EMA 202 or 304
Repeatable for Credit: No

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.
Requisites: EMA 303 or 304 or con reg
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

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.
Requisites: MATH 221
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

G L E/GEOSCI 360 -- PRINCIPLES OF MINERALOGY
3 credits.
Minerals, their physical and chemical properties, crystallography, and geologic significance.
Requisites: 1 sem college chem or concurrent registration
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.
Requisites: GEOSCI/G L E 360
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

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.
Requisites: MATH 114 Sophomore standing
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
Last Taught: Fall 2017

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.
Requisites: Envir St 301 or consent of instructor, sophomore standing
Course Designation: Level - Intermediate
L&S Credit - Counts as Liberal Arts and Science credit in L&S
Repeatable for Credit: No
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.
Requisites: Jr st
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Spring 2018

G L E/GEOSCI 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.
Requisites: GEOSCI 204, GEOSCI/G L E 360, GEOSCI/G L E 370
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: MATH 210, 211, 221 or equiv or cons inst
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. GEOSCI/G L E 360 and 370 recommended or concurrent registration
Requisites: GEOSCI 202, 204, one term of physics.
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

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.
Requisites: EMA 201 or 214, 304, or cons inst
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

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.
Requisites: MSE 474 or cons inst
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

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.
Requisites: CEE 330 Geol Engr 474, or consent of instructor
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.
Requisites: GLE 475 or senior standing in GLE, or cons inst
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.
Requisites: Sr st cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No
G L E 489 — HONORS IN RESEARCH
1-3 credits.
Undergraduate honors research projects supervised by faculty members. Not available for graduate credit.
Requisites: Admission to the GLE honors in research program
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

G L E/CIV ENGR 530 — SEEPAGE AND SLOPES
3 credits.
Practical aspects of seepage effects and ground water flow. Stability of natural and man-made slopes under various loading conditions. Design and construction of earth dams and embankments. Flow net and its use; wells; filters; total and effective stress methods of slope analysis; selection of pertinent soil parameters.
Requisites: Civ Engr 330
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.
Requisites: Civ Engr 330; Comp Sci 310 or cons inst
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.
Requisites: Civ Engr 330 Comp Sci 310 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

G L E/CIV ENGR 533 — SEEPAGE AND SLOPES
3 credits.
Practical aspects of seepage effects and ground water flow. Stability of natural and man-made slopes under various loading conditions. Design and construction of earth dams and embankments. Flow net and its use; wells; filters; total and effective stress methods of slope analysis; selection of pertinent soil parameters.
Requisites: Civ Engr 330
Course Designation: 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.
Requisites: 1 yr of college calc, 1 yr of college physics
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.
Requisites: 1 yr coll calc, 1 yr coll physics or EMA 201, 202 PHYSICS 202, prev or con reg in GLE/Geoscience 594
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 geoenineering analysis.
Requisites: 1 yr coll calc, 1 yr coll physics or EMA 201, 202 PHYSICS 202, GLE/Geology 594
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.
Requisites: Intro course in geol, Jr st MATH 221 or equiv
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.
**Requisites:** Geoscience 627 and college level chemistry or cons inst
**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

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.
**Requisites:** Civ Engr 330 320 or cons inst
**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.
**Requisites:** Civ Engr 320 330
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement
**Repeatable for Credit:** No

G L E 699 — INDEPENDENT STUDY
1-3 credits.
**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.
**Requisites:** MSE 474, 475, or equiv, or cons inst
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement
**Repeatable for Credit:** No

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.
**Requisites:** GEOSCI/G L E 627 or equivalent, calculus
**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.
**Requisites:** Civ Engr 330
**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.
**Requisites:** Grad st Civ Engr 330, or cons inst
**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 geoenengineering problems of flow and stability.
**Requisites:** Grad st Civ Engr/GLE 330 or cons inst
**Course Designation:** Grad 50% - Counts toward 50% graduate coursework requirement
**Repeatable for Credit:** No
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.
Requisites: Civ Engr 330 or consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

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.
Requisites: Civ Engr/EMA 530, EMA 545 or cons inst
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: No

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.
Requisites: Graduate or professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions
Last Taught: Fall 2017

G L E 890 — PRE-DISSERTATOR'S RESEARCH
1-9 credits.
Enroll Info: For post-master's, pre-dissertator students
Requisites: Graduate or professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions

G L E 900 — SEMINAR
1 credit.
Requisites: Graduate or professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions

G L E 990 — RESEARCH AND THESIS
1-9 credits.
Enroll Info: For students with dissertator status only
Requisites: Graduate or professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions

G L E 999 — INDEPENDENT WORK
1-3 credits.
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions

G L E 990 — RESEARCH AND THESIS
1-9 credits.
Enroll Info: For students with dissertator status only
Requisites: Graduate or professional standing
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions

G L E 999 — INDEPENDENT WORK
1-3 credits.
Requisites: Consent of instructor
Course Designation: Grad 50% - Counts toward 50% graduate coursework requirement
Repeatable for Credit: Yes, unlimited number of completions