

Deledda, Vittorini, Moravia, Pavese, Pratolini, Buzzati, Ginzburg, and Calvino. Prerequisite: ITAL 240 or reading knowledge of Italian or permission of instructor. LEC

ITAL 466 19th- and 20th-century Novels II (3). H/W See ITAL 465. Prerequisite: ITAL 240 or reading knowledge of Italian or permission of instructor. LEC

ITAL 495 Directed Readings in Italian (1-3). U May be taken more than once, total credit not to exceed nine hours. Various fields of Italian literature. Prerequisite: Consent of instructor, given only to those having demonstrated ease in reading Italian. IND

ITAL 499 Honors in Italian (3). H Various topics in Italian literature or culture. Minimum of three hours of Italian 499 required for a B.A. with Honors in the Italian option of the French degree. Students must discuss Honors eligibility and their topic with a faculty member before enrolling. Honors paper must be written in Italian. LEC

ITAL 502 Dante's Divine Comedy I (3). H/W Detailed study of Dante's masterpiece. Attention will also be given to such matters as the development of the Italian language at Dante's period and the relation of the Comedy to Dante's other works. Prerequisite: Reading knowledge of Italian. LEC

ITAL 503 Dante's Divine Comedy II (3). H/W Continuation of ITAL 502. Prerequisite: Completion of ITAL 502. LEC

ITAL 695 Studies in Italian Literature (1-3). U May be taken more than once, total credit not to exceed nine hours. Directed readings, conferences with instructor. Prerequisite: ITAL 495 or consent of instructor. IND

Genetics

Students may concentrate in genetics by seeking a B.S. degree in biology. See Biology Undergraduate Program in this chapter of the catalog.

Geography

Chair: Terry Slocum

Associate Chair: Johannes Feddema

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

Why study geography? Because people, places, and environments interact and evolve in a changing world.

Geography integrates information from a variety of sources to study the nature of culture areas, the emergence of physical and human landscapes, and problems of interaction between people and the environment. Mapping and other techniques for gathering and displaying spatial information are integral parts of the field.

Courses for Nonmajors

All geography courses below the 500 level are open to nonmajors, as are several above that level.

Majors

The B.A., B.G.S., and B.S. in geography provide general liberal arts enrichment, preparation for graduate work, and training for careers in geography and related fields. Geography may be combined with another program as a double major, or courses in another area may simply be added to those in geography.

First- and Second-year Preparation. Students should begin the major by meeting the core requirements and preparing for major courses.

Requirements for the B.A. or B.G.S. Major. Students electing a B.A. or B.G.S. degree program must meet all College principal course distribution and course requirements. The following minimum core of 15 to 16 hours, which must include specified courses, is required of all B.A. and B.G.S. majors in geography.

Core Requirements (15 hours)

- GEOG 100 World Regional Geography (3) **or**
- GEOG 101 World Regional Geography, Honors (3) **or**
- another course in regional geography (3) 3
- GEOG 104 Principles of Physical Geography (3) **or**
- GEOG 107 Principles of Physical Geography, Honors (3) 3
- GEOG 105 Introductory Laboratory in Physical Geography 2
- GEOG 102 Principles of Human Geography (3) **or**
- GEOG 103 Principles of Human Geography, Honors (3) 3

- GEOG 111 Maps and Mapping (4) **or**
- GEOG 311 Map Conception and Development (4) **or**
- GEOG 316 Methods of Analyzing Geographical Data (4) **or**
- GEOG 358 Principles of Geographic Information Systems (4) 4

In addition to the core, 15 hours must be selected from at least three of the following four groups:

Physical Studies

- GEOG 148 Scientific Principles of Environmental Studies
- GEOG 304 Environmental Conservation
- GEOG 321 Climate & Climate Change
- GEOG 331 Regional Geomorphology of the United States
- GEOG 338 Introduction to River Systems
- GEOG 339 Topics in Physical Geography: _____
- GEOG 350 Physical Geography of Africa
- GEOG 410 Human Biogeography, Honors
- GEOG 521 Microclimatology
- GEOG 531 Topics in Physical Geography: _____
- GEOG 532 Geomorphology
- GEOG 535 Introduction to Soil Geography
- GEOG 536 Landscape Ecology
- GEOG 537 Elements of Plant Geography
- GEOG 541 Geomorphology
- GEOG 731 Topics in Physical Geography: _____
- GEOG 735 Soil Genesis, Classification, & Distribution
- GEOG 741 Advanced Geomorphology
- GEOG 749 Topics in Stable Isotopes in the Natural Sciences: _____

Geographic Information Science

- GEOG 111 Maps & Mapping
- GEOG 210 Computers, Maps, & Geographical Analysis
- GEOG 311 Map Conception & Development
- GEOG 316 Methods of Analyzing Geographical Data
- GEOG 319 Topics in Techniques: _____
- GEOG 357 History and Philosophy of Geographic Information Science
- GEOG 358 Principles of Geographic Information Systems
- GEOG 418 Internship in Production Cartography
- GEOG 433 Biogeography Field & Laboratory Techniques
- GEOG 458 Geographic Information Systems: _____
- GEOG 510 Human Factors
- GEOG 511 Intermediate Cartography: _____
- GEOG 513 Cartographic Design
- GEOG 514 Visualizing Spatial Data
- GEOG 516 Applied Multivariate Analysis in Geography
- GEOG 517 Data Handling & Map Symbolization
- GEOG 519 History of Cartography
- GEOG 526 Remote Sensing of Environment I
- GEOG 558 Intermediate Geographical Information Systems
- GEOG 573 Advanced Geographic Analysis
- GEOG 658 Topics in Geographic Information Science: _____
- GEOG 711 Advanced Cartography: _____
- GEOG 713 Practicum in Cartography
- GEOG 714 Field Experience
- GEOG 716 Advanced Geostatistics
- GEOG 726 Remote Sensing of Environment II
- GEOG 733 Advanced Biogeography Field & Laboratory Techniques
- GEOG 758 Geographic Information Science

Human Studies

- GEOG 375 Intermediate Human Geography
- GEOG 377 Urban Geography
- GEOG 379 Topics in Cultural Geography: _____
- GEOG 515 Behavioral Systems
- GEOG 551 Intermediate Economic Geography
- GEOG 552 Topics in Urban/Economic Geography: _____
- GEOG 556 Geography of the Energy Crisis
- GEOG 557 Cities & Development
- GEOG 570 Geography of American Indians
- GEOG 571 Topics in Cultural Geography: _____
- GEOG 572 Political Geography
- GEOG 575 Geography of Population
- GEOG 576 Cultural Geography of the United States
- GEOG 579 Geography of American Foodways
- GEOG 657 Geographic Models
- GEOG 670 Cultural Ecology
- GEOG 719 Development of Geographic Thought
- GEOG 752 Topics in Urban/Economic Geography: _____
- GEOG 756 Energy Problems & the Economic-physical Environment
- GEOG 771 Topics in Cultural Geography: _____
- GEOG 772 Problems in Political Geography
- GEOG 773 Humanistic Geography
- GEOG 775 Proseminar in Population Geography

Regional Studies

- GEOG 100 World Regional Geography
- GEOG 351 Africa's Human Geographies
- GEOG 390 Geography of the United States & Canada
- GEOG 396 China's Geographies
- GEOG 397 Geography of Kansas & the Plains
- GEOG 399 Topics in Regional Studies: _____

GEOG 550 Environmental Issues in Africa
 GEOG 553 Geography of African Development
 GEOG 591 Geography of Latin America
 GEOG 592 Middle American Geography
 GEOG 593 Central American Peoples & Lands
 GEOG 594 Geography of the Former Soviet Union
 GEOG 595 Geography of Eastern Europe
 GEOG 596 Geography of China
 GEOG 597 Geography of Brazil
 GEOG 790 North American Regions: _____
 GEOG 791 Latin American Regions: _____
 GEOG 794 Regions of the Former U.S.S.R.
 GEOG 795 European Regions: _____
 GEOG 796 Asian Regions: _____

Courses with a _____ at the end of their titles are typically topics or seminar courses that may be repeated for credit. Usually these courses offer different topics each time they are taught. Students should check with the course instructor about the requirements to take the course and what the topic will be when it is offered.

Requirements for the B.S. Degree. B.S. students must select one of the options below (physical geography or geographical information and analysis). A total of 124 credit hours is required, of which 45 must be junior/senior hours, 30 must be KU residence hours, no more than 64 may be community college transfer hours, no more than 6 may be music organization hours, and no more than 4 may be physical education hours. An overall grade-point average of 2.0 is required, with an average of 2.0 in geography junior/senior courses.

B.S. Physical Geography Option. General Requirements

English (ENGL 101 or exemption) 0-3
 ENGL 102 (or ENGL 105 or exemption) 0-3
 200-level English course or above (ENGL 362 recommended) 3
 COMS 130 (COMS 230, PHIL 148, PHIL 310, or exemption) 0-3
 History or philosophy of science 3
 (Choose one of the following or consult undergraduate committee for approval of alternatives: HIST 103, HIST 136, HIST 305, HIST 306, HIST 311, HIST 347, HIST 360, HIST 407, PHIL 370, PHIL 375, PHIL 380, PHIL 620, PHIL 622)
 Two principal courses in the humanities 6
 Two principal courses in the social sciences 6

Preparation for the Major

MATH 121 and MATH 122 Calculus I and II (recommended) (10) **or**
 MATH 115 and MATH 116 Calculus I and II (6) 6-10
 PHSX 211 and PHSX 212 General Physics I and II (recommended) **or**
 PHSX 114 and PHSX 115 College Physics I and II 6-8
 BIOL 152 Principles of Organismal Biology (4) and
 BIOL 414 Principles of Ecology (3) 7
 CHEM 184 and CHEM 188 Foundations of Chemistry I and II 10
 EECS 128 Foundations of Information Technology: _____ or equivalent 3

Geography Requirements: Overview Courses

GEOG 104 Principles of Physical Geography (3) **or**
 GEOG 107 Principles of Physical Geography, Honors (3) 3
 GEOG 105 Introductory Laboratory in Physical Geography 2
 GEOG 100 (or GEOG 101) World Regional Geography (3) **or**
 GEOG 102 (or GEOG 103) Principles of Human Geography (3) 3

Geography Requirements: Foundation Courses

1. Physical: Choose **three** of the following: 9-10
 GEOG 304 Environmental Conservation
 GEOG 321 Climate and Climate Change
 GEOG 331 Regional Geomorphology of the United States
 GEOG 338 Introduction to River Systems
 GEOG 535 Introduction to Soil Geography
 2. Techniques: The following are required: 12
 GEOG 316 Methods of Analyzing Geographical Data
 GEOG 358 Principles of Geographic Information Systems
 GEOG 526 Remote Sensing of Environment I
 3. Field Experience: Choose **one** of the following: 3-4
 EVRN 460 Field Ecology
 GEOG 433 Biogeography Field and Laboratory Techniques
 GEOG 714 Field Experience

Geography Requirements: Elective Courses

Six additional hours from the physical geography course list (300 level or above) 6

Six additional hours of geography (any group, 300 level or above) 6
 Six additional hours in an allied field (e.g., ATMO, BIOL, EVRN, or GEOL) approved by geography adviser..... 6

Requirements for the B.S. Geographical Information and Analysis Option.

General Requirements

English (ENGL 101 or exemption) 0-3
 ENGL 102 (or ENGL 105 or exemption) 0-3
 200-level English course or above (ENGL 362 recommended) 3
 COMS 130 (COMS 230, PHIL 148, PHIL 310, or exemption) 0-3
 History or philosophy of science 3
 (Choose one of the following or consult undergraduate committee for approval of alternatives: HIST 103, HIST 136, HIST 305, HIST 306, HIST 311, HIST 347, HIST 360, HIST 407, PHIL 370, PHIL 375, PHIL 380, PHIL 620, PHIL 622)
 Two principal courses in the humanities 6
 Two principal courses in the social sciences 6

Preparation for the Major

MATH 121 and MATH 122 Calculus (10) **or**
 MATH 115, MATH 116, and MATH 122 Calculus (11) 10-11
 EECS 138 Introduction to Computing: _____ **or**
 GEOG 514 (Visualizing Spatial Data) or equivalent 3-4
 PHSX 114 and PHSX 115 or BIOL 150 and BIOL 152 8

Geography Requirements: Core Courses

GEOG 104 (or GEOG 107) Principles of Physical Geography (3) **or**
 GEOG 148 (or GEOG 149) Scientific Principles of Environmental Studies (3) 3
 GEOG 111 Maps and Mapping (4) **or**
 GEOG 210 Computers, Maps, and Geographical Analysis (3) 3
 GEOG 100 (or GEOG 101) World Regional Geography (3) **or**
 GEOG 102 (or GEOG 103) Principles of Human Geography (3) 3

Geography Requirements: Additional Geography

Two 300-level or above courses in physical studies, human studies, and/or regional studies 6

Geography Requirements: Core Geographic Information Science

Six courses, at least one from each category: 20-24
 Cartography and Visualization: GEOG 311, GEOG 513, GEOG 517
 Geographical Information Systems: GEOG 358, GEOG 558, GEOG 758
 Remote Sensing: GEOG 526, GEOG 726
 Statistics: GEOG 316, GEOG 516, GEOG 716

Geography Requirements: Geographic Information Science Electives

Two other courses from geographic information science 6-8

Allied Field. Three courses and 9 hours minimum in one field (or a minor):

area studies, atmospheric science, biology, computer science, design, environmental studies, engineering, geology, psychology, urban planning ... 9
Electives (17 to 26 credit hours). Any university courses 17-26

Requirements for the Minor. The department offers two minors. The first is a general minor in geography. The second is specifically designed to give students a background in geographic information science. Students should carefully consider which minor best meets their academic goals before choosing one.

The **Minor in Geography** requires 18 hours of geography courses with at least 12 hours numbered 300 or above and a minimum grade-point average of 2.0 in courses taken for the minor.

The **Minor in Geographic Information Science** requires 18 hours including (1) GEOG 111 or GEOG 210, and GEOG 316 and GEOG 358; (2) three additional courses from the Geographic Information Science group (300-level or above); and (3) a minimum grade-point average of 2.0 in courses taken for the minor.

Honors. To be accepted as a candidate for honors, a major must have completed at least 9 hours of upper-division credit in geography with a grade-point average of 3.5 in all geography courses and of at least 3.25 overall. In addition to outstanding work in geography, the program requires GEOG 499, an independent study course consisting of an honors paper. The student presents the results of this paper in an oral examination to a committee of at least two faculty members, normally from the geography department, chaired by the GEOG 499 supervisor. To graduate with honors, the student must complete the paper and the examination and maintain the 3.5 and 3.25 grade-point averages.

Geography offers Bachelor of Science options in physical geography and geographical information and analysis.

Visit KU online at www.ku.edu.

Career Opportunities

A major in geography may lead to a career in cartography, environmental analysis, physical geography, regional analysis, urban and regional planning, or to work that requires some combination of geographic subfields. For general questions, see the undergraduate coordinator. For career counseling, see these professors:

Atmospheric Science: Donna Tucker, 404 Lindley; David Braaten, 413C Lindley; Nate Brunzell, 417 Lindley; Richard McNulty, 413A Lindley; David Mechem, 117A Lindley; Kees van der Veen, 203 Lindley

Cartography: George McCleary, 219 Lindley; Terry Slocum, 215 Lindley

GIS: Xingong Li, 409 Lindley; Terry Slocum, 215 Lindley; George McCleary, 219 Lindley; Stephen Egbert, 217C Lindley; Jerome Dobson, 214 Lindley

Human and Cultural Geography: Pete Shortridge, 219 Lindley; Garth Myers, 201 Lindley; Chris Brown, 223 Lindley; Peter Herlihy, 202 Lindley; Shannon O’Lear, 219B Lindley; So-Min Cheong, 221 Lindley

Physical and Environmental Geography: William Johnson, 420 Lindley; Johannes Feddema, 204 Lindley; Kees van der Veen, 203 Lindley

Regional Geography and Area Studies: Chris Brown, 223 Lindley; Shannon O’Lear, 219B Lindley; So-Min Cheong, 221 Lindley; Peter Herlihy, 202 Lindley; Garth Myers, 201 Lindley

Remote Sensing/Environmental and Land-use Analysis: Stephen Egbert, 217C Lindley; Jerome Dobson, 214 Lindley

■ **Geography Courses**

GEOG 100 World Regional Geography (3). SC S An introductory survey of the environmental setting, historically formative periods, and present-day issues that distinguish the major culture areas of the world. LEC

GEOG 101 World Regional Geography, Honors (3). SC S An introductory survey of the environmental setting, historically formative periods, and present-day issues that distinguish the major culture areas of the world. Open only to students in the College Honors Program, or by consent of instructor. LEC

GEOG 102 Principles of Human Geography (3). SC S An examination of the relationships between humans and their environments. The course introduces students to basic concepts in human geography relating to economic activities, landscapes, languages, migrations, nations, regions, and religions. Serves as the basis for further course work in cultural, economic, political, population, and urban geography. LEC

GEOG 103 Principles of Human Geography, Honors (3). SC S An introduction to how human societies organize space and modify the world about them. Resultant patterns on the landscape are interpreted through principles of space perception, cultural ecology, diffusion, land use, and location theory. Comparisons are made between urban and rural areas and between subsistence and commercial societies. Open to students who have been accepted into the College Honors Program. LEC

GEOG 104 Principles of Physical Geography (3). NE N The components of the physical environment are discussed in order to familiarize the student with their distributions and dynamic nature. Major topics include the atmosphere, landforms, soils, and vegetation together with their interrelationships and their relevance to human activity. This course and GEOG 105 together satisfy the laboratory science requirement. Both courses are required for geography majors. LEC

GEOG 105 Introductory Laboratory in Physical Geography (2). N A laboratory course designed to complement GEOG 104 in satisfying the laboratory science requirement. It is required for geography majors. Laboratory exercises include a wide variety of analyses using data on the atmosphere, hydrosphere, biosphere, and lithosphere. Prerequisite: GEOG 104, which may be taken concurrently. LAB

GEOG 107 Principles of Physical Geography, Honors (3). NE N Interactive processes among the systems of the earth are studied and discussed. Major topics include vegetation, soils, landforms, water, the atmosphere, and cycles of matter between these portions of the earth. The course includes lectures and critical discussions to address study problems in physical geography. Open only to students in the University Honors Program or by consent of the instructor. LEC

GEOG 111 Maps and Mapping (4). H How do people find their way from here to there or just around? Simple—they use maps. Maybe not maps on pieces of paper but maps in their heads: mental maps. Different people have different maps, even of the same place. Mapping is an ancient form of communication and maps have created ideas and opinions, promoted understanding and confusion. A non-technical approach to the transformation of space onto maps, to their content and structure, and their role and impact in human activity, past and present. Neither background in geography nor artistic skills are required. LEC

GEOG 148 Scientific Principles of Environmental Studies (3). NB N This course presents an overview of our understanding of environmental processes and issues. Topics include scientific principles, resource issues, pollution and global change, among others. This course gives students a rigorous understanding of interactions between humans and their environment and provides students with a scientific basis for making informed environmental decisions. (Same as EVRN 148.) LEC

GEOG 149 Scientific Principles of Environmental Studies, Honors (3). NB N This course presents an overview of our understanding of environmental processes and issues. Topics include scientific principles, resource issues, pollution and global change, among others. This course gives students a rigorous understanding of interactions between humans and their environment and provides students with a scientific basis for making informed environmental decisions. An honors section of GEOG 148 designed for superior students. (Same as EVRN 149.) Prerequisite: Membership in the University Honors Program or approval of instructor required. LEC

GEOG 150 Environment, Culture, and Society (3). S An introduction to geographic approaches to the study of the environment, emphasizing societal and cultural factors that influence human interaction with the biosphere, hydrosphere, lithosphere, and atmosphere. The course involves analysis of a broad range of contemporary environmental issues from the local to global scales. (Same as EVRN 150.) LEC

GEOG 210 Computers, Maps, and Geographical Analysis (3). N This course will introduce students to a number of different methods for the visualization, representation, and analysis of geographical phenomena. Both field and computer-based techniques will be employed to demonstrate the concept of experimental design and the collection, processing, and analysis of geographical data. Topics include: 1) the unique nature of geographic data; 2) mapping techniques and technologies; 3) geographical information systems; 4) remote sensing (aerial photography and satellite imagery); and 5) methods of geographical analysis (e.g., statistic and spatial modeling). LEC

GEOG 304 Environmental Conservation (3). NE N A survey of current methods of describing and modeling the function, structure, and productivity of natural and anthropogenically modified earth resource systems, along with a discussion of contemporary views of what constitutes a natural landscape. Fundamental natural science principles about the interplay among lithospheric, atmospheric, hydrospheric, and biospheric components of earth systems are emphasized. Uses of natural resources, including fossil fuels, minerals, and water are described with attention to the earth’s total energy budget. Human activities that affect preservation, conservation, and multiple uses of earth regions receive attention. Systems under stress through population and other contemporary forces serve as examples. (Same as EVRN 304.) LEC

GEOG 311 Map Conception and Development (4). N An examination of the map process with emphasis on two areas: 1) the mental map formed during interaction with the environment and 2) the map as a physical object which emerges from mapping activity. A local area will serve as the laboratory/environment for the mapping activity including production and use. LEC

GEOG 316 Methods of Analyzing Geographical Data (4). N Introduces the benefits and limitations of using quantitative methods to analyze geographical problems. Covers traditional descriptive (e.g., measures of central tendency) and inferential statistics (e.g., hypothesis testing) but also inherently geographical approaches such as shape and point pattern analysis, and spatial autocorrelation. Laboratory emphasizes using the computer to explore and analyze geographical problems. LEC

GEOG 319 Topics in Techniques: _____ (1-3). N An investigation of special topics in Techniques. May include course work in cartography, GIS, or remote sensing. May be repeated if topic differs. LEC

GEOG 321 Climate and Climate Change (3). N This course is designed to introduce students to the nature of the Earth’s physical climate. It introduces the basic scientific concepts underlying our understanding of our climate system. Particular emphasis is placed on energy and water balances and their roles in evaluating climate change. The course also evaluates the impact of climate on living organisms and the human environment. Finally, past climates are discussed and potential future climate change and its impact on humans is evaluated. (Same as ATMO 321.) Prerequisite: ATMO 105 or GEOG 104. LEC

GEOG 331 Regional Geomorphology of the United States (3). N This course examines forces and processes affecting the earth’s surface, and furthermore identifies and describes the physiographic regions that are the result of these processes. Special efforts are made to explore various photographic resources, satellite imagery, and internet sources or geomorphic data from a regional perspective since there is no wholly satisfactory text available for the course. A research paper is required. Prerequisite: An introductory earth science course or consent of instructor. LEC

GEOG 332 Glaciers and Landscape (3). N Elements from glaciology, geology, and climatology are merged to examine the interactions between glaciers and their natural environments, including the processes involved in glacier formation, the relationship between glaciers and climate, the mechanisms of glacier flow, and interpretation of the Earth’s glacial record. Emphasis is placed on an interdisciplinary approach to study environmental change and paleoclimate reconstruction. Prerequisite: GEOG 104 or GEOL 101, or consent of instructor. LEC

GEOG 338 Introduction to River Systems (3). N A course of fluvial geomorphology. Topics include the drainage basin, fluvial processes, river channel adjustment and forms, human disturbance and geomorphic response, and research methods in fluvial geomorphology. Field trip. Prerequisite: GEOG 104. LEC

GEOG 339 Topics in Physical Geography: _____ (1-3). N An investigation of special topics in Physical Geography. May include course work under headings of soils, vegetation, climate, or geomorphology. May be repeated if topic differs. LEC

GEOG 350 Physical Geography of Africa (3). N This course is a survey of the basic physical features of the African continent including structure and relief, rivers and lakes, soils and mineral resources. It includes characteristics and processes of African climates, and the ecology of Africa’s four major biomes: tropical rain forest, savanna, steppe, and desert. Climatic and environmental variations of the past, emergence of humankind, and development of pastoral and farming systems are discussed. Contemporary environmental concerns also include deforestation and desertification, the impacts of drought, methods for monitoring African environments, and Africa’s prospects in a 21st century suffering from global warming. (Same as AAAS 350.) LEC

GEOG 351 Africa’s Human Geographies (3). NW S/W An introduction to historical, cultural, social, political, and economic issues in Africa from a geographic perspective. The course begins with the historical geography of humanity in Africa, from ancient times through to the present. Other topics include cultural dynamics, demography, health, rural development, urbanization, gender issues, and political geography. Case studies from Eastern and Southern Africa will be used to illustrate major themes. (Same as AAAS 351.) LEC

GEOG 357 History and Philosophy of Geographic Information Science (3). N An examination of the development of geographic information science (GISci) from its roots in traditional geography, cartography, and remote sensing to modern geographic infor-

mation systems (GIS). GIS is explored as a new scientific instrument, a “macroscope” for representing and analyzing complex earth processes, both physical and cultural. The societal benefits and risks of GIS are demonstrated and discussed. LEC

GEOG 358 Principles of Geographic Information Systems (4). N An introduction to computer-based analysis of spatial data. Covers basic principles of collecting, storing, analyzing, and displaying spatial data. Emphasis is on problem-solving activities using common spatial analytical techniques (e.g., map overlay). The student will gain extensive hands-on experience with state-of-the-art GIS software. LEC

GEOG 375 Intermediate Human Geography (3). S An examination of processes of cultural-economic interaction and patterns of human activity on a global scale. The topics cover the whole spectrum of human geography, with focus on urban-economic development, innovation and diffusion, and trade. Each week the third hour will be devoted to discussion of topics dealt with in lectures presented during the first two hours. Prerequisite: Introductory course in Geography or consent of the instructor. LEC

GEOG 377 Urban Geography (3). S This course explores the city from the multiple perspectives of its inhabitants. The cultural viewpoints of place, gender, age, and ethnicity are stressed. Traditional topics such as urban hierarchy, functions of the city, suburbanization, and ongoing changes in core and peripheral areas also receive attention. The distinctive landscapes of individual North American cities are emphasized, but examples also are drawn from throughout the world. LEC

GEOG 379 Topics in Cultural Geography: ____ (1-3). S An investigation of special topics in Cultural Geography. May include course work under headings of culture theory, material culture, language, foodways, or religion. May be repeated if topic differs. LEC

GEOG 390 Geography of the United States and Canada (3). S A study of the different physical, economic, and cultural settings in the United States and Canada which form the basis for the various forms of livelihood. Emphasis on the United States. (Same as AMS 390.) Prerequisite: An introductory geography course or background in the United States or Canadian history, social science, or culture or consent of instructor. LEC

GEOG 395 Environmental Issues of: ____ (3). S This regional geography course examines contemporary environmental issues of a particular region of the world based on the expertise of the professor. Course emphasis is on the interaction of natural, socio-economic, and cultural factors of development that give rise to environmental problems. Students learn how local, national, and international government and non-governmental stakeholders address environmental problems. Course may be repeated with different professors. LEC

GEOG 396 China's Geographies (3). NW S/W An appreciation of how China and the Chinese way of life has evolved. Confucianism, Buddhism, Taoism, and Communism are examined as the bases of Chinese culture values. These values are then set against a highly varied physical and economic landscape to show how an elaborate and complex society has come into being. Contemporary developments are discussed only as a part of the entire spectrum of Chinese history. No prerequisite required. LEC

GEOG 397 Geography of Kansas and the Plains (3). S A study of the different physical, economic, and cultural settings in Kansas and the Plains that form the basis for various kinds of livelihood. LEC

GEOG 399 Topics in Regional Studies: ____ (1-3). S An investigation of special topics in Regional Studies. May include course work related to a specific country or region. May be repeated if topic differs. LEC

GEOG 410 Human Biogeography, Honors (3). N Principles of evolution and earth change are used to examine distributions of human populations, wealth, and resources. Readings from the current literature will be included. Lecture and discussion. (Same as BIOL 410.) Prerequisite: BIOL 152 or 153 or GEOG 107 and membership in the University Honors Program or consent of instructor. LEC

GEOG 418 Internship in Production Cartography (1-3). N Theory and practice of producing maps and other related graphics using photo-mechanical and automated techniques. Involves a weekly consultation session and laboratory time in K.U. Cartographic Services. Prerequisite: Completion of GEOG 311 with a grade of “B” or better and consent of instructor. LEC

GEOG 433 Biogeography Field and Laboratory Techniques (3). N This course provides undergraduate students with practical experience in field data collection techniques and laboratory data analysis methods. During the first half of the semester, students work in the field using a variety of methods to measure such vegetation characteristics as: cover, density, biomass, leaf area, and canopy architecture. Students gain experience in the use of field instruments including a spectroradiometer, and techniques for quantifying biophysical attributes of vegetation. During the later part of the course, students learn to summarize their field data and examine relationships between the vegetation attributes and measurements made using remote sensing instruments. Recommended: GEOG 316 or an introductory statistics equivalent. (Same as EVRN 433.) FLD

GEOG 458 Geographical Information Systems: ____ (1-6). N An introduction to the organization and components of geographic information systems and their software. Fundamental concepts and their implementation with applications to physical and human systems. LEC

GEOG 490 Geographic Internship (1-6). N Supervised practical experience. The student submits a proposal describing the internship prior to enrollment. Upon acceptance, regularly scheduled meetings with the adviser provide assistance, guidance and evaluation of progress in the professional experience. A written summary of the experience or outcomes of the research project are prepared independently by the student, a representative of the host agency, and the adviser. Total credit not to exceed six hours. Prerequisite: Fifteen hours of geography and permission of instructor. FLD

GEOG 498 Special Topics in Geography: ____ (1-5). U Prerequisite: Fifteen hours of geography. IND

GEOG 499 Honors Course in Geography (2-3). U Open to students with nine hours of upper level credit in geography, an average of at least 3.5 in all geography courses, and an overall average of at least 3.25. Includes the preparation of an honors paper and its defense before a committee of at least two regular faculty members. IND

GEOG 510 Human Factors (4). N An introduction to the concepts and theories underlying the study of human-technological systems. Human-machine interfaces and system properties and the environment are considered. Lecture-discussion sessions are supplemented by computer-supported laboratory and research activities. (Same as INDD 510.) LEC

GEOG 511 Intermediate Cartography: ____ (1-6). N An investigation of special topics in cartography. Can be repeated for different topics. Prerequisite: A course in cartography and consent of instructor. LEC

GEOG 513 Cartographic Design (3). S A study of graphic elements and their role in the physical and perceptual structure of the map image. Concepts and principles of design are stressed with particular emphasis on the figure-ground relationships, color and lettering. Prerequisite: GEOG 311. LEC

GEOG 514 Visualizing Spatial Data (4). N Students use Visual Basic or other currently prominent programming language to visualize spatial data. Early projects cover basic principles such as color manipulation and spatial transformations. Later projects involve developing more sophisticated software for data presentation, data exploration, and map animation. Prerequisite: Some experience with Visual Basic or other programming language. LAB

GEOG 515 Behavioral Systems (3). S An introductory course in behavioral geography. Examines the development of spatial cognitions (acquisition, organization, and use of environmental knowledge), and spatial patterns of behavior based on those cognitions, at scales ranging from personal space to world views. LEC

GEOG 516 Applied Multivariate Analysis in Geography (3). N An introduction to the application of multivariate statistical analysis in geography. Techniques covered include univariate and multivariate analysis of variance, multiple regression, logistic regression, principle components analysis, and spatial regression. Practical applications of the techniques in a geographical research context are emphasized. Students will learn how to use statistical packages such as SPSS. Prerequisite: GEOG 316 or equivalent. LEC

GEOG 517 Data Handling and Map Symbolization (3). N An analysis of methods for manipulating and symbolizing spatial data. Techniques studied include dot, choropleth, proportional symbols, and isarithmic (contour) mapping. Topics covered include data classification, the use of color, and automated methods of interpolation (triangulation, inverse distance, and kriging). Emphasis is on developing maps that can be presented to the general public, although some consideration is given to visualization software that can be utilized by individuals to explore spatial data. Prerequisite: GEOG 111 or GEOG 210 or GEOG 311. LEC

GEOG 519 History of Cartography (3). H A history of mapmaking worldwide from its origins to the present day. Emphasis on maps as historical records of evolving civilizations and cultural landscapes and methods of studying early maps. (Same as HIST 546.) LEC

GEOG 521 Microclimatology (3). N A study of climatic environments near the earth-atmosphere interface. Consideration of rural climates in relation to agriculture and urban climates as influenced by air pollution and other factors. Emphasis is on physical processes in the lower atmosphere, distribution of atmospheric variables, the surface energy budget, and water balance. (Same as ATMO 521.) Prerequisite: ATMO 105 and MATH 106 or MATH 121. LEC

GEOG 526 Remote Sensing of Environment I (4). N Introduction to study of the environment through air photos and satellite imagery, including principles of remote sensing, interactions of electromagnetic energy with the atmosphere and earth's surface, aerial photography, satellite systems, and sensors (electro-optical, thermal, and radar). Emphasis in the latter part of the course is on such applications as global monitoring, land cover mapping, forestry, agriculture, and oceanography. Laboratory emphasizes visual interpretation of aerial photography and satellite imagery and an introduction to digital image processing in the department's NASA Earth Science Remote Sensing Laboratory. (Same as EVRN 526.) Prerequisite: MATH 101 or equivalent. GEOG 358 recommended. LEC

GEOG 531 Topics in Physical Geography: ____ (1-3). N An investigation of special topics in physical geography. May include specific course work under the headings of geomorphology, climatology, soils, vegetation, quaternary, paleoenvironments, hydrology, etc. May be repeated, if topic differs. LEC

Geography integrates information from a variety of sources to study the nature of culture areas, the emergence of physical and human landscapes, and problems of interaction between people and the environment.

GEOG 532 Geoarchaeology (3). N Application of the concepts and methods of the geosciences to interpretation of the archaeological record. The course will focus primarily on the field aspects of geoarchaeology (e.g., stratigraphy, site formation processes, and landscape reconstruction), and to a lesser extent on the array of laboratory approaches available. (Same as ANTH 517.) Prerequisite: GEOG 104, ANTH 110, or ANTH 310. LEC

GEOG 535 Introduction to Soil Geography (4). N This course focuses on the physical and chemical properties of soils. The student is introduced to the importance of clay minerals and organic content among other soil properties as they affect soil use and variability in a geographic context. Field trips and laboratory section required. Prerequisite: GEOG 104 or GEOG 331 or GEOL 101 or consent of instructor. LEC

GEOG 536 Landscape Ecology (3). N Landscape ecology is the study of spatial variation in landscapes at a variety of scales. It includes the biophysical and societal causes and consequences of landscape heterogeneity, linking natural sciences with related human disciplines. Its core themes address the spatial pattern of landscapes; relationships between pattern and process in landscapes; relationships between human activity and landscape pattern, process and change; and the effect of disturbance on the landscape. Prerequisite: GEOG 104 or GEOG 148 or EVRN 148, or consent of instructor. LEC

GEOG 537 Elements of Plant Geography (3). N An introduction to spatial and temporal variation in natural plant populations and communities. Included is an introduction to methods of analysis, and an overview of structure and process in the earth's major biomes. Prerequisite: GEOG 331; or an introductory biology/botany course and GEOG 104; or consent of instructor. LEC

GEOG 541 Geomorphology (4). N A critical study of land forms 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 GEOL 541.) Prerequisite: GEOL 101 and GEOL 103, GEOG 104 and GEOG 105, or GEOL 103 and GEOL 304. LEC

GEOG 550 Environmental Issues in Africa (3). S Acquaints students with the complexities of debates on environmental problems in Sub-Saharan Africa. Topics addressed may include deforestation, desert expansion, wildlife conservation, soil erosion, climate change, coral reef destruction, water resources development, mangrove preservation, the environmental effects of war, industrialization, and urbanization. Class presentations and projects synthesize the perspectives of both human and physical geography. (Same as AAAS 551.) Prerequisite: GEOG 104 or permission of instructor. LEC

GEOG 551 Intermediate Economic Geography (3). S A lecture course dealing with the principles of location theory, resource utilization and regional specialization of economic activities. Economic concepts, such as rent payment for agricultural and mineral resources, scale and agglomeration economies etc., are applied to various physical, demographic, and cultural settings of major world regions. Special emphasis is placed on the basic principles of and recent changes in patterns of world trade, international investment, and economic development. Prerequisite: GEOG 375 or introductory economics or consent of instructor. LEC

GEOG 552 Topics in Urban/Economic Geography: _____ (1-3). S An investigation of special topics in urban/economic geography. May include specific course work under the headings of energy, economic development, international trade, environmental perception, housing, transportation, and migration. May be repeated. LEC

GEOG 553 Geography of African Development (3). NW S Acquaints students with the values of social parameters of African agricultural and pastoral practice. Topics include customary land rights, African perspectives on the natural world, gender issues in African agriculture, and the urbanization of African cultures. The course also contrasts African views with those of Western development practitioners and donor agencies. Case studies from different countries are used to highlight the continent's regional differences. (Same as AAAS 553.) LEC

GEOG 556 Geography of the Energy Crisis (3). S A discussion and analysis of the basic facts and causes of energy problems on a national and world scale. Examines current production, consumption, efficiency, reserves, conservation, and other energy policy options, including adjustments that will affect consumer use, national politics, and strategic issues. Prerequisite: GEOG 102 or GEOG 375. LEC

GEOG 557 Cities and Development (3). S An intermediate level course in urban geography, with an emphasis on cities in the developing world. Example cities in Latin America and the Caribbean, Sub-Saharan Africa, the Middle East, South Asia, and/or Southeast Asia may be examined. The main focus is on the intersection between urbanization and economic development, but social, political, and cultural aspects of development in cities are considered. Other topics include the geographic impacts of European colonialism, urbanization and industrialization, rural-to-urban migration, urban structure and spatial dynamics, urban planning, and environmental sustainability. (Same as AAAS 557.) LEC

GEOG 558 Intermediate Geographical Information Systems (4). N An intermediate level course in geographic information science designed for advanced undergraduate and graduate level students who already have an introductory understanding of GIS. Emphasis will be placed on the application of spatial analytical techniques to geographical problem-solving. Topics include spatial data struc-

tures, interpolation techniques, terrain analysis, cost surfaces, and database management technique. Students will apply knowledge gained in lecture and reading to natural resource, urban, and scientific applications using state-of-the-art GIS software. Prerequisite: GEOG 358 or consent of instructor. LEC

GEOG 560 GIS Application Programming (3). N This course teaches programming within Geographic Information Systems. Students learn how to customize GIS applications to automate data processing and spatial analysis through programming languages. GIS programming concepts and methods are introduced from the aspects of spatial data management and analysis covering both the vector and raster data models. Prerequisite: GEOG 558 and a course in programming languages. LEC

GEOG 570 Geography of American Indians (3). NW S A survey of the culture and history of selected indigenous peoples of the Americas. Emphasis is placed on the environmental setting, the settlement and subsistence patterns, and the impact of European colonization. Discussion includes present-day ethnic and resource issues. LEC

GEOG 571 Topics in Cultural Geography: _____ (1-3). S An investigation of special topics in cultural geography. May include specific course work under the headings of cultural theory and methodology, material culture, foodways, religion, and similar topics. May be repeated, if topic differs. LEC

GEOG 572 Political Geography (3). S Acquaints students with the theories and methods of political geography. Topics include geographical studies of: states, nations, and nationalism; territories and territoriality; geopolitics; and elections. Case studies from various regions of the world are included with an emphasis on the developing world. Prerequisite: GEOG 102 or equivalent or consent of instructor. LEC

GEOG 573 Advanced Geographic Analysis (3). S A course designed to teach students how to define, gather, process, evaluate and present geographic research. Its emphasis is field work and original data gathering versus library research. Prerequisite: Previous course work in geography and/or permission of instructor. LEC

GEOG 575 Geography of Population (3). S Describes and analyzes the distribution of human populations and spatial relations among and within varying types of settlements. Prerequisite: GEOG 102 or GEOG 375. LEC

GEOG 576 Cultural Geography of the United States (3). S Distributions of major culture elements including folk architecture, religion, dialect, foodways, and political behavior are systematically studied from a predominately historical perspective. These discussions are followed by a survey of the major culture regions in America. Although not absolutely necessary, familiarity with concepts treated in any of the following courses would be helpful: AMS 100, AMS 110, ANTH 108, ANTH 308, GEOG 102, or GEOG 390. (Same as AMS 576.) LEC

GEOG 579 Geography of American Foodways (3). An interdisciplinary approach to food that explores the diversity of eating habits across the United States and the role of food as an indicator of cultural identity and change. Current regional and ethnic food consumption patterns are stressed. Topics include multiculturalism and regional identity, the symbiotic relationship between restaurant food and home cooking, the recent interest in farmers' markets and organic foods, and the importance of the food industry and the popular press in setting trends. (Same as AMS 579.) LEC

GEOG 591 Geography of Latin America (3). SC S/W A study of the different physical, economic, and cultural settings in Latin America which form the basis for the various forms of livelihood. LEC

GEOG 592 Middle American Geography (3). S This regional study of the natural environments and cultural-historical backgrounds of Mexico, Central America, and the Caribbean details the physical and historical processes that have shaped the cultural landscape. LEC

GEOG 593 Central American Peoples and Lands (3). S This is a study of the natural and cultural history of the region's lands and peoples that focuses on the cultural geography of the surviving indigenous populations, including their culture area, culture history, cultural landscape, and cultural ecology. LEC

GEOG 594 Geography of the Former Soviet Union (3). S/W An analysis of the spatial organization of the successor states to the U.S.S.R. A study of the diverse human and natural resources, demographic, cultural, and economic conditions. Prerequisite: An introductory geography course or background in Russian-East European history, social science, or culture, or consent of instructor. LEC

GEOG 595 Geography of Eastern Europe (3). S/W A study of nations and regions of Eastern Europe, excluding Russia. Prerequisite: An introductory geography course or background in Slavic-East European history, social science, or culture or consent of instructor. LEC

GEOG 596 Geography of China (3). S/W A detailed description and analysis of geographic patterns in both historic and modern China. Prerequisite: An introductory geography course or background in Chinese history, social science, or culture, or consent of instructor. LEC

GEOG 597 Geography of Brazil (3). S Study of geographic factors, physical and cultural, that are basic to understanding the historical development of Portuguese South America and the contemporary and cultural geography of Brazil. Course also includes a survey of Brazil's South American neighbors. LEC

The Kansas Geological Survey, a research and development organization at KU, studies energy, minerals, groundwater, and seismic activity in Kansas.

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 Paleocology (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)	