## GEOLOGICAL ENGINEERING (GE)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Credits</th>
<th>Offered</th>
<th>Description</th>
<th>Prerequisites &amp; Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE F101</td>
<td>Introduction to Geological Engineering</td>
<td>1</td>
<td>Fall</td>
<td>Multiple aspects of geological engineering as a profession; the area and scope of the field.</td>
<td>Lecture + Lab + Other: 1 + 0 + 0</td>
</tr>
<tr>
<td>GE F261</td>
<td>General Geology for Engineers</td>
<td>3</td>
<td>Spring</td>
<td>Study of common rocks and minerals, landforms and erosion. Geologic materials and engineering application of geology.</td>
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<td></td>
<td>Prerequisites: MATH F151X; MATH F152X or equivalent; Geology, science or engineering majors; or permission of instructor.</td>
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<td>Lecture + Lab + Other: 2 + 3 + 0</td>
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<tr>
<td>GE F322</td>
<td>Erosion Mechanics and Conservation</td>
<td>3</td>
<td>Spring or As Demand Warrants</td>
<td>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.</td>
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<td></td>
<td>Prerequisites: ES F341 or permission of instructor.</td>
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<td>Lecture + Lab + Other: 3 + 0</td>
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<tr>
<td>GE F365</td>
<td>Geological Materials Engineering</td>
<td>3</td>
<td>Fall</td>
<td>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.</td>
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<td></td>
<td>Prerequisites: ES F208; GE F261; or permission of instructor.</td>
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<td>Lecture + Lab + Other: 2 + 3 + 0</td>
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<tr>
<td>GE F371</td>
<td>Remote Sensing for Engineering</td>
<td>3</td>
<td>Spring</td>
<td>Applications of remote sensing to geological engineering problems. Introduction to digital satellite image processing with hands-on practice.</td>
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<td></td>
<td>Prerequisites: PHYS F212X.</td>
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<td>Lecture + Lab + Other: 2 + 3 + 0</td>
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<tr>
<td>GE F375</td>
<td>Principles of Engineering Geology and Terrain Analysis</td>
<td>3</td>
<td>Fall</td>
<td>Evaluation of terrain characteristics using basic geomorphic and engineering principles. Alaskan applications are provided due consideration.</td>
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<td></td>
<td>Prerequisites: GE F261.</td>
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<td>Lecture + Lab + Other: 2 + 3 + 0</td>
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<tr>
<td>GE F376</td>
<td>GIS Applications in Geological and Environmental Engineering</td>
<td>3</td>
<td>Spring or As Demand Warrants</td>
<td>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 to mineral resources. NRM F338 Recommended.</td>
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<td></td>
<td>Prerequisites: GE F261 or equivalent; GE F375 or equivalent.</td>
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<td>Lecture + Lab + Other: 2 + 3 + 0</td>
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<tr>
<td>GE F381</td>
<td>Field Methods and Applied Design I (W)</td>
<td>2</td>
<td>Summer</td>
<td>Techniques and geologic mapping and geotechnical instrumentation applied to engineering design and resource evaluation.</td>
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<td></td>
<td>Prerequisites: WRTG F111X; WRTG F211X or WRTG F213X; GE F261; GEOS F213; GEOS F214; GEOS F320; GEOS F314 or equivalent; or permission of instructor.</td>
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<td>Lecture + Lab + Other: 0 + 9 + 3</td>
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<tr>
<td>GE F382</td>
<td>Field Methods and Applied Design II (W)</td>
<td>4</td>
<td>Summer</td>
<td>Techniques and geologic mapping and geotechnical instrumentation applied to engineering design and resource evaluation.</td>
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<tr>
<td></td>
<td>Prerequisites: WRTG F111X; WRTG F211X or WRTG F213X; GE F261; GEOS F213; GEOS F214; GEOS F320; GEOS F314 or equivalent; or permission of instructor.</td>
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<td>Lecture + Lab + Other: 0 + 9 + 0</td>
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<tr>
<td>GE F384</td>
<td>Engineering Geology of Alaska (a)</td>
<td>4</td>
<td>Summer or As Demand Warrants</td>
<td>A survey of the geology of Alaska relevant to the definition of natural and human-induced geological engineering hazards, the evaluation of sources of and specifications for engineering materials, and the evaluation of engineering construction sites.</td>
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<td></td>
<td>Prerequisites: Upper-division standing; permission of instructor.</td>
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<td>Lecture + Lab + Other: 3 + 1 + 2</td>
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<td>GE F400</td>
<td>Geological Engineering Internship</td>
<td>1-3</td>
<td>As Demand Warrants</td>
<td>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.</td>
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<td></td>
<td>Prerequisites: Upper-division standing; permission of instructor.</td>
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<td>Lecture + Lab + Other: 1-3 + 0 + 0</td>
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<tr>
<td>GE F405</td>
<td>Exploration Geophysics</td>
<td>3</td>
<td>Fall</td>
<td>Theory and application of gravity, magnetic, electrical, electromagnetic, radioactive and seismic methods as used for geophysical exploration. Some field work.</td>
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<td></td>
<td>Prerequisites: GE F375; MATH F251X; PHYS F211X or equivalent.</td>
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<td>Lecture + Lab + Other: 2 + 3 + 0</td>
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GE F420  Subsurface Hydrology
3 Credits
Offered Fall
Hydrologic, geologic and other factors controlling groundwater flow, occurrence, development, chemistry and contamination. Elementary groundwater flow theory. Interactions between surface-subsurface hydrologic systems. Hydraulic characteristics of earth materials, engineering problems and models related to subsurface fluids, and properties of water.
Prerequisites: GE F365; MATH F302; ES F341; or permission of instructor.
Stacked with GE F610.
Lecture + Lab + Other: 2 + 3 + 0

GE F422  Soil Physics (a)
3 Credits
Offered As Demand Warrants
Fundamentals of soil physics, including soil texture, structure, size distribution, and water retention characteristics; flow of water through saturated and unsaturated soil; soil temperature and heat flow; infiltration, runoff, and evaporation. Processes relevant to active layer dynamics and permafrost are given due consideration.
Prerequisites: CHEM F105X, CHEM F106X; or permission of instructor.
Lecture + Lab + Other: 2 + 3 + 0

GE F430  Geomechanical Instrumentation
3 Credits
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 Spring
Geologic, engineering and economic considerations applied to the design and development of mineral exploration programs.
Prerequisites: GEOS F314 or permission of instructor.
Lecture + Lab + Other: 3 + 0 + 0

GE F440  Slope Stability
3 Credits
Offered Fall
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
Procedures and techniques to evaluate geological factors for geohazards, such as landslides, earthquakes, volcanoes, flooding, coastal hazards and permafrost-related problems.
Prerequisites: GE F365 or equivalent; or permission of instructor.
Lecture + Lab + Other: 3 + 0 + 0

GE F445  Design of Earth Dams and Embankments
3 Credits
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. As Demand Warrants
Prerequisites: senior standing or permission of instructor.
Lecture + Lab + Other: 3 + 0 + 0

GE F480  Senior Design (W)
3 Credits
Design factors and procedures for the solution of geological engineering problems. A design project is the focus of the course.
Prerequisites: WRTG F111X; WRTG F211X or WRTG F213X; senior standing in the geological engineering program with completion of GE F261; GE F365; GE F371; GE F375; GE F381 or equivalent; GE F382 or equivalent; GE F405; GE F420; or permission of instructor.
Lecture + Lab + Other: 1 + 6 + 0

GE F610  Subsurface Hydrology
3 Credits
Hydrologic, geologic and other factors controlling groundwater flow, occurrence, development, chemistry and contamination. Elementary groundwater flow theory. Interactions between surface-subsurface hydrologic systems. Hydraulic characteristics of earth materials, engineering problems and models related to subsurface fluids, and properties of water.
Prerequisites: Graduate standing in Engineering or permission of instructor.
Stacked with GE F420.
Lecture + Lab + Other: 2 + 3 + 0

GE F620  Advanced Groundwater Hydrology
3 Credits
Offered Fall Odd-numbered Years
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 or equivalent; graduate standing or permission of instructor.
Lecture + Lab + Other: 2 + 3 + 0

GE F622  Advanced Soil Physics (a)
3 Credits
Offered As Demand Warrants
Fundamentals of soil physical processes, multiphase flow and transport in unsaturated porous media such as soils. Application of principles of unsaturated flow to geoenvironmental and geotechnical systems. Methods for characterization of hydraulic properties in relation to soil physical parameters in the context of geoenineering problems of flow and stability. Non-isothermal flow in unsaturated soils and its impact on subsurface environment. Biogeochemical processes affecting soil and groundwater contamination. Unsaturated flow and transport modeling including heat transfer relevant to active layer dynamics and permafrost underlain soils in Alaska and other similar cold regions.
Prerequisites: GE F610 or equivalent course and Graduate standing in Engineering or permission of instructor.
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 or equivalent and graduate standing in Engineering; or permission of instructor.  
**Lecture + Lab + Other:** 3 + 0 + 0

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

**GE F635  Advanced Geostatistical Applications**  
3 Credits  
Offered Spring  
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 or equivalent; graduate standing; or permission of instructor.  
**Cross-listed with MIN F635.**  
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F665  Advanced Geological Materials Engineering**  
3 Credits  
Offered Spring  
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 or equivalent; permission of instructor.  
**Recommended:** MIN F408.  
**Lecture + Lab + Other:** 3 + 0 + 0

**GE F666  Advanced Engineering Geology**  
3 Credits  
Offered Fall Odd-numbered Years  
The interaction between geology and engineering case histories.  
**Prerequisites:** GE F365; GE F372; graduate standing; or permission of instructor.  
**Lecture + Lab + Other:** 2 + 3 + 0

**GE F668  Tunneling Geotechniques**  
3 Credits  
Offered Fall Even-numbered Years  
Tunnel design, case histories, student report.  
**Prerequisites:** Graduate standing or permission of instructor.  
**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 or permission of instructor.  
**Lecture + Lab + Other:** 1 + 0 + 0

**GE F692P  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 or permission of instructor.  
**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