Geography (GEOG)

The Geography Program offers an undergraduate major leading to a Bachelor of Arts in geography. Students may choose either the normal geography degree program or the concentration in cartography and remote-sensing GIS. The program also offers two minors: geography and historic preservation.

Undergraduates who wish to major in geography should identify themselves to the department as soon as possible in order that they may develop a meaningful sequence of courses and take part in departmental activities.

Those interested in the graduate program should consult the Graduate School Catalog (http://catalog.uark.edu/graduatecatalog/programsofstudy/geosciencesdepartmentofgeos/).

Requirements for a Major in Geography: In addition to the University Core requirements (http://catalog.uark.edu/undergraduatecatalog/academicregulations/universitycore/) and the Fulbright College of Arts and Sciences Graduation Requirements (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/jwilliamfulbrightcollegeofartsandsciences/), the following course requirements must be met. Bolded courses from the list below may be applied to portions of the University/state minimum core requirements.

GEOS 1123	3
GEOS 2003	3
GEOS 1113 & GEOS 1111L and	4
GEOS 1133 & GEOS 1131L and	4
Six hours in a single world language at the 1013 Elementary II level or higher. [1]	6
GEOS 3023	
GEOS 3543	3
In addition, students must complete a minimum of 15 hours of GEOS at the 3000-level or above, classes must include one technical, two regional and two topical courses.	15
Total Hours	**38**

[1] World language courses taken are dependent on placement level in sequence.

Students who expect to enter graduate school are encouraged to register for GEOS 410V their senior year. Electives in closely related fields are considered a part of the program and, upon prior approval of the department, six hours may be counted toward the major. Those planning to teach in secondary schools should note that they can both earn their degree in geography and qualify for a teaching certificate; they should consult with the department as early as possible.

Writing Requirement: The college writing requirement is to be met by completion of a term paper deemed satisfactory by the student's adviser and instructor of an upper-level geoscience course. The college writing requirement may also be met by the completion of an honors thesis.

Geography B.A.
Eight-Semester Degree Program

Students wishing to follow the eight-semester degree plan should see the Eight-Semester Degree Policy (http://catalog.uark.edu/undergraduatecatalog/academicregulations/eightsemesterdegreecompletionpolicy/) for university requirements of the program. Core requirement hours may vary by individual, based on placement and previous credit granted. Once all core requirements are met, students may substitute a three-hour (or more) general elective in place of a core area.

First Year	Units	
	Fall	Spring
GEOS 1123	3	
ENGL 1013	3	
MATH 1203 (or any higher level math)	3	
1013 Elementary II World Language Course	3	
University/State Core Fine Arts, Humanities or U.S. History requirement	3	
GEOS 1113 & GEOS 1111L		4
ENGL 1023		3
2003 Intermediate I World Language Course (or higher)		3
University/State Core Humanities, U.S. History, or Fine Arts requirement (as needed)		3
General Elective		3
Year Total:	15	16

Second Year	Units	
	Fall	Spring
GEOS 2003	3	
GEOS 1133 & GEOS 1131L	4	
University/State Core U.S. History, Fine Arts, or Humanities Course (as needed)	3	
University/State Core Social Science requirement (non-GEOS course)	3	
General Elective	3	
GEOS 3000 Level or Above Elective [2]		3
Advanced Level Elective[1]		3
General Electives		9
Year Total:	16	15

Third Year	Units	
	Fall	Spring
GEOS 3023 [2]	3	
GEOS 3000-level or Above Elective[2]	3	
General Electives	9	
GEOS 3543		3
GEOS 3000-level or Above Elective[2]		3
Advanced Level Elective[1]		3
General Electives		6
Year Total:	15	15

Fourth Year	Units	
	Fall	Spring
GEOS 3000-level or above Elective[2]	3	
3000-plus Upper Level ARSC Elective with Departmental Consent[2]	3	
Advanced Level Elective[1]	3	
General Electives	6	
GEOS 3000-level or above Elective		3
3000-plus Upper Level ARSC Elective with Departmental Consent[2]		3
3000-plus Upper Level ARSC Elective[2]		3
3000-plus Upper Level Elective[1]		3
General Elective		1
Year Total:	15	13
Total Units in Sequence:		**120**

[1] Meets 40-hour advanced credit hour requirement. See College Academic Regulations (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/jwilliamfulbrightcollegeofartsandsciences/).

[2] Meets 24-hour rule (24 hours of 3000-4000 level courses in Fulbright College), in addition to meeting the 40-hour rule. See College Academic Regulations (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/jwilliamfulbrightcollegeofartsandsciences/).

B.A. in Geography with Cartography/Remote Sensing GIS Concentration

Requirements for a Major in Geography: In addition to the University Core requirements (http://catalog.uark.edu/undergraduatecatalog/academicregulations/universitycore/) and the Fulbright College of Arts and Sciences Graduation Requirements (http://catalog.uark.edu/undergraduatecatalog/collegesandschools/jwilliamfulbrightcollegeofartsandsciences/), the following course requirements must be met. Bolded courses from the list below may be applied to portions of the University/state minimum core requirements.

GEOS 1123	3
GEOS 2003	3
GEOS 1113 & GEOS 1111L and	4
GEOS 1133 & GEOS 1131L and	4
Six hours in a single world language at the 1013 Elementary II level or higher. [1]	6
GEOS 3023	
GEOS 3543	3
In addition, students must complete a minimum of 15 hours of GEOS at the 3000-level or above, classes must include one technical, two regional and two topical courses.	15
Total Hours	**38**

[1] World language courses taken are dependent on placement level in sequence.

Students who expect to enter graduate school are encouraged to register for GEOS 410V their senior year. Electives in closely related fields are considered a part of the program and, upon prior approval of the department, six hours may be counted toward the major. Those planning to teach in secondary schools should note that they can both earn their degree in geography and qualify for a teaching certificate; they should consult with the department as early as possible.

Requirements for a Major in Geography with Cartography/Remote Sensing Concentration: This program gives students an opportunity to develop expertise in (1) cartography, map design and computer-assisted map production, (2) remote sensing and image interpretation, including photographic systems, sensor systems, and digital image processing, and (3) geographic information systems, including data sources, analytical techniques, and hardware/software systems.

To complete the concentration, a student is required to fulfill certain course requirements.

Required Courses		
GEOS 30203	Introduction to Cartography	3
GEOS 32103	Principles of Remote Sensing	3
GEOS/ANTH 35403	Geospatial Applications and Information Science	3
Elective Courses		
Select three of the following:		9
GEOS 45203	Cartographic Design and Production	
GEOS/ANTH 45503	Introduction to Raster GIS	
GEOS 45803/ ANTH 48503	Enterprise and Multiuser GIS	
GEOS 45903	Introduction to Global Positioning Systems and Global Navigation Satellite Systems	
STAT 30043	Statistical Methods (or other approved statistics course)	
CVEG 20503	Surveying Systems (or other approved surveying course)	
Total Hours		**18**

Writing Requirement: The college writing requirement is to be met by completion of a term paper deemed satisfactory by the student's adviser and instructor of an upper-level geoscience course. The college writing requirement may also be met by the completion of an honors thesis.

Requirements for a Minor in Geography: 15 credit hours in geography to include GEOG 11103 Human Geography and GEOG 21003 World Regional Geography or honors equivalents, with at least six credit hours numbered at the 3000-level or above that includes any combination of physical, climate, regional, and/or geographic information science (GIScience) courses.

Requirements for Departmental Honors in Geography: Admission to the Departmental Honors Program in Geography is open to geography majors with a minimum grade-point average of 3.5 in all their work. All honors candidates must take 12 hours, which may include 6 hours of thesis, in Honors Studies. During the fall semester of either the junior or senior year the candidate will enroll in GEOS 399HV (no more than three hours of credit), an undergraduate seminar in geographical philosophy and methodology. During the senior year the honors candidate will complete the program by writing a senior honors paper under GEOS 399HV (no more than three hours of credit). Successful completion of the requirements will be recognized by the award of the distinction "Geography Scholar *Cum Laude*" at graduation. Higher degree

distinctions are recommended only in truly exceptional cases and are based upon the whole of the candidate's program of honors studies.

Geography Courses

GEOG 11103. Human Geography (ACTS Equivalency = GEOG 1113). 3 Hours.
Basic course in human geography stressing the interrelationships between the natural factors of the environment and man's activities, especially the role of geography in the understanding of social problems and economic and political activities. (Typically offered: Fall and Spring)

GEOG 111H3. Honors Human Geography. 3 Hours.
Basic course in human geography stressing the interrelationships between the natural factors of the environment and man's activities, especially the role of geography in the understanding of social problems and economic and political activities. Prerequisite: Honors candidacy. (Typically offered: Fall and Spring)
This course is equivalent to GEOG 11103.

GEOG 21003. World Regional Geography (ACTS Equivalency = GEOG 2103). 3 Hours.
Survey of problems, development potential, and physical and human resources of the developing and developed world. (Typically offered: Fall and Spring)

GEOG 210H3. Honors World Regional Geography. 3 Hours.
Survey of problems, development potential, and physical and human resources of the developing and developed world. Prerequisite: Honors candidacy. (Typically offered: Fall and Spring)
This course is equivalent to GEOG 21003.

Geosciences Courses

GEOS 11504. Introduction to Geology for Science Majors. 4 Hours.
Survey of geological processes and materials and their relationships to landforms, natural resources, environments, and human beings. Students will understand the principles of physical geology, Earth's internal structure, plate tectonics, and geologic time. Students may not receive degree credit for both GEOL 11103/GEOL 11101 and GEOS 11504. Corequisite: Lab component. Prerequisite: Freshman or sophomore standing, or by instructor consent. (Typically offered: Fall)

GEOS 23103. Mineralogy. 3 Hours.
General principles of mineralogy, study and identification of common minerals, igneous & metamorphic rocks using hand samples. Prerequisite: (GEOL 11103 or GEOS 11504) and CHEM 14103. Corequisite: Lab component. (Typically offered: Fall)

GEOS 28103. Digital Earth. 3 Hours.
This course introduces the fundamental concepts and practical geospatial techniques of the digital earth initiative. Students will learn how digital geographical information is produced (also referred to as geospatial data) and utilized in a variety of economic, environmental, and scientific applications. The class will concentrate on how digital geospatial data are produced, integrated and applied in daily life and will review a variety of environmental and socioeconomic applications. (Typically offered: Fall)

GEOS 281H3. Honors Digital Earth. 3 Hours.
This course introduces the fundamental concepts and practical geospatial techniques of the digital earth initiative. Students will learn how digital geographical information is produced (also referred to as geospatial data) and utilized in a variety of economic, environmental, and scientific applications. The class will concentrate on how digital geospatial data are produced, integrated and applied in daily life and will review a variety of environmental and socioeconomic applications. Prerequisite: Honors standing. (Typically offered: Fall)
This course is equivalent to GEOS 28103.

GEOS 30103. Foundations of Geospatial Data Analysis. 3 Hours.
Basic mathematical tools applied in geospatial technology, including trigonometry in mapping, linear algebra in remote sensing, optimization in spatial decision support, and graph theory in routing. Course develops the framework for spatial data analysis and decision support. Students may receive credit for the course through testing. Prerequisite: GEOS 35403. (Typically offered: Fall and Spring)

GEOS 30203. Introduction to Cartography. 3 Hours.
Students learn basic principles of map design, cartographic theory and field surveying to produce a variety of computer-generated maps. An introductory course designed for students in a variety of different disciplines using AutoCad software and various new technologies. Field trips may be required. (Typically offered: Fall)

GEOS 30403. Sustaining Earth. 3 Hours.
Theory and growth of conservation and sustainability, the wise use of the major natural resources of the United States. This course meets the requirement in conservation and sustainability for teachers. Prerequisite: Junior standing. (Typically offered: Fall)

GEOS 304H3. Honors Sustaining Earth. 3 Hours.
Theory and growth of conservation and the wise use of the major natural resources of the United States. This course meets the requirement in conservation for teachers. Prerequisite: Junior standing. (Typically offered: Fall)
This course is equivalent to GEOS 30403.

GEOS 30603. Geology of Arkansas. 3 Hours.
A survey of the distribution, genesis, and age of the rocks, fossils, structures, landforms and geological processes of Arkansas. Equivalent to two hours of lecture per week. Field trips required. Prerequisite: (GEOL 11103 or GEOL 111H3 or GEOS 11504). (Typically offered: Spring)

GEOS 30903. Speleology. 3 Hours.
An introduction to caving techniques and the science of caves. Covers basic caving equipment, safety, and cave conservation. Cave science (speleology) is covered at an introductory level across a range of disciplines. Field trips required. (Typically offered: Irregular)

GEOS 31003. Geospatial Technologies Computational Toolkit. 3 Hours.
Basic computational tools and processes applied in geospatial software, related computer hardware components, systems and applications software, and spatial database fundamentals. Python, including SciPy and NumPy, geospatial implementations will be emphasized. No programming experience is required. Students may receive credit for the course through testing. Prerequisite: GEOS 35403. (Typically offered: Fall and Spring)

GEOS 32103. Principles of Remote Sensing. 3 Hours.
Fundamental concepts of remote sensing of the environment. Optical, infrared, microwave, LIDAR, and in situ sensor systems are introduced. Remote sensing of vegetation, water, urban landscapes, soils, minerals, and geomorphology is discussed. The course includes laboratory exercises in GIS software and field spectroscopy. (Typically offered: Fall)

GEOS 33303. Oceanography. 3 Hours.
The sea, its landforms; its winds and currents as related to the atmosphere, world climates, and world trade; its basin as avenues for continental drift; its waters as habitat for plant and animal life; its marine and submarine resources as presently and potentially useful to man. Offered as physical science. Prerequisite: Junior standing. (Typically offered: Fall)

GEOS 34103. Sedimentary Geology. 3 Hours.
An introductory study of sedimentary rocks from the standpoint of classification, field and laboratory description, genesis, and preservation. Lecture 2 hours, laboratory 2 hours per week. Corequisite: Lab component. Prerequisite: GEOS 23103. (Typically offered: Spring)

GEOS 35104. Structural Geology. 4 Hours.
Survey of deformational features and their geological significance in the crust of the earth. Lecture 3 hours per week. Corequisite: Lab component. Prerequisite: GEOL 11103 or GEOS 11504. (Typically offered: Spring)

GEOS 35403. Geospatial Applications and Information Science. 3 Hours.
An introduction to the methods and theory underlying the full range of geographic information science and collateral areas - including GNSS, remote sensing, cadastral, spatial demographics and others. (Typically offered: Fall and Spring)
This course is cross-listed with ANTH 35403.

GEOS 35503. Spatial Analysis Using ArcGIS. 3 Hours.
Applications of analysis of spatial data using ArcGIS tools in map design, on-line mapping, creating geodatabases, accessing geospatial data, geo-processing, digitizing, geocoding, spatial analysis including basic spatial statistics, analysis of spatial distributions and patterning and 3D application using ArcGIS 3D Analyst. (Typically offered: Fall and Spring)

GEOS 35603. Geospatial Data Mining. 3 Hours.
Basic tools for analyzing, summarizing and visualizing geospatial data. Exploratory data and spatial data analysis, probability distributions and application, single and multivariate analysis and hypothesis testing, and spatial smoothing and interpolation. Emphasis will be on problem solving in geospatial settings using the R statistical language. Prerequisite: GEOS 35403 and (GEOS 30103 or MATH 24004 or MATH 22003 or DASC 25904) and (GEOS 31003 or DASC 11004 or DASC 21103). (Typically offered: Fall and Spring)

GEOS 35903. Introduction to Geodatabases. 3 Hours.
Fundamental concepts and applications of geospatial databases. Schema development and spatial data models for geodata. Spatial and attribute query and optimization, properties and structures of relational and object-oriented geodatabases. Spatial extensions of SQL, spatial indexing, measurement, and geometry. Prerequisite: GEOS 35403 and (GEOS 30103 or MATH 24004 or MATH 22003 or DASC 25904) and (GEOS 31003 or DASC 11004 or DASC 21103). (Typically offered: Fall and Spring)

GEOS 3600V. Undergraduate Special Problems. 1-6 Hour.
Library, laboratory, or field research in different phases of geology. (Typically offered: Fall, Spring and Summer) May be repeated for up to 6 hours of degree credit.

GEOS 36703. Environmental Field Methods. 3 Hours.
An off campus field-based professional course emphasizing the observation and interpretation of environmental and Earth system processes with a focus on applying physical and chemical field measurement techniques. Prerequisite: GEOS 11504 or GEOL 11103. (Typically offered: Summer)

GEOS 37303. Geospatial Data Science in Public Health. 3 Hours.
Introduction to geospatial data science, including geographic information systems (GIS) and related technologies, with an emphasis on their practical applications in the fields of public health, global health, healthcare analytics, healthcare administration, and other health-related fields. (Typically offered: Fall)

GEOS 38703. Quantitative Methods in Earth Science. 3 Hours.
Foundations of quantitative thinking, data analysis and visualization, mathematical modeling, and scientific programming, with applications in the Earth Sciences. Interpretation of scientific data and communication of results. Corequisite: Lab component. Pre- or corequisite: MATH 22003 or MATH 24004. (Typically offered: Fall)

GEOS 390H1. Junior Honors Course. 1 Hour.
Special honors research in geology. One hour credit each semester. Prerequisite: Junior standing. (Typically offered: Fall, Spring and Summer)

GEOS 391H1. Junior Honors Course II. 1 Hour.
Special honors research in geology. One hour credit each semester. Prerequisite: Junior standing. (Typically offered: Fall, Spring and Summer)

GEOS 399HV. Honors Course. 1-6 Hour.
Honors course. Prerequisite: Junior standing. (Typically offered: Irregular) May be repeated for up to 6 hours of degree credit.

GEOS 40303. Hydrogeology. 3 Hours.
Occurrence, movement, and interaction of water with geologic and cultural features. Lecture 3 hours per week. Corequisite: Lab component. Prerequisite: MATH 22003 or MATH 24004. (Typically offered: Spring)

GEOS 40403. Geography of the Middle East. 3 Hours.
Physical and cultural landscapes, natural and cultural resources, art and architecture, land use, political history, OPEC, and current problems of North Africa and the Middle East region west of Afghanistan are discussed. Class participation, discussions, slides and films, and student presentations will round out the class. Prerequisite: Junior standing. (Typically offered: Fall)

GEOS 404H3. Honors Geography of the Middle East. 3 Hours.
Physical and cultural landscapes, natural and cultural resources, art and architecture, land use, political history, OPEC, and current problems of North Africa and the Middle East region west of Afghanistan are discussed. Class participation, discussions, slides and films, and student presentations will round out the class. Prerequisite: Junior standing. (Typically offered: Irregular)
This course is equivalent to GEOS 40403.

GEOS 40503. Geomorphology. 3 Hours.
A quantitative, mechanistic overview of surface processes and landscape evolution. Lecture 2 hours, laboratory 3 hours per week. One to two field trips on weekends (2 day total) are required during the semester. Corequisite: Lab component. Prerequisite: GEOS 38703 or instructor consent. (Typically offered: Spring)

GEOS 40603. Principles of Geochemistry. 3 Hours.
Introduction to fundamental principles of geochemistry from historic development to modern concepts.Prerequisite: CHEM 14201, CHEM 14203 and GEOS 23103. (Typically offered: Fall)

GEOS 40703. Urban Geography. 3 Hours.
Areal patterns of modern urban regions and the focus shaping these patterns. Emphasis is placed on American urban areas and their evolution and functional areas. Field work. Prerequisite: Junior standing. (Typically offered: Spring)

GEOS 40803. Economic Geology. 3 Hours.
Introduction to mineral deposits used as economic resources. Covers basic geology and geochemistry of mineral deposit formations and the formation of major classes of deposits. Examines the relationship between the distribution of ores, oil, gas, coal, and Plate Tectonics. Explores environmental issues associated with the extraction of earth resources. Prerequisite: GEOS 23103. (Typically offered: Irregular)

GEOS 40903. History and Philosophy of Geography. 3 Hours.
This course familiarizes students with the history of geography, the contributions of geographers to scientific thought and theory, and research techniques that are used in geography. Emphasis is given to the integration of statistical and spatial analysis, and their applications in field research. The course includes short field-based projects in and around Northwest Arkansas. (Typically offered: Spring Even Years)

GEOS 4100V. Special Problems in Geosciences. 1-6 Hour.
Designed to meet the needs of students who wish to study one particular geographic topic in some detail. Prerequisite: Junior standing. (Typically offered: Fall) May be repeated for up to 6 hours of degree credit.

GEOS 410HV. Honors Special Problems in Geosciences. 1-6 Hour.
Designed to meet the needs of students who wish to study one particular geographic topic in some detail. Prerequisite: Junior standing. (Typically offered: Fall) May be repeated for up to 6 hours of degree credit.
This course is equivalent to GEOS 4100V.

GEOS 41103. Global Change. 3 Hours.
Examines central issues of global change including natural and human induced climate change, air pollution, deforestation, desertification, wetland loss urbanization, and the biodiversity crisis. The U.S. Global Change Research Program is also examined. (Typically offered: Spring)

GEOS 411H3. Honors Global Change. 3 Hours.
Examines central issues of global change including natural and human induced climate change, air pollution, deforestation, desertification, wetland loss urbanization, and the biodiversity crisis. The U.S. Global Change Research Program is also examined. Prerequisite: Honors candidacy. (Typically offered: Spring)
This course is equivalent to GEOS 41103.

GEOS 41303. Radar Remote Sensing. 3 Hours.
Introduction to radar remote sensing and its applications in geology, geography, archeology, engineering, and agriculture. Focuses on Synthetic Aperture Radar (SAR) and advanced techniques including radar stereo, polarimetry, and interferometry. Covers Interferometric SAR (InSAR) for mapping topography and modeling Earth's surface motions due to earthquakes, volcanic eruptions, landslides, and subsidence. Prerequisite: Junior standing. (Typically offered: Spring)

GEOS 41503. Karst Hydrogeology. 3 Hours.
Assessment of ground water resources in carbonate rock terrains and how they vary with rock properties and climate. Studying the processes that develop karst conduits (caves) and understanding their impact on water quantity and quality. Prerequisite: GEOL 11103, and (MATH 22003 or MATH 24004). (Typically offered: Irregular)

GEOS 42203. Stratigraphy and Sedimentation. 3 Hours.
Introductory investigation of stratigraphic and sedimentologic factors important to the study of sedimentary rocks. Lecture 2 hours, laboratory 3 hours per week. A required weekend, two-day field trip will be conducted during the semester. Corequisite: Lab component. Prerequisite: GEOS 34103. (Typically offered: Fall)

GEOS 42303. Geography of Religion & Sacrality. 3 Hours.
Explores the spatial nature of the World's major faiths and religious institutions, focusing on the distribution and origins of these religions. Examines the religious beliefs, rituals, architecture, demographics, and art in different societies, cultures, and countries. Considers the tenets and practices of what is sacred and/or spiritual, held in common by a group or community. Prerequisite: Junior or senior standing. (Typically offered: Irregular)

GEOS 42403. Political Geography. 3 Hours.
Contemporary world political problems in their geographic context. Development of the principles of political geography with emphasis upon the problems of Eastern Europe, Africa, and Southeast Asia. Prerequisite: Junior standing. (Typically offered: Fall Odd Years)

GEOS 42503. Petroleum Geology. 3 Hours.
Distribution and origin of petroleum. Lecture 2 hours, laboratory 2 hours per week. Corequisite: Lab component. Prerequisite: Geology major and senior standing. (Typically offered: Fall)

GEOS 42603. Geospatial Data Science - Sources and Characteristics. 3 Hours.
Covers the wide range of geospatial data sources and characteristics with emphasis on data science applications through hands-on experience recognizing the unique requirements of major sources. Techniques for the integration of disparate, heterogeneous data sets will be covered. Corequisite: GEOS 35603. Prerequisite: GEOS 35403. (Typically offered: Fall)

GEOS 4300V. Internship in Physical Geography. 3-6 Hour.
Supervised experience in municipal, county, state or private natural resource management agency, or any other such organization approved by instructor. (Typically offered: Fall, Spring and Summer)

GEOS 43303. Igneous and Metamorphic Petrology. 3 Hours.
Elementary to advanced study of the origin and evolution of igneous and metamorphic rocks in a variety of plate tectonics settings. Lecture 2 hours, Laboratory 2 hours per week. Corequisite: Lab component. Prerequisite: GEOS 23103. (Typically offered: Spring)

GEOS 43503. Meteorology. 3 Hours.
Examination of the atmospheric processes that result in multifarious weather systems. Offered as physical science. Prerequisite: Junior standing. (Typically offered: Fall)

GEOS 43603. Climatology. 3 Hours.
Fundamentals of topical climatology followed by a study of regional climatology. Offered as physical science. Prerequisite: GEOL 11203 or GEOS 43503. (Typically offered: Spring)

GEOS 4370V. Geology Field Trip. 1-2 Hour.
Camping field trip to areas of geologic interest, usually conducted during Spring Break. (Typically offered: Spring) May be repeated for up to 4 hours of degree credit.

GEOS 43803. Hazard & Disaster Assessment, Mitigation, Risk & Policy. 3 Hours.
Comprehensive introduction to interdisciplinary approaches to natural and environmental hazards and risk. Hazards and disaster assessment, mitigation, and policy are the focus of the class. Prerequisite: Junior or senior standing. (Typically offered: Spring) May be repeated for up to 6 hours of degree credit.

GEOS 438H3. Honors Hazard & Disaster Assessment, Mitigation, Risk & Policy. 3 Hours.
Comprehensive introduction to interdisciplinary approaches to natural and environmental hazards and risk. Hazards and disaster assessment, mitigation, and policy are the focus of the class. Prerequisite: Junior or senior standing. (Typically offered: Spring)
This course is equivalent to GEOS 43803.

GEOS 43903. American Public Lands & Policy. 3 Hours.
The course examines the role of American federal public lands in 19th-21st century geography, history, policy, and art. It investigates the growth of conservation, preservation, and management movements in the US by looking at America's national parks, forests, dams, wildlife refuges, wilderness areas, managed and agricultural lands. Prerequisite: Junior or senior standing. (Typically offered: Irregular)

GEOS 439H3. Honors American Public Lands & Policy. 3 Hours.
The course examines the role of American federal public lands in 19th-21st century geography, history, policy, and art. It investigates the growth of conservation, preservation, and management movements in the US by looking at America's national parks, forests, dams, wildlife refuges, wilderness areas, managed and agricultural lands. Prerequisite: Honors standing and Junior or senior standing. (Typically offered: Irregular)
This course is equivalent to GEOS 43903.

GEOS 44303. Geophysics. 3 Hours.
Derivation from physical principles, of the geophysical methods for mapping the Earth. Computational methods of converting gravity, magnetic, radiometric, electrical, and seismic data into geologic information. Lecture 3 hours, laboratory 2 hours per week. Corequisite: Lab component. Prerequisite: MATH 25004 and PHYS 20203 and PHYS 20201 and GEOS 35104. (Typically offered: Irregular)

GEOS 44703. Applied Climatology. 3 Hours.
Applied climatology involves the use of climatic data to solve a variety of social, economic and environmental problems, such as for clients in agriculture, water and energy management. The basic purpose of applied climatology is to help society, at all scales and levels, to achieve a better adjustment to the climatic environment. (Typically offered: Fall)

GEOS 447H3. Honors Applied Climatology. 3 Hours.
Applied climatology involves the use of climatic data to solve a variety of social, economic and environmental problems, such as for clients in agriculture, water and energy management. The basic purpose of applied climatology is to help society, at all scales and levels, to achieve a better adjustment to the climatic environment. Prerequisite: Honors standing. (Typically offered: Fall)
This course is equivalent to GEOS 44703.

GEOS 44903. Geography of Political Violence. 3 Hours.
This seminar focuses on the rise of civil conflict in the post-World War II world. We are particularly interested in understanding the institutional challenges facing countries that experience such conflict. The class will develop a contextually-informed understanding of the international system and how it is shaped by civil war. Prerequisite: Junior or senior standing. (Typically offered: Fall Even Years)
This course is cross-listed with INST 410H.

GEOS 449H3. Honors Geography of Political Violence. 3 Hours.
This seminar focuses on the rise of civil conflict in the post-World War II world. We are particularly interested in understanding the institutional challenges facing countries that experience such conflict. The class will develop a contextually-informed understanding of the international system and how it is shaped by civil war. Prerequisite: Junior or senior standing and honors standing. (Typically offered: Fall Even Years)
This course is cross-listed with GEOS 44903, INST 410H.

GEOS 45203. Cartographic Design and Production. 3 Hours.
This course addresses advanced cartographic concepts (i.e. visual hierarchy, aesthetics, image cognition) and production techniques as they relate to computer-assisted mapping. Students produce a variety of maps using Adobe Illustrator (CS 4-6) software to build a map portfolio. Field trips may be required. Prerequisite: GEOS 30203. (Typically offered: Spring)

GEOS 45303. Introduction to Petroleum Geophysics. 3 Hours.
Introduction to seismic wave propagation and petroleum seismology with particular emphasis on seismic events, elastic waves, and seismic survey design. Prerequisite: MATH 25004, (PHYS 20203 or PHYS 20404), and GEOS 35104 or instructor consent. (Typically offered: Fall)

GEOS 453H3. Honors Introduction to Petroleum Geophysics. 3 Hours.
Introduction to seismic wave propagation and petroleum seismology with particular emphasis on seismic events, elastic waves, and seismic survey design. Prerequisite: MATH 25004, (PHYS 20203 or PHYS 20404), and GEOS 35104 or instructor consent. (Typically offered: Fall)
This course is equivalent to GEOS 45303.

GEOS 45503. Introduction to Raster GIS. 3 Hours.
Theory, data structure, algorithms, and techniques behind raster-based geographical information systems. Through laboratory exercises and lectures multidisciplinary applications are examined in database creation, remotely sensed data handling, elevation models, and resource models using boolean, map algebra, and other methods. Prerequisite: GEOS 35403 or ANTH 35403. (Typically offered: Fall)
This course is cross-listed with ANTH 45503.

GEOS 45603. Geology of Our National Parks. 3 Hours.
This course examines the underlying geology responsible for selected parks, and explores the interplay of geology, biology, climate, topography, and humans to evaluate the value of the parks, and to anticipate the problems they will face in the near and long-term. Prerequisite: GEOL 11103 or GEOS 11504. (Typically offered: Fall)

GEOS 45803. Enterprise and Multiuser GIS. 3 Hours.
GIS practice that's typical of collaborative team-based geospatial organizations. Solve real-world problems through end-to-end GIS design and implementation using ArcGIS Enterprise, extensive federal, state, and local repositories, and high quality software documentation. Includes relevant training in geospatial provenance and metadata, and in enterprise and multiuser GIS administration. (Typically offered: Spring)

GEOS 45903. Introduction to Global Positioning Systems and Global Navigation Satellite Systems. 3 Hours.
Fundamentals of navigation, mapping, and high-precision positioning using the Navstar Global Positioning System. Topics include datum definition and transformation, map projections, autonomous and differential positioning using both code and carrier processing, and analysis of errors. Prerequisite: GEOS 35403 or GEOS 55403. (Typically offered: Fall)

GEOS 46503. GIS Analysis and Modeling. 3 Hours.
Unlike conventional GIS courses that focus on studying "where", this course will teach students to address beyond "where" using various GIS analysis and modeling techniques to explore "why" and "how". The course will provide theoretical and methodological reviews of the principles of cartographic modeling and multi-criteria decision-making. (Typically offered: Spring)

GEOS 46603. Low-Temperature Geochemistry of Natural Waters. 3 Hours.
Covers the low-temperature geochemistry of waters and their associated minerals at Earth's surface. Examines the controls on the chemical composition of natural waters and the minerals precipitated from them. Topics covered will include water-rock interactions, pH, redox, the carbonate-water system, clay minerals and exchange, heavy metals, and a brief introduction to stable isotopes and geomicrobiology. Prerequisite: CHEM 14203/CHEM 14201 and (GEOL 11103/GEOL 11101 or GEOS 11504). (Typically offered: Fall)

GEOS 46806. Geology Field Camp. 6 Hours.
A professional course taught off campus emphasizing occurrence, description, mapping, and interpretation of major rock types. May not be taken for graduate credit. Prerequisite: GEOS 34103 and GEOS 35104. (Typically offered: Summer)

GEOS 46903. Environmental Justice. 3 Hours.
This course deals with the ethical, environmental, legal, economic, and social implications of society's treatment of the poor, the disenfranchised, and minorities who live in the less desirable, deteriorating neighborhoods, communities, and niches of our country. The class integrates science with philosophy, politics, economics, policy, and law, drawing on award-winning films, current news, and case studies. (Typically offered: Spring)

GEOS 47803. Geography of Europe. 3 Hours.
Geographic regions of the area with emphasis on their present development. Prerequisite: Junior standing. (Typically offered: Irregular)

GEOS 47903. Geospatial Unmanned Aircraft Systems. 3 Hours.
Geospatial unmanned aircraft systems (UAS) are becoming key technologies in a number of disciplines. This course will introduce safe and legal operation of UAS in aerial photography, multispectral, thermal and LIDAR applications, geodetic control, photogrammetric and computer vision processing, and the creation of accurate 2D and 3D digital information products. Pre- or Corequisite: GEOS 32103 or GEOS 45903 or equivalent. (Typically offered: Fall)

GEOS 48103. Geography of Eurasia. 3 Hours.
Introduction to the culture, society, and politics of Eurasia using the organizing concept of empire from the moment of its consolidation in 1945 to its dissolution in 1991. Focuses on places that have emerged from this order and emphasizes experience and memory at each of these different times and places. Prerequisite: Junior standing. (Typically offered: Spring Even Years)

GEOS 49204. Earth System History. 4 Hours.
Physical and biological events that form the history of the earth from its formation to the beginning of the historical era. Corequisite: Lab component. Prerequisite: Junior Standing. (Typically offered: Spring)

GEOS 49303. Ancient Forest Science and Sustainability. 3 Hours.
Ancient forests preserve beautiful habitat with high ecological integrity. This course will examine the development, spatial distribution, and ongoing destruction of ancient forests worldwide, and how science can contribute to the understanding and sustainable management of these valuable resources. (Typically offered: Spring)

GEOS 497H2. Senior Honors Course I. 2 Hours.
Special honors research in geology. Two hours of credit each semester. Prerequisite: Junior honors. (Typically offered: Fall, Spring and Summer)

GEOS 498H2. Senior Honors Course II. 2 Hours.
Special honors research in geology. Two hours of credit each semester. Prerequisite: Junior honors. (Typically offered: Fall, Spring and Summer)

GEOS 49903. Dynamics of Sediment Transport. 3 Hours.
This is a course focused on how fluids transport sediment and construct stratigraphy. Lectures will develop environmental fluid mechanics and sediment transport from first principles so they can be used to evaluate sedimentological and stratigraphic problems. This framework will be applied to a sedimentological problem using original data and analysis. Pre- or Corequisite: GEOS 42203. Prerequisite: GEOS 34103. (Typically offered: Fall Odd Years)