

GGIS - GEOGRAPHY & GEOGRAPHIC INFORMATION SCIENCE

GGIS Class Schedule (<https://courses.illinois.edu/schedule/DEFAULT/DEFAULT/GGIS/>)

Courses

GGIS 100 Introduction to Meteorology credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/100/>)

Same as ATMS 100. See ATMS 100.

This course satisfies the General Education Criteria for:

Nat Sci Tech - Phys Sciences

GGIS 101 Global Development & Environment credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/101/>)

[IAI Code: S4902N] Introduces geographical perspectives on environment and development studies with case studies drawn from Africa, Asia, and Latin America. Investigates the origins of the global South in relation to the global North, especially the historical and contemporary processes driving environmental, economic, and cultural change.

This course satisfies the General Education Criteria for:

Cultural Studies - Non-West

Social Beh Sci - Soc Sci

GGIS 103 Earth's Physical Systems credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/103/>)

A basic introduction to the environmental systems of the Earth's surface, including landforms, soils, and ecosystems and how these systems are affected by global change. Emphasizes the importance of human-Earth relations and a holistic view of environmental systems. Same as ESE 103.

This course satisfies the General Education Criteria for:

Nat Sci Tech - Phys Sciences

GGIS 104 Social and Cultural Geography credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/104/>)

[IAI Code: S4900N] Introduces the basic concepts of social and cultural geography, and the application of these concepts to a variety of topics; mental maps, territoriality, cultural regions, cultural elements and their diffusion, population movement and migration, settlement patterns, environmental hazards, and spatial patterns of social problems.

This course satisfies the General Education Criteria for:

Social Beh Sci - Soc Sci

GGIS 106 Geographies of Globalization credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/106/>)

A survey of major world regions by systematically considering five themes: environment, population and settlement patterns, cultural coherence and diversity, geopolitical fragmentation and unity, and economic and social development. While examining the persistence of unique regions, the course will both scale up to global linkages and scale down to place-specific impacts of globalization processes. Same as ESE 106.

This course satisfies the General Education Criteria for:

Cultural Studies - Non-West

Social Beh Sci - Soc Sci

GGIS 199 Undergraduate Open Seminar credit: 1 to 5 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/199/>)

Undergraduate Open Seminar. May be repeated.

GGIS 204 Cities of the World credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/204/>)

In-depth exploration of global urbanization. Using a comparative regional approach, discuss the recent history of global urbanization, dissect its problems, and offer possible solutions. Approximately ten major regions of the world will be examined, exploring the significant urban patterns and processes, built and natural environments, and social, economic, and cultural landscapes of each.

This course satisfies the General Education Criteria for:

Social Beh Sci - Soc Sci

Cultural Studies - Western

GGIS 205 Business Location Decisions credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/205/>)

Analyzes location decision-making emphasizing industrial and commercial location patterns; identifies important institutional factors and their changing roles over the recent past; and focuses on plant closings, economic disruptions, and problems of structural change. Same as BADM 205. Prerequisite: ECON 102 or ECON 103, or equivalent.

GGIS 210 Social & Environmental Issues credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/210/>)

Introduction to the complex relationship between people and the natural environment from a social science perspective. Explores different approaches to environmental issues, and examines the role of population change, political economy, technologies, environmental policymaking, and social institutions in causing and resolving contemporary social and environmental global issues. Same as ESE 210.

This course satisfies the General Education Criteria for:

Social Beh Sci - Soc Sci

GGIS 220 Landscapes, Ecosystems and Environmental Change credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/220/>)

Addresses the fundamental question of how science can guide sustainable management of landscapes and the associated ecosystems in the era of rapid global environmental change. To achieve this goal, we will integrate basic concepts and methods from a range of disciplines, including earth sciences, ecology, environmental management, and environmental studies.

This course satisfies the General Education Criteria for:

Nat Sci Tech - Phys Sciences

GGIS 221 Geographies of Global Conflict credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/221/>)

Focuses on geopolitical conflicts over ideology, resources, and territory from the mid-nineteenth century to the present. Examines these conflicts from the perspectives of political geography and political theory. Same as GLBL 221.

This course satisfies the General Education Criteria for:

Social Beh Sci - Soc Sci

GGIS 222 Big Rivers of the World credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/222/>)

An interdisciplinary approach to the study of big rivers, encompassing geomorphology, engineering, ecology, risk assessment and planning. Commencing with an assessment of the nature of big rivers; their hydrology and geomorphic setting; hazards associated with large rivers, and issues of river impoundment and management, then proceed to examine the geography, geomorphology, and ecology and management of a range of the World's greatest rivers, focusing on how a geomorphological understanding of such large rivers can aid study of riverine ecohabitats and inform decisions regarding water usage and engineering management. If the weather permits, a one day field-trip will be organized in the second half of the course to view aspects of a local river in Illinois/Indiana. Same as ESE 222.

GGIS 223 Geopolitics & Technology credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/223/>)

Examines the role of engineers, technology, and geopolitics from the mid-nineteenth century to the present. Colonialism, the world wars, the Cold War, the War on Terror and other historical contexts are covered. Present-day politics are grounded in these longer histories to illustrate how engineering and technology continue to transform geopolitical relations.

GGIS 224 Environmental Data Science credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/224/>)

Systematic analysis of the environmental and human processes shaping rural and urban Illinois through a data science lens.

This course satisfies the General Education Criteria for:

Social Beh Sci - Soc Sci

GGIS 254 People, Places, and Environments of the US credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/254/>)

Students will broaden their understanding of how the United States' physical and human geography interact to produce unique cultural landscapes. Covers multiple regions of the U.S., exploring the significant spatial patterns and processes, built and natural environments, and social, economic, and cultural landscapes of each. Focuses on the experiences of minority cultures in the U.S. through specific themes that vary by semester, including environmental justice, memory and memorials, music, and food. Same as ESE 254.

This course satisfies the General Education Criteria for:

Social Beh Sci - Soc Sci

Cultural Studies - US Minority

GGIS 280 Intro to Social Statistics credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/280/>)

Same as SOC 280. See SOC 280.

This course satisfies the General Education Criteria for:

Quantitative Reasoning I

GGIS 287 Environment and Society credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/287/>)

Same as Same as ESE 287, NRES 287, and PS 273. See NRES 287.

This course satisfies the General Education Criteria for:

Social Beh Sci - Soc Sci

Cultural Studies - Western

GGIS 350 Sustainability and the City credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/350/>)

Examination of the tools, techniques, strategies, and rationales that can be used by urbanists to produce and sustain a productive, fair, and equitable city. Emphasis is placed on diagnosing, implementing, and sustaining an ideal U.S. city as a complex whole that embeds an array of interconnecting parts (neighborhoods, retail districts, downtowns, city economies). Lectures and discussion cover the broad background of theories, concepts, and principles that will be essential for imagining and implementing these ideals, strategies and plans. Same as ESE 350.

GGIS 370 Water Planet, Water Crisis credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/370/>)

Same as ESE 320 and GEOL 370. See ESE 320.

GGIS 371 Spatial Analysis credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/371/>)

Overview of the spatial analysis (nomothetic) approach to geographic research, both physical and human; includes discussion of the scientific method, with explanations and uses of analytic geographic concepts in studying real world problems. Prerequisite: A course in geography.

This course satisfies the General Education Criteria for:

Quantitative Reasoning II

GGIS 379 Introduction to Geographic Information Systems credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/379/>)

Investigates the fundamentals of geographic information science as well as the basic skills in the execution of that theoretical knowledge with industry standard software packages. Student will learn the basics of projections and coordinate systems, how geographic information is stored and manipulated, and the theory and practice behind the production of thematic maps. Includes lecture and hands-on laboratory components. Same as ESE 379.

GGIS 380 Geographic Information Systems II credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/380/>)

Study of the analytical capabilities of geographic information systems with an emphasis on learning to solve spatial problems in both the vector and raster data formats. Students will develop the skills necessary to answer questions or solve problems in their areas of interest, with particular emphasis on problems and questions that require multiple steps to resolve. Students will learn the fundamental theory behind spatial problem solving, but also learn to execute these procedures with industry-standard software packages. Thus, this class contains both lecture/discussion elements and hands-on laboratory work. Same as ESE 380. Prerequisite: GGIS 379/ESE 379.

This course satisfies the General Education Criteria for:

Quantitative Reasoning II

GGIS 381 Enterprise GIS credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/381/>)

Geospatial data used by public-sector, private-sector, and research organizations is commonly kept in enterprise geodatabases and distributed using geospatial data servers. Following successful completion of this course, students will be able to perform tasks typical for early-career positions in such organizations. Topics include creation and maintenance of spatial and non-spatial database tables, construction of basic SQL queries for selection and joins, publication of geospatial services and web apps, and security best practices. Prerequisite: GGIS 379 or consent of instructor.

GGIS 384 Population Geography credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/384/>)

Problems and issues surrounding the geographic distribution of populations at the world, regional, and local levels; emphasizes problems associated with population growth and decline, recent population redistribution, births and deaths, and elderly and minority populations.

GGIS 390 Independent Study credit: 2 to 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/390/>)

Supervised independent study of special topics or regions. May be repeated once. Prerequisite: Junior standing; at least one formal course in the topic or region of interest; consent of instructor.

GGIS 391 Honors Independent Study credit: 2 to 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/391/>)

Independent study and research projects for students who are working toward the degree with distinction in geography. Prerequisite: Junior standing; consent of honors adviser.

GGIS 392 Geography & GIS Internship credit: 0 to 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/392/>)

Supervised, off-campus experience in a field directly pertaining to Geography and/or GIS. A written report is required at the end of the internship relating work accomplishments to the student's program of study. Approved for Letter and S/U grading. May be repeated in separate terms up to 6 hours. Prerequisite: Consent of faculty sponsor and Director of Undergraduate Studies; at least two courses taken within Geography & GIS.

GGIS 401 Watershed Hydrology credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/401/>)

Same as NRES 401. See NRES 401.

GGIS 403 Geographic Information Science and Systems credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/403/>)

Introduces the conceptual and technical fundamentals of geographic information science as a gateway to advanced study in geographic information science, and cover geographic information science as an interdisciplinary scientific field and geographic information systems as a tool in many application domains. Students will be introduced to unique characteristics of geospatial data in the capture, processing, storage, analysis, communication, and interpretation of geospatial information, which will prepare them to utilize information science techniques and critical spatial-thinking skills to address geospatially-related challenges. 4 undergraduate hours. 4 graduate hours. Prerequisite: There are no prerequisites for this course, although familiarity with basic descriptive and inferential statistics as well as some experience with at least one computer scripting/programming language will be helpful.

GGIS 405 Geography Field Course credit: 1 to 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/405/>)

Field observation and mapping of human and/or physical phenomena using basic geographic field techniques, including pre- and post-trip meetings. Required field trip. Additional fees may apply. See Class Schedule. 1 to 4 undergraduate hours. 1 to 4 graduate hours. May be repeated if topics vary. Prerequisite: Major or minor in Geography & GIS, or consent of instructor.

GGIS 406 Fluvial Geomorphology credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/406/>)

Systematic overview of the forms and processes associated with rivers and drainage basins; topics include basin hydrology, drainage networks, river hydraulics, sediment transport processes, channel morphology, channel change, and human impacts on fluvial systems. Same as GEOL 406 and NRES 406. 4 undergraduate hours. 4 graduate hours. Prerequisite: PHYS 101, and GGIS 103 or GEOL 107, or consent of instructor.

GGIS 407 Foundations of CyberGIS & Geospatial Data Science credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/407/>)

Intended to introduce students to CyberGIS – Geospatial Information Science and Systems (GIS) based on advanced cyberinfrastructure as well as the state of the art in high-performance computing, big data, and cloud computing in the context of geospatial data science. Students will use CyberGISX, which is an innovative cyberGIS framework for conducting data-intensive, reproducible, and scalable geospatial analytics with Jupyter Notebook as its primary user environment. Students are expected to learn how to develop Jupyter notebooks to analyze and visualize geospatial data using leading-edge cyberGIS software and python libraries. Emphasis is placed on learning the cutting-edge advances of cyberGIS and its underlying geospatial data science principles. Same as GEOL 407. 4 undergraduate hours. 4 graduate hours.

GGIS 408 Humans and River Systems credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/408/>)

Systematic analysis of the biophysical processes operating in rivers and watersheds and the interaction of humans on these processes. The course will emphasize the importance of biophysical processes and human interaction with these processes in river and watershed management. Class discussion and a class project will focus on analysis of practical river and watershed problems. 4 undergraduate hours. 4 graduate hours. Prerequisite: GGIS 103 or an introductory course in earth or environmental science.

GGIS 410 Green Development credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/410/>)

Theory and practice of sustainable development. Course materials draw upon theoretical and case study material from the social and natural sciences to analyze environment and development relations with emphasis on the Global South. Same as ESE 410. 4 undergraduate hours. 4 graduate hours.

GGIS 412 Geospatial Technologies & Society credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/412/>)

Examines the use of geographic information systems (GIS) and global positioning systems (GPS) with emphasis on their social and political implications. Topics may include critical cartography, social theory, health geography, historical geography, geopolitics, crime mapping, environmental justice, data feminism, environmental change, and science, technology, and society studies (STS). 3 undergraduate hours. 3 graduate hours. May be repeated to a maximum of 6 if topic varies. Prerequisite: GGIS 379 or equivalent.

GGIS 421 Earth Systems Modeling credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/421/>)

Same as ATMS 421, ESE 421, GEOL 481, and NRES 422. See ATMS 421.

GGIS 425 Urban Geographies of Migration credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/425/>)

Explores migrant urbanisms worldwide, foregrounding migrants as city-makers. Through theoretical and case-study engagements at the intersection of migration and urbanization, the course examines how migrants' everyday struggles over urban space forge new territories key to global migration projects and governance. Students will gain a critical lens to reimagine migration beyond the nation-state, as a distinctive urban phenomenon, and to understand the role of urban processes in shaping contemporary migrant trajectories. 3 undergraduate hours. 4 graduate hours. Prerequisite: Restricted to Junior, Senior or Graduate students.

GGIS 436 Biogeography credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/436/>)

Same as ANTH 436, ESE 439, IB 439, and NRES 441. See IB 439.

GGIS 438 Geography of Health Care credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/438/>)

Methods and perspectives of health care. Emphasizing the spatial analysis of health and health care. The organization, provision and competition of health care will be highlighted. Same as SOC 478. 3 undergraduate hours. 4 graduate hours. Prerequisite: GGIS 384 or SOC 274, or consent of instructor.

GGIS 439 Health Applications of GIS credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/439/>)

Students use spatial technologies and data to address issues of health. Topics include disease outbreak surveillance and response, environmental factors such as climate and socio-economic context, and the medical and other data needed to spatial analysis of health information. Application-based learning and class lectures are complemented by readings, guest lectures and class discussions. Geographic information system and global positioning system use is covered with examples drawn from public and veterinary health. Same as PATH 439. 3 undergraduate hours. 3 graduate hours. Approved for Letter and S/U grading. Prerequisite: An introductory statistics course such as ACE 261, HK 209, ECON 202, SOC 280 or equivalent.

GGIS 446 Sustainable Planning Seminar credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/446/>)

Same as LA 446, UP 446, and NRES 446. See LA 446.

GGIS 455 Geography of Sub-Saharan Africa credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/455/>)

Regional geography of Africa south of the Sahara. Geographic analysis of Africa which includes topics in both physical and human geography and provides a general overview of the processes and interactions between human and environmental factors that shape Africa's physical and human geography. 3 undergraduate hours. 3 graduate hours.

GGIS 459 Ecohydraulics credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/459/>)

Same as CEE 459. See CEE 459.

GGIS 460 Aerial Photo Analysis credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/460/>)

Review of methods for extracting quantitative and qualitative information from aerial photographs using computer-based techniques and visual interpretation. The first part of the course will cover basic photogrammetry and mapping. The second part will focus on interpretation of physical, biological, and cultural features. Same as NRES 460. 3 undergraduate hours. 4 graduate hours. Prerequisite: Knowledge of trigonometry and basic physical geography (GGIS 103 or equivalent).

GGIS 465 Transportation & Sustainability credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/465/>)

Descriptors of transportation systems; transportation as an industrial activity and public good; and transportation and spatial development, including the role of transportation in urban and regional development. Emphasis on the economic, environmental, and social aspects of sustainability as they apply to transportation systems and the activities they enable at local, regional, national and global levels. Field trip required. Same as ESE 465. Additional fees may apply. See Class Schedule. 3 undergraduate hours. 4 graduate hours.

This course satisfies the General Education Criteria for: Advanced Composition

GGIS 466 Environmental Policy credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/466/>)

Examination of the geographical and political aspects of human-environmental relations; focusing on how environmental problems are defined, negotiated, and addressed through policy formulation. Specific approaches to environmental policy will be considered at different geographical scales. Same as ESE 466. 3 undergraduate hours. 4 graduate hours. Prerequisite: One course in Geography or Political Science or consent of instructor.

GGIS 468 Biological Modeling credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/468/>)

Interdisciplinary modeling course for students interested in dynamic system modeling of living processes; each student will build a model by the end of the course. No special mathematical background required. Same as ANSC 449, CPSC 448, and IB 491. 3 undergraduate hours. 4 graduate hours. Prerequisite: IB 444 or equivalent, depending on curriculum.

GGIS 471 Modern Geographic Thought credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/471/>)

Examination of recent trends in human and physical geography. Themes include empiricism, logical positivism, regionalism, Marxism, realism, phenomenology, and postmodernism as applied to geographic research. Emerging geographic literature is explored to identify the latest conceptual developments. 4 undergraduate hours. 4 graduate hours.

GGIS 473 Digital Cartography & Map Design credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/473/>)

Instruction and practice in the basic techniques of map making followed by a consideration of problems involved in the construction of maps for presentation in a reproduced form (i.e., printed, photographed); the selection of proper source materials for the base and body of the map, the compilation and correlation of these materials, and methods of mechanical and photographic reproduction. 4 undergraduate hours. 4 graduate hours. Prerequisite: GGIS 379 or consent of instructor.

GGIS 476 Environmental Remote Sensing credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/476/>)

Application of remote sensing and geographic information system (GIS) technologies in solving geospatial and environmental problems. Same as IB 476. 3 undergraduate hours. 3 graduate hours. Prerequisite: GGIS 103, GGIS 224, or consent of instructor.

GGIS 477 Introduction to Remote Sensing credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/477/>)

Fundamentals of energy-matter interaction mechanisms, and the manifestation of reflected and emitted radiation on photographs and images; introduces characteristics of aerial films and filters, electro-optical scanners, and digital processing; and emphasizes applications in environmental problems. Same as NRES 477. 3 undergraduate hours. 3 graduate hours. Prerequisite: GGIS 280 or STAT 100 or equivalent, or consent of instructor.

GGIS 478 Techniques of Remote Sensing credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/478/>)

Introduce remote sensing techniques to identify features and phenomena at the surface of Earth with aircraft and satellite platforms. The covered topics include remotely sensed data and major sensor systems, optical, thermal, LiDAR, and hyperspectral remote sensing, techniques for image enhancement and image classification, and applications of remote sensing in various domain fields. 3 undergraduate hours. 3 graduate hours. Prerequisite: GGIS 477 or equivalent.

GGIS 479 Advanced Topics in GIS credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/479/>)

Introduces advanced concepts in Geographic Information Science. Course topics may vary. 4 undergraduate hours. 4 graduate hours. May be repeated in separate terms up to 8 hours, if topics vary. Prerequisite: GGIS 379 or ESE 379 or equivalent.

GGIS 480 Principles of Geographic Information Science credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/480/>)

Focuses on Geographic Information Science (GIScience) principles that underlie the development of Geographic Information Systems (GIS) software and its intelligent use. Helps students adapt to rapidly changing geospatial technologies. Knowledge gained in this course will be general and, thus, not be limited to any specific software product that may be revised in the future. 4 undergraduate hours. 4 graduate hours. Prerequisite: Graduate standing or instructor approval.

GGIS 482 Challenges of Sustainability credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/482/>)

Same as ESE 482 and GEOL 483. See ESE 482.

GGIS 483 Urban Geography credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/483/>)

Broad background of theories, concepts, and methods of research for understanding how and why our cities have reached their current status. Focus on examining the internal structure of the North American city, including analysis of the commercial, industrial, and residential sectors of the urban environment. Particular emphasis is placed on the range of urban theories developed to explain both urban structure and contemporary urban ills. 3 undergraduate hours. 3 graduate hours.

GGIS 489 Programming for GIS credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/489/>)

Introduction to programming to customize and extend the capabilities of geographic information systems. Topics include the principles of programming, advanced function and tools coding, visualization, fundamental spatial data structures, and spatial algorithms. 4 undergraduate hours. 4 graduate hours. Prerequisite: GGIS/ESE 379 or equivalent, or consent of instructor.

GGIS 491 Research in Geography credit: 2 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/491/>)

Detailed examination and discussion of the methods of initiating and executing research projects in human or physical geography (taught in separate sections); requires students to write a research proposal of a quality suitable for a graduate thesis. 2 undergraduate hours. 2 graduate hours. Prerequisite: GGIS 471; either graduate standing in geography or senior standing as a geography major and consent of department.

GGIS 495 Advanced Topics in Geography credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/495/>)

Explores special topics not covered in regularly scheduled Geography courses. 3 or 4 undergraduate hours. 3 or 4 graduate hours. May be repeated if topics vary in the same term to a maximum of 9 undergraduate hours or 12 graduate hours or in separate terms to a maximum of 12 undergraduate hours or 12 graduate hours.

GGIS 496 Climate & Social Vulnerability credit: 3 or 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/496/>)

Existing climate variability and likely climate change call for policies to protect vulnerable people who make their livelihoods in a changing environment. Students will explore: 1) causes of climate related stress and disaster; 2) theories of vulnerability and adaptation; 3) practices and policies designed to reduce economic loss, hunger, famine and dislocation in the face of climate trends and events. Focus on multiple policy scales affecting poor and marginal populations, who are disproportionately vulnerable when facing climate stress, drawing on case examples primarily from the developing world. Same as ATMS 446 and SOC 451. 3 undergraduate hours. 4 graduate hours.

GGIS 507 High-Performance Geospatial Computing credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/507/>)

Intended to introduce students to high-performance geospatial computing using python to resolve computational bottlenecks and produce faster and scalable solutions. Students will learn how to use Python on high-performance and parallel computing architecture. Specifically, NumPy, SciPy, Numba, and Cython will be covered to optimize and speed up geospatial computation. Students will use CyberGISX as the primary learning environment, and be expected to learn how to develop such notebooks to address computational challenges in solving geospatial problems. By the end, students will have gained solid knowledge of common Python tools for developing high-performance geospatial computing solutions that can be applied to many applications. Prerequisite: GGIS 407 or equivalent.

GGIS 517 Geospatial Visualization & Visual Analytics credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/517/>)

Intended to introduce students to geospatial visualization and visual analytics as well as the state-of-the-art of cartographic mapping and visualization technologies in the context of cyberGIS (cyber geospatial information science and systems) and geospatial data science. Students will learn open source mapping and visualization libraries such as Leaflet, D3 and Plotly and how to mash up these libraries to create interactive and dynamic visualization tools and GIS applications. Students are expected to learn how to visualize not only geospatial data but also results of spatial analysis. Emphasis is placed on learning the cutting-edge advances of geospatial visualization and visual analytics and practical skills to create geospatial applications based on such advances.

GGIS 527 Geospatial Artificial Intelligence & Machine Learning credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/527/>)

The field of Artificial Intelligence (AI) has made significant progress in recent years, and a number of AI algorithms have even surpassed human ability at tasks such as computer vision, natural language processing and machine translation. The intersection of AI and geospatial analysis is creating massive and unprecedented opportunities for knowledge discovery and innovative applications. A growing number of Geospatial AI and machine learning applications have emerged in a diverse set of disciplines such as geography and geographic information science, agriculture, business, economics, sustainable development, and urban planning. In this course, students will learn a variety of Geospatial AI and Machine Learning (ML) algorithms (e.g., decision trees, and support vector machine) and tools that allow us to investigate and identify patterns, clusters, classes, and anomalies based on various types of geospatial data. The course will include extensive hands-on interactions with geospatial data and applications based on cutting-edge AI and ML techniques. Prerequisite: GGIS 407 or equivalent.

GGIS 560 Spatial Epidemiology credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/560/>)

Same as PATH 560. See PATH 560.

GGIS 561 Landscapes and Human Health credit: 3 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/561/>)

Same as LA 570. See LA 570.

GGIS 570 Advanced Spatial Analysis credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/570/>)

Advanced techniques of spatial analysis, including spatial autocorrelation, trend surface analysis, grouping and regionalization procedures, and point pattern analysis.

GGIS 587 Qualitative Research Methods credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/587/>)

Same as UP 587. See UP 587.

GGIS 590 Graduate Independent Study credit: 1 to 8 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/590/>)

Independent research project or thesis topic development to be supervised by Geography & GIS faculty advisor. May be repeated in separate semesters. After passing the Preliminary Exam, PhD candidates should register for GGIS 599: Thesis Research instead of this course.

GGIS 593 Geography & GIS Colloquium credit: 0 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/593/>)

Weekly research presentations by invited speakers and Geography & GIS PhD students on a wide range of topics. Required for all GGIS graduate (excluding PSM) students. 0 graduate hours. 0 professional hours. Approved for S/U grading only. May be repeated in separate terms.

GGIS 594 Seminar in Social Geography credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/594/>)

Advanced study of current research in social geography; topic will vary from term to term. Prepares students for thesis and dissertation research through the study of relevant literature and completion of a research paper. May be repeated up to 8 hours, if topics and instructor vary.

GGIS 595 Graduate Seminar credit: 1 to 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/595/>)

Graduate-level exploration of a topic in Geography & GIS that is not covered by an existing course. Topics and instructors vary by semester. Approved for Letter and S/U grading. May be repeated if topics vary.

GGIS 598 Graduate Capstone Project credit: 4 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/598/>)

Major individual project that demonstrates the student's ability to solve an advanced geospatial problem or develop a GIS-based application. Student will work closely with a faculty capstone advisor to determine the project focus and expected outcome(s).

GGIS 599 Thesis Research credit: 0 to 16 Hours. (<https://courses.illinois.edu/schedule/terms/GGIS/599/>)

Individual research under supervision of members of the faculty in their respective fields. Approved for S/U grading only. May be repeated in separate terms.