

GEOG 657 Geographic Models (3). S Examination of several methodologies and specific techniques from geographical and operations research having proven applicability to public facility location decisions. The course emphasizes hands-on student experience with canned computer programs and real world problems. Prerequisite: An introductory course in either urban planning, transportation, geography, urban geography, or consent of instructor. LEC

GEOG 658 Topics in Geographic Information Science: ____ (1-6). An investigation of special topics in geographic information science. May include specific course work under the headings of methodology, basic research, thematic or regional applications, geographic information systems (GIS), Global Positioning System (GPS), and geostatistics. May be repeated if topic differs. LEC

GEOG 670 Cultural Ecology (3). S Investigation of the interrelations between socio-cultural systems and the natural environment, including a survey of major theories and descriptive studies. (Same as ANTH 695.) Prerequisite: An introductory course in geography or anthropology. LEC

GEOG 710 Information Design (3).

GEOG 711 Advanced Cartography: ____ (3).

GEOG 713 Practicum in Cartography (1-6).

GEOG 714 Field Experience (3).

GEOG 716 Advanced Geostatistics (3).

GEOG 719 Development of Geographic Thought (2-3).

GEOG 726 Remote Sensing of Environment II (4).

GEOG 731 Topics in Physical Geography: ____ (1-3).

GEOG 733 Advanced Biogeography Field and Laboratory Techniques (3).

GEOG 735 Soil Genesis, Classification, and Distribution (3).

GEOG 741 Advanced Geomorphology (1-3).

GEOG 749 Topics in Stable Isotopes in the Natural Sciences: ____ (2-3).

GEOG 751 Analysis of Regional Development (3).

GEOG 752 Topics in Urban/Economic Geography: ____ (1-3).

GEOG 756 Energy Problems and the Economic-physical Environment (2-3).

GEOG 758 Geographic Information Science (4).

GEOG 771 Topics in Cultural Geography: ____ (1-3).

GEOG 772 Problems in Political Geography (3).

GEOG 773 Humanistic Geography (3).

GEOG 775 Proseminar in Population Geography (3).

GEOG 790 North American Regions: ____ (3).

GEOG 791 Latin American Regions: ____ (3).

GEOG 794 Regions of the Former U.S.S.R. (3).

GEOG 795 European Regions: ____ (3).

GEOG 796 Asian Regions: ____ (2-3).

Geology

Chair: Robert H. Goldstein

Lindley Hall, 1475 Jayhawk Blvd., Room 120

Lawrence, KS 66045-7613, www.geo.ku.edu, (785) 864-4974

Degrees offered: B.A., B.S., M.S., Ph.D.

Why study geology? Because its leadership role among geoscience programs advances higher learning and serves society through the discovery, dissemination, and application of knowledge.

Geology is an interdisciplinary science that applies the principles of chemistry, physics, biology, and other fields to the study of the earth, its resources, and its natural processes. The field has many subdisciplines and specialties that offer stimulating challenges and careers. KU offers broad undergraduate programs in geology and geophysics but emphasizes research in paleontology, sedimentology, crustal evolution, hydrogeology, seismology, and geomorphology.

Courses for Nonmajors

The department offers several courses of interest to nonmajors who wish to learn more about geology and related areas such as environmental science, oceanography, and economic resources. Principal courses include GEOL 101, GEOL 105, GEOL 121, GEOL 171, GEOL 302, and GEOL 351. GEOL 103 may be taken in conjunction with either GEOL 101 or GEOL 105 to fulfill the CLAS laboratory science requirement. GEOL 304, GEOL 360, and GEOL 552 all offer opportunities to study more specialized aspects of the earth and do not require advanced prerequisites.

Majors

The B.A. program allows many free electives for background courses in the sciences or liberal arts. The program permits study of traditional geology (with emphasis on the solid earth, the earth's surface, or environmental geology and natural resources), environmental geology (with emphasis on water or urban environmental geology), or an individually tailored program.

The B.S. program provides intensive training in geology and other sciences. B.S. majors may emphasize traditional geology, environmental geology (with a specialized track in hydrogeology), engineering geology, or geophysics. The hydrogeology track, the engineering geology option, and the geophysics option combine basic training in geology with training in mathematics, engineering, physics, and geophysics. The environmental geology option combines training in geology with many different sciences.

Degree requirements may be altered to suit particular needs of a student upon petition to the undergraduate studies committee and in consultation with a geology faculty adviser. Special consideration is given to students with strong backgrounds in supporting sciences and students with superior records who decide to major in geology late in their programs.

First- and Second-year Preparation. Students interested in geology, especially in the B.S. degree, should see a department adviser as soon as possible. They should enroll in mathematics, chemistry, and English in addition to Introduction to Geology and electives. Students should take GEOL 360 as soon as possible.

Advising. Developing a strong relationship with a faculty adviser helps students get the most out of their educational programs in the shortest time. Most courses for majors are offered in only one semester each year. Advisers can guide the student through complexities of the curriculum or into a specialized program.

Requirements for the B.A. Major. In addition to College requirements, these courses are required:

MATH 115 Calculus I (3) or MATH 121 Calculus I (5)	3-5
CHEM 184 Foundations of Chemistry I (5) or CHEM 125 College Chemistry (5) ...	5
PHSX 111 Introductory Physics (3) or PHSX 114 College Physics I (4) or	
PHSX 211 General Physics I (4)	3-4
BIOL 100 Principles of Biology	3
BIOL 102 Principles of Biology Laboratory	2
EECS 128 Foundations of Information Technology: ____ (3) or	
EECS 138 Introduction to Computing: ____ (3)	3

Geology Core (24 hours)

GEOL 101 Introduction to Geology (3) and	
GEOL 103 Geology Fundamentals Laboratory (2)	5
GEOL 311 Mineralogy and Structure of the Earth	3
GEOL 331 Sedimentology and Surface Processes	4
GEOL 360 Field Investigation	2
GEOL 521 Paleontology	3
GEOL 560 Introductory Field Geology	3
GEOL 562 Structural Geology	4

Option A: General Geology

College Requirements and Geology Core Courses

Geology Electives: A minimum of 15 hours in geology or related courses. Several possible tracks of upper-level course work are given below. No more than 40 hours in geology may be counted toward the minimum 124 hours required for graduation.

Track 1: Solid Earth

GEOL 312 Mineral Structures and Equilibria Laboratory (1)	
GEOL 512 Igneous and Metamorphic Petrology (3) and	
GEOL 513 Petrology Laboratory (1)	
GEOL 532 Stratigraphy (4)	
GEOL 572 Geophysics (3) or GEOL 573 Geodynamics and Plate Tectonics (3)	

Track 2: Surface Earth

GEOL 171 Earthquakes and Natural Disasters (3)	
GEOL 351 Environmental Geology (3)	
GEOL 532 Stratigraphy (4)	
GEOL 541 Geomorphology (4)	
GEOL 722 Paleoeecology (3)	

Track 3: Geology and Natural Resources

GEOL 351 Environmental Geology (3)	
GEOL 391 Special Studies in Geology: Water Resources (3)	
GEOL 541 Geomorphology (4)	
GEOL 572 Geophysics (3)	
EVRN 332 Environmental Law (3) (Prerequisite: EVRN 148)	

Option B: Environmental Geology

College Requirements and Geology Core Courses

Geology Electives: A minimum of 15 hours in geology or related courses. Several possible tracks of upper-level course work are given below. Students may choose from these or select other courses in consultation with an adviser. No more than 40 hours in geology may be counted toward the minimum 124 hours required for graduation.

Track 1: Water, Geology, and the Environment

- GEOL 302 Oceanography (3)
- GEOL 351 Environmental Geology (3)
- GEOL 391 Special Studies in Geology: Water Resources (3)
- GEOL 541 Geomorphology (4)
- GEOL 552 Introduction to Hydrogeology (3)
- ATMO 515 Energy and Water Balance (3)
- CE 477 Introduction to Environmental Engineering and Science (3)
- BIOL 660 Lake Ecology (3)

Track 2: Urban Environmental Geology

- GEOL 351 Environmental Geology (3)
- ATMO 525 Air Pollution Meteorology (3)
- CE 477 Introduction to Environmental Engineering and Science (3)
- GEOG 304 Environmental Conservation (3)

Other Elective Courses

- GEOL 532 Stratigraphy (4)
- ATMO 105 Introductory Meteorology (5)
- BIOL 414 Principles of Ecology (3)
- BIOL 460 Plants and Humans (3)
- GEOG 558 Intermediate Geographical Information Systems (4)

Requirements for the B.S. Degree in Geology: General Geology Option

Satisfaction of the College English requirement	6-9
COMS 130 Speaker-Audience Communication (3) or	
COMS 150 Personal Communication (3) (or exemption)	0-3
Two courses in the humanities	6-10
Two courses in the social sciences (an introductory course in economics is recommended)	6-8
MATH 121 and MATH 122 Calculus I and II (recommended) (10) or	
MATH 115 and MATH 116 plus MATH 122 Calculus (11)	10-11
PHSX 211 and PHSX 212 General Physics I and II	8
CHEM 184 and CHEM 188 Foundations of Chemistry I and II	10
BIOL 150 Principles of Molecular and Cellular Biology (4) and	
BIOL 152 Principles of Organismal Biology (4)	8
EECS 128 Foundations of Information Technology: ____ (3) or	
EECS 138 Introduction to Computing: ____ (3) or	
C&PE 121 Introduction to Computers in Engineering (3)	3

Geology (49 hours)

GEOL 101 Introduction to Geology (3) and	
GEOL 103 Geology Fundamentals Laboratory (2)	5
GEOL 311 Mineralogy and Structure of the Earth	3
GEOL 312 Mineral Structures and Equilibria Laboratory	1
GEOL 331 Sedimentology and Surface Processes	4
GEOL 360 Field Investigation	2
GEOL 512 Igneous and Metamorphic Petrology	3
GEOL 513 Petrology Laboratory	1
GEOL 521 Paleontology	3
GEOL 523 Paleontology Laboratory	1
GEOL 532 Stratigraphy	4
GEOL 560 Introductory Field Geology	3
GEOL 561 Field Geology	3
GEOL 562 Structural Geology	4
GEOL 572 Geophysics (3) or GEOL 573 Geodynamics and Plate Tectonics (3)	3
At least 9 hours in geology courses numbered 500 or above	9
This can include 3 hours of GEOL 399, GEOL 105, GEOL 304, or GEOL 121 can also count if taken before the student has completed 60 hours. Electives may include an upper-division course in statistics (MATH 365 or BIOL 570).	

Note: No more than 50 hours in geology may be counted toward the minimum 124 hours required for graduation.

Requirements for the B.S. Degree in Geology: Engineering Geology Option

ENGL 101, ENGL 102, and ENGL 362	9
COMS 130 Speaker-Audience Communication (3) or	
COMS 150 Personal Communication (3) (or exemption)	0-3
Two courses in the humanities	6-10
ECON 104 Introductory Economics	4
One additional course in the social sciences	3
MATH 121, MATH 122, MATH 220, and MATH 290	15
CHEM 184 and CHEM 188 Foundations of Chemistry I and II	10
PHSX 211 and PHSX 212 General Physics I and II	8
CE 201 Statics	2
CE 300 Dynamics	3
CE 311 Strength of Materials	3
CE 330 Fluid Mechanics	4
CE 455 Hydrology	3
CE 487 Soil Mechanics	4
EECS 128 Foundations of Information Technology: ____ (3) or	
C&PE 121 Introduction to Computers in Engineering (3) or	
EECS 138 Introduction to Computing: ____ (3)	3

Geology (45-51 hours)

GEOL 101 Introduction to Geology (3) and	
GEOL 103 Geology Fundamentals Laboratory (2) or	
GEOL 105 History of the Earth (3)	3-5
GEOL 311 Mineralogy and Structure of the Earth	3
GEOL 312 Mineral Structures and Equilibria Laboratory	1
GEOL 331 Sedimentology and Surface Processes	4
GEOL 351 Environmental Geology	3
GEOL 360 Field Investigation	2
GEOL 512 Igneous and Metamorphic Petrology	3
GEOL 513 Petrology Laboratory	1
GEOL 541 Geomorphology	4
GEOL 560 Introductory Field Geology	3
GEOL 561 Field Geology	3
GEOL 562 Structural Geology	4
GEOL 572 Geophysics (3) or GEOL 573 Geodynamics and Plate Tectonics (3)	3
Three additional geology or civil engineering courses, at least two of which must be from the following:	8-12
GEOL 521 Paleontology (3)	
GEOL 532 Stratigraphy (4)	
GEOL 535 Petroleum and Subsurface Geology (4)	
GEOL 715 Geochemistry (3)	
GEOL 751 Physical Hydrogeology (3)	
CE 770 Concepts of Environmental Chemistry (2) and	
CE 771 Environmental Chemical Analysis (1)	
Electives may include an upper-division course in statistics (MATH 365 or BIOL 570).	

Note: Graduation totals must include 74 hours of nongeology courses and may exceed 124 hours.

Requirements for the B.S. Degree in Geology: Environmental Geology Option

Satisfaction of the College English requirement	6-9
COMS 130 Speaker-Audience Communication (3) or	
COMS 150 Personal Communication (3) (or exemption)	0-3
Two courses in the humanities	6-10
Two courses in the social sciences (an introductory course in economics is recommended)	6-8
MATH 121 and MATH 122 Calculus I and II (10) or	
MATH 115 and MATH 116 plus MATH 122 Calculus (11)	10-11
PHSX 211 and PHSX 212 General Physics I and II (recommended) (8) or	
PHSX 114 and PHSX 115 College Physics I and II (8)	8
CHEM 184 and CHEM 188 Foundations of Chemistry I and II	10
BIOL 150 Principles of Molecular and Cellular Biology (4) and	
BIOL 152 Principles of Organismal Biology (4)	8
EECS 128 Foundations of Information Technology: ____ (3) or	
EECS 138 Introduction to Computing: ____ (3) or	
C&PE 121 Introduction to Computers in Engineering (3)	3

Geology (50 hours)

GEOL 101 Introduction to Geology (3) and	
GEOL 103 Geology Fundamentals Laboratory (2)	5
GEOL 311 Mineralogy and Structure of the Earth	3
GEOL 331 Sedimentology and Surface Processes	4
GEOL 351 Environmental Geology	3
GEOL 360 Field Investigation	2
GEOL 521 Paleontology	3
GEOL 532 Stratigraphy	4
GEOL 541 Geomorphology	4
GEOL 552 Introduction to Hydrogeology	3
GEOL 560 Introductory Field Geology	3
GEOL 562 Structural Geology	4
GEOL 572 Geophysics	3
Additional courses to total at least 9 hours numbered 500 or above or other courses approved by adviser. Recommended:	9
GEOL 391 Special Studies in Geology: Water Resources (3)	
GEOL 535 Petroleum and Subsurface Geology (4)	
GEOL 715 Geochemistry (3)	
GEOL 751 Physical Hydrogeology (3)	
CE 770 Concepts of Environmental Chemistry (2) and	
CE 771 Environmental Chemical Analysis (1)	
GEOG 535 Introduction to Soil Geography (4)	
GEOG 558 Intermediate Geographical Information Systems (4)	
GEOL 753 Chemical Hydrogeology (3)	
BIOL 400 Fundamentals of Microbiology (3)	
C&PE 517 Reservoir Engineering I (4)	

Note: No more than 50 hours in geology may be counted toward the minimum 124 hours required for graduation.

Environmental Hydrogeology Track. Besides the general program above, a specialized track in hydrogeology satisfies degree requirements. In addition to College, supporting science, and geology courses, the environmental hydrogeology track requires the following mathematics and civil engineering/physics courses:

MATH 220 Applied Differential Equations (3) and	
MATH 290 Elementary Linear Algebra (2)	5
CE 330 Fluid Mechanics (4) or PHSX 623 Physics of Fluids (3)	3-4

Technical Electives (9 hours). These normally are chosen from courses numbered 500 or above in geology, physics, mathematics, chemistry, engineering or computer science. Courses numbered below 500 must be approved by a geology adviser.

Requirements for the B.S. Degree in Geology: Geophysics Option**College English and Principal Course Requirements** (21 hours)

ENGL 101, ENGL 102, and a third course as specified by the College of Liberal Arts and Sciences	9
Courses in humanities and social sciences	12
(At least 3 hours must be taken in each area. An introductory course in economics is recommended.)	

Chemistry, Mathematics, Computer Science, Engineering (28-31 hours)

EECS 138 Introduction to Computing: ____ (3) or demonstrate equivalent programming skills	0-3
CHEM 184 and CHEM 188 Foundations of Chemistry I and II	10
MATH 121 and MATH 122 Calculus I and II	10
MATH 223 Vector Calculus (3) and MATH 290 Elementary Linear Algebra (2) ..	5
MATH 320 Elementary Differential Equations	3

Physics (17 hours)

PHSX 211 and PHSX 212 General Physics I and II	8
PHSX 313 General Physics III	3
PHSX 521 Mechanics I	3
PHSX 531 Electricity and Magnetism	3

Geology (33 hours)

GEOL 101 Introduction to Geology (3) and GEOL 103 Geology Fundamentals Laboratory (2)	5
GEOL 311 Mineralogy and Structure of the Earth	3
GEOL 331 Sedimentology and Surface Processes	4
GEOL 360 Field Investigation	2
GEOL 512 Igneous and Metamorphic Petrology	3
GEOL 560 Introductory Field Geology	3
GEOL 562 Structural Geology	4
GEOL 572 Geophysics (3) or GEOL 573 Geodynamics and Plate Tectonics (3) ..	3
Two of these four courses in addition to geology courses above:	
GEOL 572 Geophysics (3)	
GEOL 573 Geodynamics and Plate Tectonics (3)	
GEOL 575 Seismic Exploration (3)	
GEOL 577 Environmental Geophysics (3)	

Technical Electives (9 hours). These normally are chosen from courses numbered 500 or above in geology, physics, mathematics, chemistry, engineering, or computer science. Courses numbered below 500 must be approved by a geophysics adviser.

Free Electives (12 hours)

Graduation Requirements. Students must earn a grade-point average of 2.0 in both physics and geology courses.

Summer Field Courses. All undergraduate degree programs require field courses during two summers. Students should plan to take GEOL 360 in the summer after completing the introductory course. GEOL 560 and GEOL 561 (if required by the program) ideally are taken in the summer between the junior and senior years. Substantial scholarship support is available for geology majors who enroll in those courses.

Requirements for the Minor. The minor requires 18 to 23 hours of geology courses, of which 12 hours must be junior/senior hours or higher (courses numbered 300 or above).

Required Courses

GEOL 101 Introduction to Geology (3) and GEOL 103 Geology Fundamentals Laboratory (2)	5
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Recommended Courses (necessary as prerequisites for many upper-division courses)

GEOL 311 Mineralogy and Structure of the Earth (3) or GEOL 331 Sedimentology and Surface Processes (4)	3-4
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Students must work with an adviser to select courses to complete the requirements for the minor. Students must turn in a signed Geology Minor Advising form and a Minor Declaration form to the department office, 120 Lindley Hall, before taking any courses numbered 500 or above.

Combined Degree Programs. A student may combine an interest in geology with a degree in business, education, or journalism.

Honors. The honors program increases interest in scholarship, offers the maximum intellectual challenge to superior students, and provides an opportunity for undergraduate research. A student may enter the program by invitation of the department

honors program committee or approval of an application to that committee. Information is available from the department chair or the undergraduate studies committee chair.

Scholarships

The department awards scholarships from its endowment to meritorious incoming or continuing students in geology. Scholarships also are awarded to students enrolled in Field Camp or Field Investigation. For information, contact the chair.

Career Opportunities

Opportunities include environmental geology, engineering geology, and hydrogeology, as well as the oil and minerals industries, research, and teaching. Practice as a professional geologist often requires course work and training beyond the baccalaureate level.

Licensure. Formal study of geology at an accredited college or university is a principal requirement for becoming licensed to practice geology. During the senior year, students who plan to become licensed geologists should take the Fundamentals of Geology examination, offered twice a year. Information on registration is available from the department office or from the Web site of the Kansas Board of Technical Professions, www.accesskansas.org/ksbtp. After passing the examination and after further practice, candidates can sit for the Practice of Geology examination to become licensed. Regulations for licensure may vary from state to state.

■ Geology Courses

GEOL 101 Introduction to Geology (3). NE N Introduction to the principles of earth science. Study of the formation, occurrence, and structure of minerals and rocks; action of streams, oceans, glaciers, and other agents in the formation and modification of the landscape; volcanism, earthquakes, and plate tectonics. This course with GEOL 103 satisfies the College laboratory science requirement. Concurrent enrollment in GEOL 103 is recommended for students taking both. LEC

GEOL 102 Introduction to Geology Honors (3). NE N Honors section of GEOL 101. An introduction to the principles of earth science. Study of the formation, occurrence, and structures of minerals and rocks; action of streams, oceans, glaciers, and other agents in the formation and modification of the landscape; mountain building volcanism, and earthquakes. Not open to students who have taken GEOL 101. This course with GEOL 103 satisfies the College laboratory science requirement. Concurrent enrollment in GEOL 103 is recommended for students taking both. LEC

GEOL 103 Geology Fundamentals Laboratory (2). N A course in geologic laboratory studies. This course plus GEOL 101 (Introduction to Geology), GEOL 102 (Introduction to Geology, Honors), GEOL 105 (History of the Earth), or GEOL 106 (History of the Earth, Honors) will satisfy the College laboratory science requirement. Gives students practical, hands-on experience with identifying earth materials (rocks, minerals, fossils) and understanding their relationships to earth processes, understanding topographic and geologic maps, interpreting results of surficial processes, and learning about deep-earth processes such as earthquakes. Includes short field trips to see geologic structures and results of local geologic processes. Prerequisite: Previous or concurrent enrollment in GEOL 101, GEOL 102, GEOL 105, or GEOL 106. LAB

GEOL 105 History of the Earth (3). NE N An introduction to the physical and biological history of the earth, the methods used to decipher earth history, and the development of the geological sciences. This course with GEOL 103 satisfies the College laboratory science requirement. Concurrent enrollment in GEOL 103 is recommended for students taking both. Not open to students who have taken GEOL 106 or GEOL 304. LEC

GEOL 106 History of the Earth Honors (3). NE N Honors section of GEOL 105. An introduction to the physical and biological history of the earth, the methods used to decipher earth history, and the development of the geological sciences. This course with GEOL 103 satisfies the College laboratory science requirement. Concurrent enrollment in GEOL 103 is recommended for students taking both. Not open to students who have taken GEOL 105 or GEOL 304. LEC

GEOL 121 Prehistoric Life: DNA to Dinosaurs (3). NB N An introduction to the history of life and the origin and evolution of animals and plants during the earth's long history. The fossil record is interpreted by applying both biological and geological principles. LEC

The Treatise on Invertebrate Paleontology, the standard national reference, is published by KU's Paleontological Institute.

KU's Isotope Geochemistry Laboratory is a leading center for studies of the history and evolution of the earth's crust.

GEOL 171 Earthquakes and Natural Disasters (3). NE N Addresses the subject of natural disasters with concentration on earthquake effects and their mitigation. Briefly treats volcanic eruptions, tidal waves, floods, global warming, severe weather, and catastrophic meteorite impacts from the perspective of geological and human significance. Provides a basic background into earth-science processes. LEC

GEOL 302 Oceanography (3). NE N Basic description of oceanography: description and discussion of the ocean as a dynamic system. Relationships between and dependence upon the interactions of submarine topography, water chemistry, wave action, and biota in understanding the ocean system. Review of part that humanity plays in perturbing the natural oceanic environment. Discussions of estuarine problems as related to the sea, cultural activities, and rivers. Prerequisite: An introductory science course. LEC

GEOL 304 Historical Geology (2). N A summary of the measurement of time, the history of life, and the earth's development and the tectonics and rock-forming episodes of North America. Not open to students who have taken GEOL 105, GEOL 106 or GEOL 121. Prerequisite: GEOL 101. LEC

GEOL 311 Mineralogy and Structure of the Earth (3). N Basic identification and properties of rocks and minerals in the context of whole-earth structure and evolution. Includes basic chemical equilibria for rock and mineral systems and their bearing on processes involved with formation and evolution of Earth's crust, mantle, and core. Two lectures and one lab per week. Prerequisite: GEOL 101, CHEM 125 or CHEM 184, and eligibility for MATH 121 or MATH 115. LEC

GEOL 312 Mineral Structures and Equilibria Laboratory (1). U A laboratory to accompany GEOL 311. Presents more rigorous analysis of the structures, compositions, and chemical equilibria governing the formation and stability of common rock-forming mineral systems. Prerequisite: GEOL 311 (may be taken concurrently), CHEM 125 or CHEM 184, and eligibility for MATH 121 or MATH 115. LAB

GEOL 315 Gemstones (3). N The properties, occurrence, description, determination, and mineral affinities of gems, ornamental stones, and gem materials. LEC

GEOL 331 Sedimentology and Surface Processes (4). N Physical, chemical, and biological processes in surface and near-surface environments applied to the recognition of the depositional environment, preservation, and alteration of sedimentary rocks. Field and laboratory study of sedimentary rocks with emphasis on interpretation of original depositional environments and alter processes affecting sedimentary rocks. Prerequisite: GEOL 101. LEC

GEOL 351 Environmental Geology (3). NE N An introductory course dealing with the implications of geologic processes and materials for civilization. Topics to be considered include: geologic hazards such as floods, landslides, earthquakes, and volcanism; the availability of water, mineral, and energy resources; and the environmental impact of resource utilization. The importance of recognizing geologic constraints in land use planning and engineering projects is emphasized and illustrated by examples. LEC

GEOL 360 Field Investigation (2). N Summer session. A field-geology course that provides beginning geology students with an initial understanding of the nature of geological evidence in the field, the breadth of geological phenomena, and the importance of the interplay of information from many geological disciplines in solving problems. Given at various geologically diverse locations. Fee. Prerequisite: GEOL 101. LEC

GEOL 391 Special Studies in Geology (1-6). N Special reports upon subjects in which students have a particular interest. Prerequisite: Fifteen hours of geology. IND

GEOL 399 Senior Honors Research (2-5). N Normally two to five hours in any one semester with a maximum of eight hours. An undergraduate research course, in any of the fields of geology, open by permission of the department to seniors in the College who have an average grade of B or higher in geology courses. Prerequisite: Thirty hours of geology, five of which may be taken concurrently with this course. IND

GEOL 512 Igneous and Metamorphic Petrology (3). N The study of minerals, rocks and fluids within the earth's crust and mantle to elucidate their mechanisms of formation and the pressure-temperature-composition conditions within the earth. The course emphasizes equilibrium thermodynamics, phase equilibria, fractionation mechanisms, tectonic control of petrogenesis, and quantitative analysis of mineral parageneses. Prerequisite: GEOL 311 and first semester calculus, or permission of instructor. LEC

GEOL 513 Petrology Laboratory (1). U A laboratory course to accompany GEOL 512. Material covered will include the use of the polarizing microscope in study of rocks in thin sections; identification of rock-forming minerals in thin section; study of textures as guides to the crystallization process; calculations of chemical changes during fractional crystallization and partial melting. Students will also make extensive study of igneous and metamorphic rocks in hand specimens, accompanied by thin section study, with emphasis on composition, texture, and structure. Students must co-enroll in GEOL 512. Prerequisite: GEOL 312. Concurrent enrollment in GEOL 512 required. LAB

GEOL 521 Paleontology (3). N A study of the structure and evolution of ancient life; the nature and diversity of life through time; the interactions of ancient organisms with their environments and the information that the study of fossils provides about ancient environments; the use of fossils to determine the ages of rocks and the timing of past events in earth history; and the patterns of extinction through time. (Same as BIOL 622.) Prerequisite: BIOL 100 or BIOL 152 or GEOL 105 or GEOL 304. LEC

GEOL 523 Paleontology Laboratory (1). U Laboratory course in the study of fossils with emphasis on the practice of paleontology and the morphology of ancient organisms. (Same as BIOL 623.) LEC

GEOL 528 The Biology and Evolution of Fossil Plants (3). N A lecture course in which fossil plants, protists and fungi are examined throughout geologic time. Emphasis will be directed at paleoecology, biogeography and the stratigraphic distribution and composition of ancient floras. (Same as BIOL 640.) Prerequisite: BIOL 413, or permission of instructor. LEC

GEOL 529 Laboratory in Paleobotany (1). U An examination of selected fossil plants throughout geologic time and the techniques used to study them; laboratory will include identification and the use of plant fossils in biostratigraphy. (Same as BIOL 641.) Prerequisite: BIOL 413 or permission of instructor. Must be taken concurrently with GEOL 528. LAB

GEOL 532 Stratigraphy (4). N A study of the principles of lithostratigraphy, biostratigraphy, and sequence stratigraphy. Methods of analysis of stratigraphic data focus on the interpretation of earth history. The stratigraphic record of North America is presented for evaluation of its geologic history. Three lectures and one laboratory per week. Required field trip. Prerequisite: GEOL 101, GEOL 521, and GEOL 331. LEC

GEOL 535 Petroleum and Subsurface Geology (4). N A general study of the occurrence, properties, origin, and migration of petroleum. Examples are studied of typical oil fields. Well logs, cuttings, subsurface maps and cross-sections are studied in the laboratory. Prerequisite: GEOL 331 or C&PE 527. LEC

GEOL 536 Geological Log Analysis (1). U Application of well logging measurements to interpretation subsurface. LEC

GEOL 541 Geomorphology (4). N A critical study of landforms in relation to tectonics, climatic environment, and geologic processes. The use of geomorphic methods in the interpretation of Cenozoic history is emphasized. Laboratory exercises in analysis of field observations, maps, and photographs. Required field trip and fee. (Same as GEOG 541). Prerequisite: GEOL 101 and GEOL 103, GEOG 104 and GEOG 105, or GEOL 304 and GEOL 103. LEC

GEOL 551 Engineering Geology (3). N Consideration of geologic factors affecting engineering projects. Topics include: techniques of site exploration, engineering properties of soil and rock, geologic conditions important in the design of major structures, and geologic information useful in land-use planning. Prerequisite: An introductory course in geology or consent of instructor. LEC

GEOL 552 Introduction to Hydrogeology (3). N Physical description of hydrogeologic media. Elementary groundwater hydraulics: analytical and graphical solutions for steady-state application. Well hydraulics and pumping tests. Basic groundwater geology. Effects of topography and geology on regional flow systems. Field and numerical delineation and analysis of groundwater flow systems and applications. Chemical characteristics of groundwaters and their relationship to aquifer geology and hydrology. Investigations of groundwater quality and contamination. Prerequisite: Two semesters each of calculus, physics, and chemistry. LEC

GEOL 560 Introductory Field Geology (3). N Summer session. The study of the principles of field geology and the application of field methods to solve geological problems. Includes use of topographic maps and aerial photographs for geological mapping, the study of stratigraphic methods by measuring sections, and working field trips to areas of regional geological interest. Given at the University of Kansas Geology Field Camp near Canon City, Colorado. Fee. Prerequisite: GEOL 360 and GEOL 562, or consent of instructor. FLD

GEOL 561 Field Geology (3). N Summer session. The application of the principles of field geology to solve complex geological problems in the field. Given at the University of Kansas Geology Field Camp near Canon City, Colorado, or at other sites as appropriate. Fee. Prerequisite: GEOL 560. FLD

GEOL 562 Structural Geology (4). N A study of primary and secondary rock-structures and their genesis. Includes techniques of structural analysis and introduces mechanics of rock deformations. Lectures, laboratory, and required field trip. Prerequisite: GEOL 311 and PHSX 111 or PHSX 114 or PHSX 211, and MATH 115 or MATH 121. LEC

GEOL 571 Natural Disasters (2-3). N Scientific assessment of natural disasters with concentration on earthquake effects and their mitigation. Briefly treats volcanic eruptions, tidal waves, floods, global warming, severe weather, and catastrophic meteorite impacts in a geological and human framework. A research paper or project is required. Prerequisite: An introductory course in a physical science. LEC

GEOL 572 Geophysics (3). N Introductory study of gravitational, magnetic, seismic, electrical, and thermal properties of the earth. Measurements, interpretation, and applications to exploration, earth structure, and global tectonics. Prerequisite: an introductory course in geology, MATH 116 or MATH 122, and PHSX 115 or PHSX 212. PHSX 115 or PHSX 212 may be taken concurrently. LEC

GEOL 573 Geodynamics and Plate Tectonics (3). N Study of physical processes in the solid Earth and of geophysical approaches to studying Earth systems at regional and global scales. Topics include global potential fields, thermal regime, rheology and Earth deformation, earthquakes and seismic structure, plate motions



The Kansas Geological Survey and the Kansas Department of Agriculture monitor levels at 1,400 water wells in 47 western and central Kansas counties, helping farmers and local officials manage important water resources such as the Ogallala Aquifer.

Students in all areas are eligible for Undergraduate Research Awards. Contact the University Honors Program, www.honors.ku.edu, for information.

and global tectonics. (Same as PHSX 528.) Prerequisite: An introductory course in geology, MATH 116 or MATH 122, and PHSX 115 or PHSX 212 or PHSX 214. LEC

GEOL 575 Seismic Exploration (3). N Application of seismic reflection and refraction techniques to the description of near-surface geology and the exploration for energy and mineral resources. Theory of seismic information, data collection, data processing using computers, and geologic interpretation. Prerequisite: A course in computer programming, either FORTRAN or C, which may be taken concurrently. An introductory geophysics course, such as GEOL 572. LEC

GEOL 576 Potential Fields Exploration (3). N Use of gravity, magnetic, and electrical signals in the exploration for energy and mineral resources. Elementary potential field theory, data collection methods, data analysis, and interpretation using computers. Prerequisite: A course in computer programming, either FORTRAN or C, which may be taken concurrently. An introductory geophysics course, such as GEOL 572. LEC

GEOL 577 Environmental Geophysics (3). Application of the methods of geophysical exploration to evaluate, mitigate, and prevent environmental problems below the surface of the earth. Development of fundamental principles and discussion of environmental case histories using seismic, gravity, magnetic, electromagnetic, electrical, and radar methods. Prerequisite: An introductory course in geology, MATH 116 or MATH 122, and PHSX 115 or PHSX 212. LEC

GEOL 591 Topics in Geology: _____ (1-5). N May include lectures, discussions, readings, laboratory, and field work in geology. Will be given as needed. May be taken more than once. LEC

GEOL 711 X-ray Analysis (1-2).

GEOL 712 Microstructures and Petrofabrics (3).

GEOL 713 Advanced Petrology (1).

GEOL 714 Thermochronology (3).

GEOL 715 Geochemistry (3).

GEOL 716 Geologic Thermodynamics (2).

GEOL 717 Geochronology (2-4).

GEOL 718 Stable Isotope Geochemistry (1-3).

GEOL 721 Micropaleontology (3).

GEOL 722 Paleocology (3).

GEOL 723 Paleontology Museum Apprenticeship (1-6).

GEOL 724 Paleobiogeography (3).

GEOL 725 Paleontology of Lower Vertebrates (3).

GEOL 726 Paleontology of Higher Vertebrates (3).

GEOL 727 Macroevolution (3).

GEOL 728 Paleopedology (3).

GEOL 729 Ichnology (3).

GEOL 731 Terrigenous Depositional Systems (4).

GEOL 732 Carbonate Depositional Systems (3).

GEOL 741 Advanced Geomorphology (1-3).

GEOL 751 Physical Hydrogeology (3).

GEOL 752 Field and Laboratory Hydrogeology (3).

GEOL 753 Chemical Hydrogeology (3).

GEOL 754 Contaminant Transport (3).

GEOL 761 Regional Field Geology (1-5).

GEOL 763 Tectonics and Regional Geology (3).

GEOL 771 Advanced Geophysics: _____ (1-3).

GEOL 772 Geophysical Data Analysis (3).

GEOL 773 Seismology (3).

GEOL 774 Finite Difference Methods for Geophysics (2-3).

GEOL 775 Near-surface Seismology (3).

GEOL 780 Conservation Principles and Practices (3).

GEOL 781 Introduction to Museum Exhibits (3).

GEOL 782 The Nature of Museums (3).

GEOL 783 Museum Management (3).

GEOL 784 Introduction to Museum Public Education (3).

GEOL 785 Principles and Practices of Museum Collection Management (3).

GEOL 791 Advanced Topics in Geology: _____ (1-5).

Germanic Languages and Literatures

Chair: William Keel, german@ku.edu

Wescoe Hall, 1445 Jayhawk Blvd., Room 2080

Lawrence, KS 66045-7590, www2.ku.edu/~germanic, (785) 864-4803

Degrees offered: B.A., M.A., Ph.D.

Why study Germanic languages and literatures? Because understanding the language, literature, and culture of Central Europe is essential for our history and our future.

The study of German language, literature, and culture enables students to develop skills in reading, writing, speaking,

and understanding German as well as the structure of language in general and introduces students to one of the world's great literatures. A knowledge of German is useful for careers in business, journalism, and education or graduate work in the arts and sciences. Students interested in the future of Central and Eastern Europe find a knowledge of German essential. The department also offers the four-semester proficiency sequence in a Scandinavian language (Swedish, Danish, or Norwegian), in Dutch, in Hungarian, and in Yiddish.

Courses for Future Teachers

Candidates for the B.S. in education majoring or minoring in German should see the School of Education chapter of this catalog.

Placement

Students beginning the study of German at KU should take GERM 104. Students with high school German who attend orientation may take a placement test and see a placement adviser. Upon request, the department can give a placement test to other students who seek advice about initial enrollment in German.

Retroactive Credit. Students with no prior college or university German course credit are eligible for retroactive credit according to the following formula:

Three hours of retroactive credit are awarded to a student with two or three years of high school German who enrolls initially at KU in a third-level German course (GERM 212) and receives a grade of C or higher.

Six hours of retroactive credit are awarded to a student with three or four years of high school German who enrolls initially at KU in a fourth-level German course (GERM 216) and receives a grade of C or higher.

Nine hours of retroactive credit are awarded to a student with four years of high school German who enrolls initially at KU in a German course with a fourth-level course as a prerequisite and receives a grade of C or higher.

Advanced Placement. See Advanced Placement under Undergraduate Admission and Scholarships in the General Information chapter of this catalog.

Credit by Examination. See Credit by Examination in the General Regulations chapter of this catalog.

Native Speakers. Students who have completed secondary education in a German-speaking country are not eligible to enroll in German courses below the 500 level. The department disenrolls such students.

Honors Courses

Special honors sections such as GERM 105, GERM 109, GERM 213, and GERM 217 are offered in the basic language program.

Majors

First- and Second-year Preparation. GERM 104, GERM 108, GERM 212, and GERM 216 should be completed as early as possible.

Requirements for the B.A. Major. In addition to the College language requirement, the German major requires 30 hours in courses numbered 300 and above. After completion of the basic language requirement (GERM 216 or equivalent), prospective majors must complete four required intermediate core courses: two intermediate composition courses selected from GERM 340, GERM 344, and GERM 348; and two introductory literature courses selected from GERM 400, GERM 408, and GERM 416. In addition to the intermediate core courses (12 hours), 15 hours of course work at the 500 level and above are required. Included among these 15 hours must be 6 hours of literature. Students complete the required 30 hours with one additional elective from any course numbered 300 or above.