### 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>
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<tr>
<td>GE F261</td>
<td>General Geology for Engineers</td>
<td>3</td>
<td>Spring</td>
<td>MATH F151X; MATH F152X; Geology, science or engineering majors.</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>ES F341.</td>
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<tr>
<td>GE F365</td>
<td>Geological Materials Engineering</td>
<td>3</td>
<td>Fall</td>
<td>ES F208; GE F261.</td>
<td>3 + 0 + 0</td>
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<tr>
<td>GE F371</td>
<td>Remote Sensing for Engineering</td>
<td>3</td>
<td>Spring</td>
<td>PHYS F212X.</td>
<td>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>GE F261.</td>
<td>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 Odd-numbered Years</td>
<td>GE F261; GE F375.</td>
<td>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>WRTG F111X; WRTG F211X; WRTG F212X; WRTG F213X or WRTG F214X; GE F261; GEOS F213; GEOS F214; GEOS F320; GEOS F314.</td>
<td>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>WRTG F111X; WRTG F211X; WRTG F212X; WRTG F213X or WRTG F214X; GE F261; GEOS F213; GEOS F214; GEOS F320; GEOS F314.</td>
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<tr>
<td>GE F384</td>
<td>Engineering Geology of Alaska (a)</td>
<td>4</td>
<td>Summer</td>
<td>Upper-division standing.</td>
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<tr>
<td>GE F400</td>
<td>Geological Engineering Internship</td>
<td>1-3</td>
<td>Summer</td>
<td>Upper-division standing.</td>
<td>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>GE F375; MATH F251X; PHYS F211X.</td>
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</table>
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.
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 permafrosts are given due consideration.
Prerequisites: CHEM F105X, CHEM F106X.
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 F365.
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, procedures 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: WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; senior standing in the geological engineering program with completion of GE F261; GE F365; GE F371; GE F375; GE F381; GE F382; GE F405; GE F420.
Lecture + Lab + Other: 1 + 6 + 0
GE F610  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: Graduate standing in Engineering.
Stacked with GE F420.
Lecture + Lab + Other: 2 + 3 + 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 (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 geoenengineering 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 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 geohydraulic 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 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