### GEOLOGICAL ENGINEERING (GE)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Offered</th>
<th>Prerequisites</th>
<th>Lecture + Lab + Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>GE F101</td>
<td>Introduction to Geological Engineering</td>
<td>1</td>
<td>Fall</td>
<td></td>
<td>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>
<td>2 + 3 + 0</td>
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<tr>
<td>GE F322</td>
<td>Erosion Mechanics and Conservation</td>
<td>3</td>
<td>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>
<td>3 + 0 + 0</td>
</tr>
<tr>
<td>GE F326</td>
<td>Introduction to Geotechnical Engineering and Foundations</td>
<td>4</td>
<td>Fall</td>
<td>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.</td>
<td>3 + 3 + 0</td>
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<tr>
<td>GE F375</td>
<td>Terrain Analysis and GIS</td>
<td>3</td>
<td>Spring</td>
<td>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.</td>
<td>3 + 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</td>
<td>Offered Odd-numbered Years</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 of mineral resources. NRM F338 Recommended.</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>
<td>1 + 0 + 40</td>
</tr>
<tr>
<td>GE F382</td>
<td>Field Methods and Applied Design II (W)</td>
<td>2</td>
<td>Summer</td>
<td>Techniques and geologic mapping and geotechnical instrumentation applied to engineering design and resource evaluation.</td>
<td>1 + 0 + 40</td>
</tr>
<tr>
<td>GE F400</td>
<td>Geological Engineering Internship</td>
<td>1-3</td>
<td>Summer</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>
<td>1 + 3 + 0 + 0</td>
</tr>
<tr>
<td>GE F405</td>
<td>Engineering and Environmental Geophysics</td>
<td>3</td>
<td>Fall</td>
<td>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.</td>
<td>2 + 3 + 0</td>
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<tr>
<td>GE F420</td>
<td>Groundwater Engineering</td>
<td>3</td>
<td>Fall</td>
<td>Fundamentals of groundwater occurrence, hydrology, resource development, water quality, monitoring and remediation. Field methods and modeling</td>
<td>2 + 3 + 0</td>
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<tr>
<td>GE F430</td>
<td>Geomechanical Instrumentation</td>
<td>3</td>
<td>As Demand Warrants</td>
<td>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.</td>
<td>2 + 3 + 0</td>
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**Prerequisites:**
- WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; GE F261; GEOS F213; GEOS F214; GEOS F322; GEOS F314.
- GE F261; GE F261 or GEOS F101X.
- ES F341
- MATH F151X; MATH F152X; Geology, science or engineering majors.
- ES F331.
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  (W)
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 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 geoengineering 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 F663  Groundwater Hydrology
3 Credits
Offered Fall Even-numbered Years
Fundamentals of groundwater aquifer formations, groundwater flow, resource development, management and protection.
Cross-listed with CE F663.
Lecture + Lab + Other: 3 + 0 + 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