

GEOLOGY (GEOLOGY)

GEOLOGY 1001 Special Topics (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

GEOLOGY 1110 Physical And Environmental Geology (LAB 1.0 and LEC 2.0)

Materials, structure, and surface features of the Earth and planets are studied in the context of the processes that continuously transform the Earth and affect management of Earth resources, hazards, engineering problems, and environmental challenges. Prerequisite: Entrance requirements. (Co-listed with Geo Eng 1150).

GEOLOGY 1110 - MOTR GEOL 100: Geology

GEOLOGY 1111 Introduction to Physical Geology (LAB 1.0 and LEC 2.0)

A study of Earth materials, surface features, internal structures and processes. Particular attention is paid to Earth resources, geological hazards, engineering and environmental problems. Prerequisite: Entrance requirements.

GEOLOGY 1111 - MOTR GEOL 100L: Geology with Lab

GEOLOGY 1120 Evolution Of The Earth (LEC 3.0)

A survey of the Earth history from the coalescence of the solar system to the present and the events that have profoundly transformed the planet in the context of the dynamic feedback between physical and biological systems. A one day field trip is required. Prerequisites: Recommend Geo Eng 1150 or Geology 1110 or Bio Sci 1113 but not required.

GEOLOGY 1129 Evolution of the Earth Laboratory (LAB 1.0)

Geology 1129 is designed to accompany Geology 1120 and consists of laboratory explorations of fundamental concepts in geology and the diversity of the fossil record. Prerequisite: Preceded or accompanied by Geology 1120.

GEOLOGY 1141 Physical Oceanography (LEC 3.0)

An introduction to the study of the physical and geological processes in the world's oceans including the importance of the oceans to the environment and to life on Earth. Prerequisites: Entrance requirements.

GEOLOGY 2001 Special Topics (LEC 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

GEOLOGY 2096 Field Geology (LEC 3.0)

Theory and practice in the qualitative and quantitative description of spatial relationships of major rock types, contacts, and structures through construction of geologic maps. Emphasis on developing fundamental field skills, including logistical planning, navigation, data collection and documentation, and professional protocol during site visits. Students will be charged a fee to cover the cost of field trip expenses. Prerequisites: GEOLOGY 1111, 1110, 1119, & 1129.

GEOLOGY 2610 Mineralogy And Crystallography (LAB 1.0 and LEC 3.0)

An introduction to the study of minerals, including their systematic classification, crystallography, morphology, chemistry, societal use, geologic occurrence, environmental application and impact, and identification by means of their physical and chemical properties. Prerequisites: Chem 1310.

GEOLOGY 2611 Physical Mineralogy And Petrology (LAB 1.0 and LEC 2.0)

An introduction to the study of physical mineralogy and petrology, overviewing systematic determination of minerals and rocks by means of their physical properties. Includes the recognition of crystal forms and field relationships of rocks. Course designed for non-geology majors, credit will not count towards a geology-geophysics degree. Prerequisites: Chem 1310 and Chem 1319 or Chem 1351; Geo Eng 1150 or Geology 1110.

GEOLOGY 2620 Igneous And Metamorphic Petrology (LAB 1.0 and LEC 3.0)

A comprehensive study of megascopic and microscopic characteristics of igneous and metamorphic rocks. Fundamental theories for their origin are presented. The class includes a trip to examine these rock types in the field. Prerequisite: Geology 2610.

GEOLOGY 2731 Introduction to Planetary Science (LEC 3.0)

Basic principles of astronomy, the origin and evolution of the universe, stellar evolution, and the origin, composition, and processes operating on the planetary bodies in the solar system.

GEOLOGY 3000 Special Problems (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

GEOLOGY 3001 Special Topics (IND 0.0-6.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

GEOLOGY 3310 Structural Geology (LEC 3.0)

Students will develop of an appreciation for the geometrical beauty of geologic structures through an understanding of crustal deformation at scales from mineral lattices to tectonic plates. Field trip fee required. Prerequisites: GEOLOGY 1110 or GEO ENG 1111.

GEOLOGY 3319 Structural Geology Lab (LAB 1.0)

This course reinforces the principles of Structural Geology through detailed analysis of rock deformation. Techniques will include using a geologic compass, preparing rock descriptions, stereographic analysis, interpretation of geologic maps, construction of cross-sections, and orthographic projections to solve scientific and engineering problems. Prerequisites: Preceded or accompanied by GEOLOGY 3310.

GEOLOGY 3410 Introduction To Geochemistry (LEC 3.0)

Application of basic chemical principals towards investigations of element distributions in geologic systems. Emphasis on origin of elements in our Solar System, element distribution during planetary formation, phase equilibria, rock-water interactions, thermodynamic principles, environmental and isotope geochemistry. Prerequisite: Chem 1310.

GEOLOGY 3511 Introduction to Mineral Deposits (LEC 3.0)

Basic processes involved in the formation of metallic and industrial mineral deposits illustrated by typical examples of deposits from throughout the world. Exploration and economic factors in mineral exploration and development are reviewed. Prerequisites: Geology 1110 and Geology 2610.

GEOLOGY 3620 Stratigraphy And Sedimentation (LEC 3.0)

Principles of physical stratigraphy, bio-stratigraphy and introductory sedimentation. Introduction to depositional systems, facies, unconformities, stratigraphic nomenclature and correlation. One field trip at student expense is required. Prerequisite: Geology 2620 or Geology 2611.

GEOLOGY 3629 Stratigraphy Lab (LAB 1.0)

This course re-enforces the principles of stratigraphy and sedimentation through the use of "hands-on" laboratory procedures such as seive and pipette analyses, correlation problems, fence diagrams and stratigraphic maps. One field trip at student expense is required. Prerequisite: Concurrent with Geology 3620.

GEOLOGY 3811 Fundamentals Of Geographic Information Systems (LAB 1.0 and LEC 2.0)

Introduction to the fundamental concepts and components of Geographic Information Systems. Techniques for acquiring, manipulating and analyzing digital terrain data for geological and geotechnical applications. (Co-listed with Geo Eng 3148).

GEOLOGY 4000 Special Problems (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

GEOLOGY 4001 Special Topics (LAB 1.0 and LEC 2.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

GEOLOGY 4010 Seminar (LEC 0.50)

Discussion of current topics. Required for two semesters during senior year. (Course cannot be used for graduate credit). Prerequisite: Senior standing.

GEOLOGY 4085 Internship (IND 3.0)

Students will select, with the advice of their advisor, appropriate problems for investigation through practical application of fundamental geoscience principles. The problems selected must provide higher level experiential learning. Assessment is based upon the quality of written and oral presentations and supervisor's evaluation. Prerequisite: Advisor's approval.

GEOLOGY 4097 Advanced Field Geology (LEC 3.0)

Advanced instruction in theory and practice of qualitative and quantitative description of spatial relationships of rock types in areas exhibiting complex deformation. Emphasis on experiential learning where students plan, implement, and reflect on outcomes for several scientific field campaigns in a manner consistent with professional scientific practices. Students will be charged a fee to cover the cost of field trip expenses. Prerequisites: GEOLOGY 2610, 2620, 3310, 3620, 3629, and 2096.

GEOLOGY 4099 Undergraduate Research (IND 0.0-6.0)

Designed for the undergraduate student who wishes to engage in research. Not for graduate credit. Not more than six (6) credit hours allowed for graduation credit. Subject and credit to be arranged with the instructor.

GEOLOGY 4211 Electrical Methods In Geophysics (LEC 3.0)

The theory and instrumentation for measurements of the electrical properties of the earth. Includes passive and active techniques, the advantages and disadvantages of the various techniques, and geologic interpretations of electrical soundings. Several weekends are spent making a variety of electrical surveys of local features. Prerequisites: Math 5325 and Geophys 3221.

GEOLOGY 4310 Remote Sensing Technology (LAB 1.0 and LEC 2.0)

Principles of digital image processing including image enhancement and multispectral classification. Emphasis upon design and implementation of remote sensing systems and analysis of remotely sensed data for geotechnical and environmental investigations. Prerequisite: Geology 1110. (Co-listed with Geo Eng 5144).

GEOLOGY 4411 Hydrogeology (LAB 1.0 and LEC 2.0)

This course discusses geologic aspects of major surface and subsurface hydrologic systems of North America. Chemical and physical relationships between groundwater and fractures, faults, karst, subsurface pressures, mineral deposits plus both contaminant and hydrocarbon migration are discussed. Prerequisites: Geo Eng 1150 or Geology 1110, Geology 3620 recommended.

GEOLOGY 4421 Radioactive Waste Management And Remediation (LEC 3.0)

Sources and classes of radioactive waste, long-term decay, spent fuel storage, transport, disposal options, regulatory control, materials issues, site selection and geologic characterization, containment, design and monitoring requirements, domestic and foreign waste disposal programs, economic and environmental issues; history of disposal actions, and conduct of remedial actions and cleanup. Prerequisite: Math 3304. (Co-listed with Nuc Eng 4367).

GEOLOGY 4431 Methods Of Karst Hydrogeology (LEC 3.0)

Familiarize geoscientists with the origin and identification of karst features, discuss groundwater movement, engineering problems, water quality and supply in karst areas, and teach investigative techniques including fluorescent dye tracing. Several field trips at student expense will be required. Prerequisite: Geology 1110 or Geo Eng 1150; Geology 3620.

GEOLOGY 4441 Applied Geochemistry (LAB 1.0 and LEC 2.0)

Application of the principles of geochemistry and techniques of geochemical analysis in a student research project investigating geochemical processes (mineral deposits, environmental geochemistry, trace element migration, or water-rock interaction). Field trip fee required. Prerequisites: Geology 2610 and Geology 3410.

GEOLOGY 4451 Aqueous Geochemistry (LEC 3.0)

Studies of the interaction of water with minerals and organic materials at low temperatures; including processes affecting the migration of elements (alteration, precipitation, and adsorption), the influence of geochemical processes on water composition, weathering, soil formation, and pollution. Field trip fee required. Prerequisite: Geology 3410.

GEOLOGY 4461 Isotope Geochemistry (LAB 1.0 and LEC 2.0)

Introduction to the fundamentals of radiogenic and stable isotopes as used to understand geologic processes. The use of selected isotopic systems in petrology, ore petrogenesis, paleontology, and the global climate systems will be discussed. Prerequisites: Geology 2620, 3620, 3410.

GEOLOGY 4521 Ore Microscopy (LAB 2.0 and LEC 1.0)

A study of polished sections of minerals and ores under reflected light. Includes the preparation of polished sections, the identification of ore minerals, and the study of the textures, associations, and alterations of ore minerals. Prerequisite: Geology 2610 and Geology 3511.

GEOLOGY 4630 Systematic Paleontology (LAB 1.0 and LEC 2.0)

Provide understanding of paleontological principles, morphological concepts, evolution of life, and applications/uses of fossils. Chronicles evolution and classification of microfossils, invertebrates, plants and palynomorphs. Emphasis on communication skills and team work. A compulsory field trip to The Field Museum (Chicago) may be at student expense. Prerequisite: Geology 1110 or Geology 1120 or Bio Sci 1113.

GEOLOGY 4631 Advanced Igneous and Metamorphic Petrology (LAB 1.0 and LEC 3.0)

Processes governing the formation of igneous and metamorphic rocks as constrained by geochemical, isotopic, and thermodynamic data, with particular reference to the relationship between rock suites and tectonic setting. The laboratory will emphasize the description of rock suites in hand sample and thin section. A field trip at the student's expense is required. Prerequisite: Geology 2620.

GEOLOGY 4711 Paleoclimatology and Paleoecology (LEC 3.0)

This course will introduce students to the elements of climate, evidence of climate changes, proxy measurements and paleoclimate models. There is a review of Holocene climates and Archean to Pleistocene paleoclimates. Prerequisite: Geology 1110 or Geology 1120 or Geo Eng 1150.

GEOLOGY 4721 Meteorology and Climatology (LEC 3.0)

An introduction to the atmospheric and climatic systems of the Earth including weather, paleoclimatology, and global climate change. Prerequisites: GEOLOGY 1110 or GEOLOGY 1120 or equivalent.

GEOLOGY 4821 Applications Of Geographic Information Systems (LAB 1.0 and LEC 2.0)

Applications of Geographical Information Systems and remote sensing to environmental monitoring, mineral resource exploration, and geotechnical site evaluation. Prerequisite: Geo Eng 31+D151275 or consent of instructor. (Co-listed with Geo Eng 5146).

GEOLOGY 4831 Computational Geology (LAB 1.0 and LEC 2.0)

This course introduces the technology used for both surface and subsurface geologic mapping. It utilizes common systems and programs such as UNIX, Windows and industry-standard mapping applications. The goal of the course is to fully prepare students for their first professional assignment. Prerequisites: Geology 1110 or Geology 1120 or Geo Eng 1150.

GEOLOGY 4841 Geological Field Studies (LEC 3.0)

Intensive review of the scientific literature corresponding to a selected geographical region of geologic interest; followed by a 7 to 10 day long field trip to be held over spring break or after the end of the semester. Students will be expected to bear a portion of the field trip expenses. Repeatable for credit. Prerequisites: Geology 1110 or Geo Eng 1150.

GEOLOGY 5000 Special Problems (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

GEOLOGY 5001 Special Topics (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

GEOLOGY 5010 Seminar (LEC 0.50)

Discussion of current topics.

GEOLOGY 5040 Oral Examination (IND 0.0)

After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/ written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

GEOLOGY 5085 Internship (IND 3.0)

Students will select, with their committee's advice, problems for investigation and preparation of a graduate research proposal. Problems must provide higher level experiential learning consistent with a graduate degree in geology. Assessment is based upon the quality of written and oral presentations and supervisor's evaluation. Repeatable for credit. Prerequisite: Graduate Standing.

GEOLOGY 5099 Research (IND 0.0-15)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation.

GEOLOGY 5100 Professional Geoscience Skills (LEC 3.0)

Development and communication of complex topics in the geosciences is required for successful post-MS career advancement. Best practices for developing these skills in the geosciences will be critiqued weekly, culminating with poster and oral presentations. Assessment by peer-review and self-evaluation. Topics selected from geosciences careers. Prerequisites: Graduate Standing.

GEOLOGY 5111 Advanced Physical Geology (LEC 3.0)

Examination of topics concerned with the physical properties of earth materials, processes affecting change of the surface and interior of the earth, and the driving forces causing these changes. Weekly critical assessment of literature, and an oral presentation and term paper required. Prerequisite: Consent of instructor.

GEOLOGY 5121 Advanced Historical Geology (LAB 1.0 and LEC 2.0)

Study of the physical and biological history of the Earth beginning with the origin of the solar system up to the present. Emphasis will be placed on processes that shaped the Earth and its ecosystems. Prerequisite: Entrance requirements for the MST program in Earth Science.

GEOLOGY 5311 Depositional Systems (LEC 3.0)

Development of three dimensional depositional models using Walther's Law, Walther's Warning and seismic stratigraphy. Emphasis on overall geometries and internal porosity and permeability characteristics of aquifers and hydrocarbon reservoirs. Includes 3-D models for clastic, carbonate and evaporate sequences. Prerequisites: Geology 1110 or Geo Eng 1150; accompanied or preceded by both Geology 3310 and Geology 3620.

GEOLOGY 5510 Organic Geochemistry (LEC 3.0)

This course explores the carbon cycle, the history and inventory of organic matter on Earth, the transport of organic matter in aqueous systems, the burial of organic matter, the maturation of organic matter to become petroleum, and organic contaminants in the environment. Prerequisites: Graduate standing or consent of instructor.

GEOLOGY 5511 Applied Petroleum Geology (LAB 2.0 and LEC 1.0)

The principles of petroleum geology are applied in solving hydrocarbon exploration and developmental problems. Geological and economical techniques for evaluating hydrocarbonbearing reservoirs are presented, with methods for decisionmaking under conditions of extreme uncertainty. Prerequisite: Consent of instructor.

GEOLOGY 5513 Petroleum Geology (LAB 1.0 and LEC 2.0)

Principles of origin, migration, and accumulation of oil and gas. The laboratory introduces the procedures used for exploration, and development of hydrocarbon resources. Prerequisites: Geology 1110 or Geo Eng 1150; accompanied or preceded by both Geology 3310 and Geology 3620.

GEOLOGY 5521 Coal Petrology (LEC 3.0)

Formation, composition, and properties of coals. Discussion of the geology of selected coal deposits, the analysis of coal, and the optical identification of coal minerals. Prerequisite: Permission of instructor.

GEOLOGY 5611 Granites And Rhyolites (LAB 1.0 and LEC 3.0)

Processes governing the generation and crystallization of felsic magma will be covered, with specific reference to: 1) crust vs mantle sources, 2) melt migration and emplacement, 3) magma chamber dynamics, 4) the volcanic-plutonic connection, and 5) the relationship to tectonic setting. A field trip at the student's expense is required. Prerequisite: Geology 2620.

GEOLOGY 5631 Carbonate Petrology (LAB 1.0 and LEC 2.0)

Petrology, chemistry and sedimentology of carbonates and other associated chemical sedimentary rocks. Prerequisites: GEOLOGY 2620, 3620 and CHEM 1320 or equivalent; GEOLOGY 3410 recommended.

GEOLOGY 5641 Advanced Igneous Petrology (LAB 1.0 and LEC 2.0)

The genesis of eruptive rocks as evidenced by the physico-chemical conditions of formation of their constituent minerals. A critical examination of various magmatic processes. Use of advanced petrographic techniques. Prerequisites: GEOLOGY 4631.

GEOLOGY 5661 Advanced Stratigraphy and Basin Evolution (LEC 3.0)

Advanced topics in sedimentary geology including: tectonic controls on sedimentary basin development, global sequence stratigraphy, regional facies and diagenetic patterns, basin hydrogeology, thermal evolution of basins and distribution of economic resources. This course should be preceded or accompanied by Geology 3410. Prerequisites: Geology 3620 and Geology 3310.

GEOLOGY 5671 Clay Mineralogy (LAB 1.0 and LEC 2.0)

Mineral structure, geochemical properties, occurrence, environment, and uses of clays. Determination of physical properties, optics, x-ray diffraction, and thermal features of clays. Field trip fee required. Prerequisites: Geology 2610 and 3410, or Chem 2310, or Civ Eng 5715, or Geo Eng 5172.

GEOLOGY 5679 Field and Laboratory Studies in Earth Science (LAB 3.0)

Hands-on laboratory and field experiences in the Earth Sciences. This course is designed to be taught in an intensive three week session during the summer on the S&T campus. Prerequisites: GEOLOGY 2096 or 5121 or equivalents.

GEOLOGY 5681 Lidar Principles and Application (LEC 3.0)

Provides a comprehensive understanding of light detection and ranging (lidar) technology as it has been developed for commercial use; various methods of deploying technology for collection of data for mapping, engineering and science, and application of the data using specialized software for editing and processing point cloud data. Assumes GIS experience. Prerequisite: Senior or graduate standing.

GEOLOGY 5741 Micropaleontology (LAB 1.0 and LEC 2.0)

This course studies the fossil and soft-body characteristics of bacteria, protists, microinvertebrates and organic-walled microfossils (palynomorphs). Focused discussions on systematics, evolutionary histories, paleoecology, and geologic applications of the microfossil groups. Extraction of foraminifera and palynomorphs from rocks in lab. Prerequisite: Geology 4630.

GEOLOGY 6000 Special Problems (IND 0.0-6.0)

Problems or readings on specific subjects or projects in the department. Consent of instructor required.

GEOLOGY 6001 Special Topics (LAB 0.0 and LEC 0.0)

This course is designed to give the department an opportunity to test a new course. Variable title.

GEOLOGY 6010 Seminar (IND 0.0-6.0)

Discussion of current topics.

GEOLOGY 6040 Oral Examination (IND 0.0)

After completion of all other program requirements, oral examinations for on-campus M.S./Ph.D. students may be processed during intersession. Off-campus M.S. students must be enrolled in oral examination and must have paid an oral examination fee at the time of the defense/comprehensive examination (oral/ written). All other students must enroll for credit commensurate with uses made of facilities and/or faculties. In no case shall this be for less than three (3) semester hours for resident students.

GEOLOGY 6050 Continuous Registration (IND 1.0)

Doctoral candidates who have completed all requirements for the degree except the dissertation, and are away from the campus must continue to enroll for at least one hour of credit each registration period until the degree is completed. Failure to do so may invalidate the candidacy. Billing will be automatic as will registration upon payment.

GEOLOGY 6085 Internship (IND 3.0)

Students will select, with their committee's advice, problems for investigation and preparation of a graduate research proposal. Problems must provide higher level experiential learning consistent with a graduate degree in geology. Assessment is based upon the quality of written and oral presentations and supervisor's evaluation. Repeatable for credit. Prerequisite: Graduate standing.

GEOLOGY 6097 Advanced Geologic Field Methods (LEC 3.0)

Advanced instruction in planning and implementation of geologic field campaigns, development of an appropriate scientific plan, including logistics, safety, and supervision of field personnel in a manner consistent with professional practices. Emphasis placed upon reflection on projects outcomes supervised with faculty oversight. Field Trip fee required.

GEOLOGY 6098 Advanced Geologic Field Methods (LEC 3.0)

Adv. instruction in theory and practice of qualitative/quantitative description of spatial relationships of rock types in areas exhibiting complex deformation. Emphasis on expl. learning where students plan, implement, and reflect on outcomes for sev. scientific field campaigns in a manner consistent with prof. scientific practices. Field trip fee required.

GEOLOGY 6099 Research (IND 0.0-15)

Investigations of an advanced nature leading to the preparation of a thesis or dissertation.

GEOLOGY 6100 Advanced Professional Geoscience Skills (LEC 3.0)

Communication of complex research topics in the geosciences is required for successful post-doctoral career advancement in both academic and non-academic career paths. Best practices for developing and proposing scientific ideas in the geosciences will be critiqued weekly. Assessment of research proposals presentations includes peer-and self-evaluation. Prerequisites: Doctoral Graduate Standing. (Co-listed with Pet Eng 6100).

GEOLOGY 6211 Geodynamics (LEC 3.0)

The applications of continuum physics to geological and petroleum engineering problems. Topics include plate tectonics, stress and strain in solids, elasticity and flexure, heat transfer, gravity, fluid mechanics, rock rheology, faulting, and flow in porous media. Prerequisites: Math 2222 and Geology 3310. (Co-listed with Pet Eng 6711).

GEOLOGY 6311 Advanced Structural Geology (LAB 1.0 and LEC 2.0)

The course provides theoretical background, analytical techniques, and hands-on experience for analyzing geologic structures at a variety of scales hand sample to global. Prerequisites: Geology 3310, Geophys 4096.

GEOLOGY 6321 Analytical Structural Geology (LAB 1.0 and LEC 2.0)

The course provides theoretical background, analytical techniques, and hands-on experience, for quantifying processes that lead to the formation and evolution of rocks and structures produced as a result of deformation at a variety of scales - hand sample to global. Poster - and oral - presentations, and a research paper required. Prerequisites: Geology 3310, Geophys 4096.

GEOLOGY 6331 Geotectonics (LEC 3.0)

A critical study of the origin, and differentiation of the earth, evolution of the crust, and plate tectonics. Geology of the continents and ocean basins. Regional tectonic analysis of precambrian shields, platforms, orogenic belts, and a review of internal energy sources. Emphasis is on North America. Prerequisite: Geology 3310.

GEOLOGY 6341 Advanced Remote Sensing And Image Processing (LAB 1.0 and LEC 2.0)

Quantitative methods of utilizing remote sensing technology for terrain analysis. Digital image processing of landsat and/or aircraft scanner data for mineral resource studies and geological engineering applications. Prerequisite: Geo Eng 5146. (Co-listed with Geo Eng 6146).

GEOLOGY 6351 Advanced Geochemistry (LEC 3.0)

A study of the absolute and relative abundance of elements and isotopes in the Earth, principles of element transport, formation of the Earth's crust, mineral deposits, and soils. Field trip fee required. Prerequisite: Geology 3410.

GEOLOGY 6411 Advanced Isotope Geochemistry (LAB 1.0 and LEC 2.0)

The use of radiogenic and stable isotopes in geology in the study of the evolution of Earth, crust, mantle, and the Solar System as well as applications to geothermometry, ore petrogenesis, paleontology, and the global climate system. Prerequisites: Geology 2620, 3620, 3410.

GEOLOGY 6421 Environmental Geology (LEC 3.0)

Overview of environmental problems facing humans. Emphasis will be placed on surface and groundwater pollution, geological hazards, and pressures on Earth's ecosystems and natural resources by urbanization and population growth. Prerequisites: GEOLOGY 1110 or 1120 or equivalents.

GEOLOGY 6511 Advanced Petroleum Geology (LAB 2.0 and LEC 1.0)

The principles of petroleum geology are applied in solving hydrocarbon exploration and developmental problems. Various types of oil and gas accumulations are reviewed in detail. Study of criteria useful in evaluating the petroleum potential of undrilled areas. Special investigation assignment is required. Prerequisite: Geology 3310, Geology 5513, Geology 5661, or Geology 6811.

GEOLOGY 6521 Advanced Ore Microscopy (LAB 2.0 and LEC 1.0)

A study of ore suites utilizing various advanced, quantitative ore microscopy techniques including hardness, spectral reflectance, indentation, color, rotation property measurements, fluid inclusion geothermometry, and salinity measurements. Laboratory study includes demonstration and operation of the luminoscope and other microbeam techniques. Prerequisite: Geology 4521.

GEOLOGY 6531 Applied Ore Microscopy (LAB 2.0 and LEC 1.0)

Application of ore microscopic and petrographic techniques to problems in ore beneficiation, pelleting, sintering, smelting, refining, refractories, cement, mining, and exploration. Discussions and laboratories are based upon industrial case histories. Prerequisite: Geology 4521.

GEOLOGY 6541 Geology of Natural Resources (LEC 3.0)

The origin and distribution of economically important natural resources including soils, water resources, metals, non-metals, building materials, petroleum, and other energy resources. Prerequisites: GEOLOGY 1110 or 1120 or equivalents.

GEOLOGY 6551 Global Tectonics and Metallogeny (LAB 1.0 and LEC 2.0)

An advanced study of metallic ore deposits. Theories of ore genesis in different tectonic regimes and the effects on exploration. Discussions based on maps, logs, exploration datasets and samples from the world's typical mineral deposits. Prerequisites: Geology 3511 and preceded or accompanied by Geology 4521.

GEOLOGY 6611 Advanced Palynology (LAB 2.0 and LEC 1.0)

Study of organic-walled microfossils, and the processes of sporopollenin preservation, sedimentation and palynofacies. Chronicle of Phanerozoic palynology in lectures. Major emphasis on independent palynostratigraphic research and applications, such as biostratigraphy, paleoclimatology and paleoenvironments. Prerequisite: Geology 4630 or Geology 5741.

GEOLOGY 6621 Clastic Sedimentary Petrology (LAB 1.0 and LEC 2.0)

Petrology and petrography of clastic sedimentary rocks. Emphasis on origin, diagenesis and description of clastic, sedimentary rocks. Prerequisite: Geology 3620.

GEOLOGY 6651 Granite and Rhyolite Petrogenesis (LAB 1.0 and LEC 3.0)

The origin of granites and rhyolites with respect to extreme fractionation, crustal anatexis, magma mixing, and tectonic setting will be explored through critical reading of the literature and examination of hand samples and thin sections from classic geologic terranes. A research paper is required as well as a field trip at the student's expense. Prerequisite: Geology 2620.

GEOLOGY 6711 Advanced Paleoclimatology and Paleoecology (LEC 3.0)

Advanced study of paleoclimatic and paleoecologic processes since the Archean, and the interpretation of Holocene climate changes, including human impacts. Extensive presentations and discussions of current ideas and techniques in paleoclimatic studies. Prerequisite: Geology 3620.

GEOLOGY 6811 Sedimentary Basin Analysis (LEC 3.0)

An advanced study of stratigraphic, diagenetic and tectonic processes in sedimentary basins. Prerequisites: Geology 3310, 3620, 3410 or 4441 or 4451.
