

Geolog & Mining Engrg & Sci

GE 1100 - Geological Engineering and Sciences Orientation

Introduction to geosciences as a profession, including discussions of career opportunities and geoscience programs. Earth materials and the earth's processes are also introduced. Includes frequent field trips. Intended for freshman or sophomore students in geological engineering, geology, applied geophysics, hydrology, geotechnics, earth science teaching, or any other geoscience program.

Credits: 1.0; Graded Pass/Fail Only

Lec-Rec-Lab: (0-0-3)

Semesters Offered: Fall

Restrictions: Must be enrolled in one of the following Major(s): Geological Engineering, Sciences & Arts Undeclared, Engineering Undeclared, General Sciences and Arts, Applied Geophysics, Geology; May not be enrolled in one of the following Class(es): Junior, Senior

GE 2000 - Understanding the Earth

Introduction to materials and processes that shape the earth we live on. Lecture and laboratories acquaint students with minerals, rocks, earth resources, weathering, geologic time, landslides, groundwater, streams, shorelines, deserts, glaciers, geologic structures, earthquakes, plate tectonics, and the dynamics of the earth's crust, mantle, and core.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Fall, Summer

GE 2020 - Introduction to Mining Engineering and Mining Methods

Learn how various mining components, from prospecting to financing to reclamation, fit together. Includes advantages and drawbacks of different mining methods and their selection. Introduces ethics and professional development. Use of basic computer and mine design software.

Credits: 4.0

Lec-Rec-Lab: (4-0-0)

Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2005-2006 academic year

GE 2100 - Environmental Geology

Introduction and study of current environmental issues related to the earth sciences. Covers major topics such as volcanism, earthquakes, shoreline erosion, and pollution of groundwater as multi-week modules with associated labs, lectures, and field projects.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Spring

GE 2300 - Earth Materials I: Mineralogy

Identification, physical properties, chemistries, structures, uses, and occurrences of minerals. Laboratory includes hand specimen and x-ray diffraction identification of minerals.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Fall

Pre-Requisite(s): GE 2000 and CH 1100 or CH 1110 or (CH 1150 and CH 1151)

GE 2310 - Earth Materials II: Rocks and Mineral Resources

Identification, physical properties, chemical composition, occurrence, and origin of the important types of igneous, sedimentary, and metamorphic rocks. Laboratory includes hand specimen description and identification of rocks.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Spring

Pre-Requisite(s): GE 2300

GE 2500 - Introduction to Oceanography

Effect of waves, tides, currents, natural hazards along shorelines, and air-sea interactions on the climate.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Spring

GE 2640 - Atmospheric Observations and Meteorology

Introduction to fundamentals of atmospheric science and meteorology through direct observations of the atmosphere.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall - Offered alternate years beginning with the 2002-2003 academic year

GE 2800 - Water and Society

The course introduces basic concepts of the water cycle, human interactions in the water cycle, and the social and political dimensions of water. Areas of coverage include: hydrology, water economics, water law, water and politics, water and religion, and water and health.

Credits: 3.0

Lec-Rec-Lab: (2-0-2)

Semesters Offered: Fall

Pre-Requisite(s): UN 2002

GE 2900 - Geology of the National Parks: Field Experience

Two-week, field-based course taught in national parks. Focuses on making and recording observations, developing and testing hypotheses, integrating information from a variety of sources, and presenting results in a variety of formats. Lab fee costs dependent on location.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Summer

Restrictions: Permission of instructor required

GE 3040 - Fundamentals of Applied and Environmental Geophysics

An introduction to geophysical used in applied and environmental geophysics concentrating on the fundamentals of data reduction and interpretation. This course is not only pertinent for the practicing geoscientist but also for environmental engineers, civil engineers, and others interested in learning how physics can be used to investigate Earth's substance.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Pre-Requisite(s): PH 2200

GE 3050 - Structural Geology

Rock structures and regional settings resulting from the application of deforming forces, including the geometry, origin, and mechanics of folds, foliations, lineations, faults and joints, and structures in orogenic belts.

Credits: 4.0

Lec-Rec-Lab: (3-0-2)

Semesters Offered: Spring

Pre-Requisite(s): GE 2000

GE 3100 - Depositional Systems

Introduction to sedimentary processes and their products. Investigates the physical processes controlling sedimentation along with principles of correlation and interpretation of strata. Focuses on interpreting sedimentary rocks as a record of climate, sea-level and tectonic change.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Fall

Pre-Requisite(s): GE 2000 and GE 2310

GE 3200 - Geochemistry

Introduction to elements of modern geochemistry including aqueous solutions, isotopes, age dating, etc. Emphasizes concepts and quantitative methods. Teaches principles of thermodynamics and phase equilibria from an introductory perspective as they pertain to geologic systems.

Credits: 3.0

Lec-Rec-Lab: (2-1-0)

Semesters Offered: Fall

Pre-Requisite(s): CH 1100 or CH 1110 or (CH 1150 and CH 1151)

GE 3250 - Computational Geosciences

Introduction to quantitative analysis and display of geologic data using Matlab and Excel, covering basic Matlab syntax and programming, and analysis of one-dimensional (e.g. time series) and two-dimensional datasets (i.e. spatial data). Techniques are applied to geological datasets.

Credits: 3.0

Lec-Rec-Lab: (2-0-1)

Semesters Offered: Spring

Restrictions: May not be enrolled in one of the following Class(es): Freshman

Pre-Requisite(s): MA 1160 or MA 1161

GE 3320 - Earth History

This course covers the history of the Earth from 4.5 billion years to the present. Plate tectonics is the organizing theme with emphasis on recognizing and evaluating the evidence for the major reorganizations of the Earth's crust.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Fall

Pre-Requisite(s): GE 2000 or GE 2100

GE 3400 - Drilling and Blasting

Rock penetration and fragmentation methods to include boring, cutting, drilling, and blasting techniques. Design of surface and underground blasting rounds. Formulation of design criteria to minimize the adverse effects of blasting. Field demonstration in the design, monitoring, and evaluation of blasts.

Credits: 3.0

Lec-Rec-Lab: (2-0-2)

Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2006-2007 academic year

Pre-Requisite(s): GE 2020 and PH 2100

GE 3410 - Mine Safety & Health Cert

Principles of health and safety in mine practice, hazard recognition, and preventive and corrective actions.

Credits: 1.0

Lec-Rec-Lab: (0-0-3)

Semesters Offered: Summer

GE 3820 - Mechanics of Rock Materials

Analysis of stress and strain in rock for scientists and engineers. Topics range from Mohr circles for stress, incremental strain and finite strain through stress and strain tensors, and constitutive equations, with applications in rock slope stability. Previous coursework in tensors not required.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Pre-Requisite(s): GE 3050

GE 3850 - Geohydrology

Geologic and hydrologic factors controlling the occurrence, movement, and development of subsurface water. Quantitative methods for analyzing groundwater systems are introduced.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Fall

GE 3900 - Field Geophysics

Introduction to field geophysical techniques including basic land surveying. Emphasizes the recording, reduction, presentation, and interpretation of gravity, magnetic, electrical, seismic, and electromagnetic data as well as the proper use, care, and calibration of equipment used to collect the data. Requires report writing. Students must provide their own transportation.

Credits: 5.0

Lec-Rec-Lab: (0-0-15)

Semesters Offered: Summer

Restrictions: Permission of department required

Pre-Requisite(s): GE 3040

GE 3910 - Field Geology with Engineering Applications

Introduction to methods and problems of field geology, interpretation of field relationships, and engineering site investigation. Field areas are located in northern Michigan. Requires geological and/or engineering report and memo writing.

Credits: 5.0

Lec-Rec-Lab: (0-0-15)

Semesters Offered: Summer

Restrictions: Permission of department required

Pre-Requisite(s): GE 2000 and GE 2310 and GE 3050

GE 3915 - Introduction to Field Geology

An introduction to geologic field mapping and site investigations. Requires geological and/or engineering report and memo writing.

Credits: 3.0

Lec-Rec-Lab: (0-0-9)

Semesters Offered: Summer

Restrictions: May not be enrolled in one of the following Major(s):

Geological Engineering, Applied Geophysics

Pre-Requisite(s): GE 2000 and GE 2310 and GE 3050

GE 3920 - Geological Field Excursion

A geological field excursion of one week or more to areas of outstanding interest to geologists.

Credits: variable to 6.0; Repeatable to a Max of 6

Semesters Offered: On Demand

GE 4000 - Earth Science Teaching Experience

Development of earth science teaching skills through assisting in instruction in a geology course laboratory. Students gain experience in organizing, preparing, and presenting earth science topics and answering questions.

Credits: variable to 3.0; Repeatable to a Max of 3

Semesters Offered: On Demand

GE 4050 - Advanced Structural Geology

How rocks deform on a microstructural to hand specimen scale. Topics include dislocations, work hardening and recovery processes, annealing and recrystallization, slip systems, preferred orientation mechanisms, and foliation development.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: On Demand

Pre-Requisite(s): GE 3050

GE 4100 - Geomorphology and Glacial Geology

The study of the processes, including fluvial, glacial, wind, mass movement, and wave action, shaping the earth's surface by erosion and deposition of geologic materials. Emphasizes the role of past and present climate. Field trips are a major component.

Credits: 4.0

Lec-Rec-Lab: (3-0-3)

Semesters Offered: Fall - Offered alternate years beginning with the 2003-2004 academic year

Restrictions: May not be enrolled in one of the following Class(es):

Freshman, Sophomore

Pre-Requisite(s): GE 2000

GE 4150 - Natural Hazards

This course focuses on current mitigation agencies and warning systems, case studies of successes and failures in hazard mitigation, and technical tools for hazard study and mitigation such as satellite remote sensing and GIS.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Fall

Restrictions: May not be enrolled in one of the following Class(es):

Freshman, Sophomore

Pre-Requisite(s): (GE 2000 or GE 2100) and UN 2002

GE 4250 - Fundamentals of Remote Sensing

This course focuses on the basic physics behind above-surface remote sensing and remote sensing systems. Topics covered include: properties of the atmosphere, absorption and scattering of electromagnetic radiation, instrument design, data acquisition and processing, validation, and basic applications.

Credits: 3.0

Lec-Rec-Lab: (2-1-0)

Semesters Offered: Spring

Restrictions: May not be enrolled in one of the following Class(es):

Freshman, Sophomore

Pre-Requisite(s): PH 2200 and MA 2160

GE 4360 - Materials Handling

Surface and underground materials handling methods. Selection and performance analysis of materials handling equipment. Computer applications.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: On Demand

Pre-Requisite(s): PH 2100

GE 4450 - Advanced Environmental Geophysics

Covers the principles, design, and practice of geophysical site investigation utilizing electrical and electromagnetic techniques with emphasis on near surface application pertinent to the environmental consulting industry.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Fall

Pre-Requisite(s): GE 3040

GE 4500 - Plate Tectonics and Global Geophysics

Plate tectonics and the internal structure of the earth using information from seismology, geomagnetism, gravity, and heat flow.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring

Pre-Requisite(s): MA 3160 and PH 2200 and GE 2000

GE 4550 - Gravity and Magnetic Interpretation Methods

Interpretation of gravity and magnetic anomalies based on forward modeling techniques, including space filtering to enhance anomalies of importance. Emphasis will also be given to the design of the gravity/magnetic survey based on cost, implementation, and interpretation methods used.

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2004-2005 academic year

Pre-Requisite(s): GE 3040

GE 4560 - Earthquake Seismology

Physics of earthquakes and seismic energy propagation including stress and strain, elastic wave equation, body and surface waves, anelasticity, anisotropy, earthquake location, earthquake sources, passive seismic imaging. Homework will require computer skills in Matlab or similar.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore

Pre-Requisite(s): GE 3050 and PH 2100 and MA 3160

GE 4600 - Reflection Seismology

Principles of reflection seismic techniques, including theoretical background and application, and hands-on computer projects. Included are acquisition, data processing, and 2D/3D data interpretation. Students conduct projects using actual commercial-quality seismic data.

Credits: 3.0

Lec-Rec-Lab: (2-1-0)

Semesters Offered: Spring

Pre-Requisite(s): GE 3040

GE 4610 - Formation Evaluation and Petroleum Engineering

Principles and practice of formation evaluation, primarily through analysis of well logs and the principles and practice of petroleum engineering. Emphasizes reservoir engineering and simulation. Students conduct projects using actual field data. A three-day field trip is required.

Credits: 3.0

Lec-Rec-Lab: (2-1-0)

Semesters Offered: Fall

GE 4620 - Energy Economics

Introduction to the institutional, technical, and economic issues of the production and use of energy resources, including petroleum, natural gas, coal, nuclear, electric utilities, and alternative energy sources. Applies economic analysis to industrial and policy problems of the supply, distribution, and use of energy resources, including environmental and social consequences.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Spring

Pre-Requisite(s): (EC 2001 or EC 3002 or EC 3003) and UN 2002

GE 4630 - Mineral Industry Economics

Studies the role of minerals and metals in society and the economics of their use. Applies economic principles to examine the supply, demand, markets, and foreign trade for important minerals and metals. Examines the effect of government policies on the minerals industries. Requires a technical report.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall, Spring - Offered alternate years beginning with the 2009-2010 academic year

Pre-Requisite(s): EC 2001 and UN 2002

GE 4700 - Geologic Mapping of Remote Terrain

Introduces students to the art and science of producing a geologic map for virtually any area of the world using satellite data and modern software and tools.

Credits: 3.0

Lec-Rec-Lab: (0-2-1)

Semesters Offered: Spring

Restrictions: Permission of department required

GE 4750 - Subsurface Mapping of Petroleum Prospects

Extensional, wrench and compressional features that produce petroleum traps including subsurface geological mapping. Lab topics include fault surface mapping; fault bifurcations, intersections, and terminations; structural integration; and volumetrics of bottom water, edge water, and fault wedge reservoirs.

Credits: 3.0

Lec-Rec-Lab: (3-0-0)

Semesters Offered: Fall

Pre-Requisite(s): GE 3050

GE 4760 - Mining Geology

Exploration, geologic evaluation, and mining of mineral resources with emphasis metals. An integrated engineering evaluation project includes factors such as geologic characteristics, design of exploration of program, design of drilling program, resource estimation, reporting requirements, mining methods, engineering economics, environmental impact, and mine permitting.

Credits: 3.0

Lec-Rec-Lab: (2-0-3)

Semesters Offered: Fall

Pre-Requisite(s): GE 2310 and GE 3050 and GE 3910

GE 4800 - Groundwater Engineering

Application of geohydrology principles to design water-well supplies, site investigations, and subsurface remediation systems.

Credits: 3.0

Lec-Rec-Lab: (0-2-3)

Semesters Offered: On Demand

Pre-Requisite(s): GE 3850

GE 4900 - Geological Engineering Design Project I

Capstone geological engineering design course focusing on a realistic, complex, open-ended geological engineering problem. Project includes technical design, economic analysis, environmental impacts, and regulations. Report writing required. (Senior project ready as defined by major substitutes for prerequisites)

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Fall

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

GE 4910 - Geological Engineering Design Project II

Continuation of GE4900. Capstone geological engineering design course focusing on a realistic, complex, open-ended geological engineering problem. Project includes technical design, economic analysis, environmental impacts, and regulations. Report writing required. (Senior project ready as defined by major substitutes for prerequisites)

Credits: 3.0

Lec-Rec-Lab: (0-3-0)

Semesters Offered: Spring

Restrictions: May not be enrolled in one of the following Class(es): Freshman, Sophomore, Junior

Pre-Requisite(s): GE 4900

GE 4915 - Field Geology Excursions in Michigan's Upper Peninsula

Three week course which provides background necessary to understand several field sites visited as part of course. Participants are encouraged to lead other groups, particularly school groups, on visits to these sites as part of their own teaching activities.

Credits: 3.0

Lec-Rec-Lab: (0-0-9)

Semesters Offered: Summer

GE 4916 - Field Geology in East Africa

Introduction to methods and problems of field geology. Data gathering and interpretation of field relationships using Brunton, GPS LandSat, etc. in East Africa. Requires geological report and digital maps.

Credits: 5.0

Lec-Rec-Lab: (0-0-15)

Semesters Offered: Summer

Restrictions: Permission of instructor required

Pre-Requisite(s): GE 3050

GE 4917 - Geology of East Africa

Introduction to geology of East Africa. Intended for students with an interest in geological sciences. Requires paper(s) and digital scrapbook.

Credits: 4.0

Lec-Rec-Lab: (0-0-12)

Semesters Offered: Summer

Restrictions: Permission of instructor required

GE 4918 - Geology and Field Excursion to Canada Preparation

The geology of Canada is awesome and spectacular. This course prepares the students for the trip in terms of logistics and overviews of the geology of each location that will be visited. Students may retake class for different locations.

Credits: 1.0; May be repeated

Lec-Rec-Lab: (1-0-0)

Semesters Offered: Spring

GE 4919 - Geology and Field Excursion to Canada

The geology of Canada is visited on this 28 day field excursion via van and camping. Canada's geology offers spectacular study opportunities and provides a true field based experience. Students may retake class for different locations.

Credits: 3.0; Repeatable to a Max of 9

Lec-Rec-Lab: (0-0-9)

Semesters Offered: Summer

Restrictions: Permission of instructor required

Pre-Requisite(s): GE 4918

GE 4920 - Geological Engineering Seminar

Seminar course dealing with geological engineering subjects of current interest.

Credits: 3.0; Repeatable to a Max of 9

Lec-Rec-Lab: (0-3-0)

Semesters Offered: On Demand

Restrictions: May not be enrolled in one of the following Class(es):

Freshman, Sophomore

GE 4921 - Geology Seminar

Seminar course dealing with geology subjects of current interest.

Credits: 3.0; Repeatable to a Max of 9

Lec-Rec-Lab: (0-3-0)

Semesters Offered: On Demand

Restrictions: May not be enrolled in one of the following Class(es):

Freshman, Sophomore

GE 4922 - Geophysics Seminar

Seminar course dealing with geophysics subjects of current interest.

Credits: 3.0; Repeatable to a Max of 9

Lec-Rec-Lab: (0-3-0)

Semesters Offered: On Demand

Restrictions: May not be enrolled in one of the following Class(es):

Freshman, Sophomore

GE 4930 - Special Topics in Geological Engineering

Study and discussion of geological engineering topics.

Credits: variable to 5.0; Repeatable to a Max of 10

Semesters Offered: On Demand

Restrictions: Permission of instructor required

GE 4931 - Special Topics in Geology

Study and discussion of geology topics.

Credits: variable to 5.0; Repeatable to a Max of 10

Semesters Offered: On Demand

Restrictions: Permission of instructor required

GE 4932 - Special Topics in Mineralogy

The study of special topics in mineralogy using the Seaman Mineral Museum.

Credits: variable to 5.0; Repeatable to a Max of 10

Semesters Offered: On Demand

Restrictions: Permission of instructor required

Pre-Requisite(s): GE 2300

GE 4933 - Special Topics in Geophysics

Study and discussion of geophysics topics.

Credits: variable to 5.0; Repeatable to a Max of 10

Semesters Offered: On Demand

Restrictions: Permission of instructor required

GE 4934 - Special Topics in Mining Engineering

Study and discussion of topics in mining engineering not included in regular undergraduate courses.

Credits: variable to 5.0; Repeatable to a Max of 10

Semesters Offered: On Demand

Restrictions: Permission of instructor required

GE 4960 - Independent Geological Engineering Research Project

Approved engineering design research project originated by the student or assigned by the instructor. A final report is required.

Credits: variable to 9.0; Repeatable to a Max of 9

Semesters Offered: On Demand

Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

GE 4961 - Independent Geology Research Project

Approved literature, laboratory, and/or field geology research problem originated by the student or assigned by the instructor. A final report is required.

Credits: variable to 9.0; Repeatable to a Max of 9

Semesters Offered: On Demand

Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore

GE 4962 - Independent Geophysics Research Project

Approved literature, laboratory, and/or field geophysics research problem originated by the student or assigned by the instructor. A final report is required.

Credits: variable to 9.0; Repeatable to a Max of 9

Semesters Offered: On Demand

Restrictions: Permission of instructor required; May not be enrolled in one of the following Class(es): Freshman, Sophomore