GEOLOGICAL ENGINEERING (GE)

College of Engineering and Mines
Department of Civil, Geological, and Environmental Engineering (http://cem.uaf.edu/cee.aspx)
907-474-7241

GE F101  Introduction to Geological Engineering
1 Credit
Offered Fall
Multiple aspects of geological engineering as a profession; the area and scope of the field.
Lecture + Lab + Other: 1 + 0 + 0

GE F261  General Geology for Engineers
3 Credits
Offered Spring
Study of common rocks and minerals, landforms and erosion. Geologic materials and engineering application of geology.
Prerequisites: MATH F151X; MATH F152X; Geology, science or engineering majors.
Lecture + Lab + Other: 2 + 3 + 0

GE F322  Erosion Mechanics and Conservation
3 Credits
Offered As Demand Warrants
Engineering mechanics of water and wind erosion processes, types of geologic or anthropogenic induced erosion, application of engineering principles for design, management and control of erosion and engineering analysis of conservation structures.
Prerequisites: ES F341.
Lecture + Lab + Other: 3 + 0 + 0

GE F326  Introduction to Geotechnical Engineering and Foundations
4 Credits
Offered Fall
Identification and classification of soils; physical and mechanical properties of soil; subsurface exploration; movement of water through soil; soil deformation. Bearing capacity of shallow foundations and piles, and stability of retaining walls. Laboratory testing techniques, and introduction to soil issues related to cold regions.
Prerequisites: ES F331 (may be taken concurrently); GE F261.
Crosslisted with CE F326.
Lecture + Lab + Other: 3 + 3 + 0

GE F365  Geological Materials Engineering
3 Credits
Offered Fall
Identification and classification of soils, physical and mechanical properties of soil, interaction of soils with subsurface water, subsurface exploration and case studies with an emphasis on permafrost.
Prerequisites: ES F208; GE F261.
Lecture + Lab + Other: 2 + 3 + 0

GE F375  Terrain Analysis and GIS
3 Credits
Offered Spring
Evaluation of terrain characteristics and their geomorphic processes, using GIS techniques in combination with remotely sensed data for engineering and environmental applications. Alaska applications are considered.
Prerequisites: GE F261.
Lecture + Lab + Other: 2 + 3 + 0

GE F376  GIS Applications in Geological and Environmental Engineering
3 Credits
Offered Spring Odd-numbered Years
Fundamentals, concepts and components of geographic information systems (GIS) in engineering design. Introduction to acquiring, manipulating and analyzing digital terrain data for geological engineering and environmental applications, and the assessment of mineral resources. NRM F338 Recommended.
Prerequisites: GE F261; GE F375.
Lecture + Lab + Other: 2 + 3 + 0

GE F381  Field Methods and Applied Design I
2 Credits
Offered Summer
Techniques and geologic mapping and geotechnical instrumentation applied to engineering design and resource evaluation.
Prerequisites: WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; GE F261; GEOS F213; GEOS F214; GEOS F322; GEOS F314.
Lecture + Lab + Other: 1 + 0 + 40

GE F382  Field Methods and Applied Design II
2 Credits
Offered Summer
Techniques and geologic mapping and geotechnical instrumentation applied to engineering design and resource evaluation.
Prerequisites: WRTG F111X, WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; GE F261; GEOS F213; GEOS F214; GEOS F322; GEOS F314.
Lecture + Lab + Other: 1 + 0 + 40

GE F400  Geological Engineering Internship
1-3 Credits
Offered Summer
Supervised work experience in engineering organizations. Assignments will be individually arranged with cooperating organizations from the private and public sectors. A report of activities must be completed and reviewed by the sponsoring organization. The report may be held in confidence at the request of the sponsoring organization.
Prerequisites: Upper-division standing.
Lecture + Lab + Other: 1-3 + 0 + 0

GE F405  Engineering and Environmental Geophysics
3 Credits
Offered Fall
Theory and application of seismic, electrical, gravity, magnetic, and electromagnetic methods for delineating near-surface features and structures as applied to engineering, environmental, and resource exploration problems. Overview of instrumentation, and the data acquisition, analysis, and interpretation process through hands-on practice.
Prerequisites: GE F375; PHYS F212X.
Lecture + Lab + Other: 2 + 3 + 0
GE F420  
**Groundwater Engineering**  
3 Credits  
Offered Fall  
Fundamentals of groundwater occurrence, hydrology, resource development, water quality, monitoring and remediation. Field methods and modeling.  
**Prerequisites:** CE F326, GE F326, ES F341.  
**Cross-listed with:** CE F420.  
**Lecture + Lab + Other:** 2 + 3 + 0

GE F430  
**Geomechanical Instrumentation**  
3 Credits  
Offered As Demand Warrants  
Measurement of groundwater pressure, ground deformation, stress and temperature as well as the planning of monitoring programs, instrument calibration, maintenance and installation, data collection, interpretation, and reporting. Case histories are used.  
**Prerequisites:** ES F331; GE F261 or GEOS F101X.  
**Lecture + Lab + Other:** 2 + 3 + 0

GE F435  
**Exploration Design**  
3 Credits  
Offered As Demand Warrants  
Geologic, engineering and economic considerations applied to the design and development of mineral exploration programs.  
**Prerequisites:** GEOS F314.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F440  
**Slope Stability**  
3 Credits  
Offered Fall Odd-numbered Years  
Slope design for open pit mining and other excavations. Stability analysis by various methods and on-site measuring and monitoring techniques.  
**Prerequisites:** ES F331.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F441  
**Geohazard Analysis**  
3 Credits  
Offered Fall Even-numbered Years  
Procedures and techniques to evaluate geological factors for geohazards, such as landslides, earthquakes, volcanoes, flooding, coastal hazards and permafrost-related problems.  
**Prerequisites:** GE F326.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F445  
**Design of Earth Dams and Embankments**  
3 Credits  
Offered Fall Odd-numbered Years  
Preliminary planning for design and construction of dams, site selection, reservoir assessment, foundation and other building materials, procedure for design of earth dams, design of abutment and spillway, estimation of volume of earthworks and storage capacities, site preparation for construction, excavation, slope stability issues and other geological engineering assessments.  
**Prerequisites:** senior standing.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F480  
**Senior Design**  
3 Credits  
Offered Spring  
Design factors and procedures for the solution of geological engineering problems. A design project is the focus of the course.  
**Prerequisites:** Senior standing in the geological engineering program with completion of GE F381; GE F382; GE F405; GE F420.  
**Lecture + Lab + Other:** 1 + 6 + 0

GE F620  
**Advanced Groundwater Hydrology**  
3 Credits  
Offered As Demand Warrants  
Study of groundwater hydrology with emphasis on solute and contaminant transport, chemical reaction and ion exchange, advection and diffusion and computer modeling.  
**Prerequisites:** GE F610; graduate standing.  
**Lecture + Lab + Other:** 2 + 3 + 0

GE F622  
**Advanced Soil Physics**  
3 Credits  
Offered As Demand Warrants  
Fundamentals of soil physical processes, multiphase flow, heat transfer and transport in unsaturated porous media such as soils. Application of principles of unsaturated flow to geo-environmental and geotechnical problems. Characterization of hydraulic properties in relation to soil physical parameters in the context of geotechnical problems of flow, transport and stability.  
**Prerequisites:** GE F610 and Graduate standing in Engineering.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F624  
**Stochastic Hydrology and Geohydrology**  
3 Credits  
Offered As Demand Warrants  
Overview of the stochastic methods used to study and analyze hydrologic and geohydrologic processes. Emphasis on modeling hydrologic processes using statistical methods and stochastic interplay of processes between surface and subsurface hydrology.  
**Prerequisites:** GE F620 and graduate standing in Engineering.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F626  
**Thermal Geotechnics**  
3 Credits  
Offered As Demand Warrants  
**Prerequisites:** CE F326; CE F422.  
**Cross-listed with:** CE F626.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F635  
**Advanced Geostatistical Applications**  
3 Credits  
Offered As Demand Warrants  
Introduction to the theory and application of geostatistics. Review of classical statistics, continuous and discrete distributions, hypothesis testing and global estimation. Presentation of fundamental geostatistical concepts including: variogram, estimation variance, block variance, kriging, geostatistical simulation. Emphasis on the practical application of geostatistical techniques.  
**Prerequisites:** MIN F408; graduate standing.  
**Cross-listed with:** MIN F635.  
**Lecture + Lab + Other:** 2 + 3 + 0

GE F660  
**Thermal Geotechnics**  
3 Credits  
Offered As Demand Warrants  
**Prerequisites:** CE F326; CE F422.  
**Cross-listed with:** CE F626.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F663  
**Groundwater Hydrology**  
3 Credits  
Offered As Demand Warrants  
Study of groundwater hydrology with emphasis on solute and contaminant transport, chemical reaction and ion exchange, advection and diffusion and computer modeling.  
**Prerequisites:** GE F610; graduate standing.  
**Lecture + Lab + Other:** 2 + 3 + 0

GE F665  
**Advanced Soil Physics**  
3 Credits  
Offered As Demand Warrants  
Fundamentals of soil physical processes, multiphase flow, heat transfer and transport in unsaturated porous media such as soils. Application of principles of unsaturated flow to geo-environmental and geotechnical problems. Characterization of hydraulic properties in relation to soil physical parameters in the context of geotechnical problems of flow, transport and stability.  
**Prerequisites:** GE F610 and Graduate standing in Engineering.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F667  
**Stochastic Hydrology and Geohydrology**  
3 Credits  
Offered As Demand Warrants  
Overview of the stochastic methods used to study and analyze hydrologic and geohydrologic processes. Emphasis on modeling hydrologic processes using statistical methods and stochastic interplay of processes between surface and subsurface hydrology.  
**Prerequisites:** GE F620 and graduate standing in Engineering.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F670  
**Thermal Geotechnics**  
3 Credits  
Offered As Demand Warrants  
**Prerequisites:** CE F326; CE F422.  
**Cross-listed with:** CE F626.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F672  
**Advanced Geostatistical Applications**  
3 Credits  
Offered As Demand Warrants  
Introduction to the theory and application of geostatistics. Review of classical statistics, continuous and discrete distributions, hypothesis testing and global estimation. Presentation of fundamental geostatistical concepts including: variogram, estimation variance, block variance, kriging, geostatistical simulation. Emphasis on the practical application of geostatistical techniques.  
**Prerequisites:** MIN F408; graduate standing.  
**Cross-listed with:** MIN F635.  
**Lecture + Lab + Other:** 2 + 3 + 0

GE F674  
**Thermal Geotechnics**  
3 Credits  
Offered As Demand Warrants  
**Prerequisites:** CE F326; CE F422.  
**Cross-listed with:** CE F626.  
**Lecture + Lab + Other:** 3 + 0 + 0

GE F676  
**Groundwater Hydrology**  
3 Credits  
Offered As Demand Warrants  
Study of groundwater hydrology with emphasis on solute and contaminant transport, chemical reaction and ion exchange, advection and diffusion and computer modeling.  
**Prerequisites:** GE F610; graduate standing.  
**Lecture + Lab + Other:** 2 + 3 + 0

GE F680  
**Senior Design**  
3 Credits  
Offered Spring  
Design factors and procedures for the solution of geological engineering problems. A design project is the focus of the course.  
**Prerequisites:** Senior standing in the geological engineering program with completion of GE F381; GE F382; GE F405; GE F420.  
**Lecture + Lab + Other:** 1 + 6 + 0
GE F665  Advanced Geological Materials Engineering  
3 Credits  
Offered As Demand Warrants  
In-depth study of geological materials (aggregates—sand, gravel and crushed rock for construction purposes) exploration, evaluation, testing and production. Emphasis placed on geological materials used for construction in Arctic and sub-Arctic environments, economic analysis of pit and quarry operations and availability of materials in Alaska.  
Prerequisites: GE F365.  
Recommended: MIN F408.  
Lecture + Lab + Other: 3 + 0 + 0

GE F666  Advanced Engineering Geology  
3 Credits  
Offered As Demand Warrants  
The interaction between geology and engineering case histories.  
Prerequisites: GE F365; graduate standing.  
Lecture + Lab + Other: 2 + 3 + 0

GE F668  Tunneling Geotechniques  
3 Credits  
Offered As Demand Warrants  
Tunnel design, case histories, student report.  
Prerequisites: Graduate standing.  
Lecture + Lab + Other: 3 + 0 + 0

GE F692  Graduate Seminar  
1 Credit  
Topics in geological engineering explored through talks, group discussions and guest speakers with a high level of student participation.  
Prerequisites: Graduate standing.  
Lecture + Lab + Other: 1 + 0 + 0

GE F692P  Graduate Seminar  
1 Credit  
Offered As Demand Warrants  
Topics in geological engineering explored through talks, group discussions and guest speakers with a high level of student participation.  
Prerequisites: Graduate standing.  
Lecture + Lab + Other: 1 + 0 + 0

GE F698  Non-thesis Research/Project  
1-9 Credits  
Lecture + Lab + Other: 0 + 0 + 0

GE F699  Thesis  
1-9 Credits  
Lecture + Lab + Other: 0 + 0 + 0