GEOGRAPHIC INFORMATION SCIENCE (GIS)

GIS 420 Web-based GIS: Technologies and Applications (3)
Prerequisites for Undergraduate: GY 307 or equivalent. Prerequisites for Graduate: GIS 451 or GIS 510 or equivalent. This course introduces students to the growing field of web-based GIS. The course focuses on the design, development, and implementation of web mapping applications, allowing students to apply techniques in real-world applications. Students taking this course will be required to develop a web GIS application. For graduate credit, a separate GIS application must be hosted by the GIS server and published to the World Wide Web.

GIS 451 Applied Geographical Information Systems (3)
Prerequisite(s): GY 307.
Training in advanced Geographic Information Systems (GIS) techniques using spatial data collection, project design, geospatial modeling, data management, and implementation. This course examines the use of GIS to solve real-world spatial problems. This course will require a project to be designed and implemented by the student with pre-approval of instructor. For graduate credit, the project must be completely self-contained and, as a deliverable, must include final map plotted at 24"x36" containing accurate symbology and registration and follow all general cartographic principles.

GIS 459 Spatial Data Collection and Management (3)
Prerequisites for Undergraduate: GIS 451 or equivalent. Prerequisites for Graduate: GIS 451 or GIS 510 or permission of the department head. This course covers multiple methods of capturing data, acquiring and importing existing spatial data (both raster and vector) into geographic information systems, and deriving spatial information from these data. This includes manipulation and management of spatial data from various platforms, devices, and sources. For graduate credit, the student must develop a project using various data types (vector, raster, LiDAR, etc.) and produce a complete and self-contained project. The student will also be required to present the project to a public forum (class, lecture, colloquium, etc.)

GIS 503 Independent Study (3)
This course gives the advanced student opportunity to pursue directed research. May be duplicated for credit for a total of 6 semester hours. Grades: Pass/Fail.

GIS 506 Digital Image Analysis (3)
Advanced techniques, data collection, and analytical methods using various types of remotely sensed data. These will include LiDAR data, Ground Penetrating Radar, and various types of multi-spectral data from satellites such as Landsat, Quickbird, Ikonos, SPOT, and others. Multi-spectral data will include: thermal, natural color (RBG), near to far-infared and others. This course will use various methodologies for collection, classification (supervised ad unsupervised), and analysis of digital data to accomplish change detection, Normalized difference Vegetation Index (NVD1), land use-land cover (LULC), etc. Students will demonstrate mastery of advanced remote sensing skills through a projected at the end of the course. The student should then give a presentation on their project to the class and give a thorough discussion of the analytics used.

GIS 508 Drone Piloting and Mapping (3)
Prerequisite(s): GIS 510 or permission of the department head.
This graduate-level course provides an in-depth examination of unmanned aerial systems (UAS), remote sensing principles, and photogrammetry techniques for aerial mapping applications. Students will gain knowledge of Federal Aviation Administration (FAA) regulations, safety protocols, and advanced flight planning for UAS operations. Through hands-on field work, students will collect aerial imagery using a variety of sensor platforms and cameras. Advanced image processing skills will be developed using photogrammetry software to create accurate 2D and 3D maps, point clouds, and 3D models from the aerial data. Graduate students will apply this knowledge in a mapping project which includes: project proposal and flight planning, data acquisition, processing and analysis of aerial imagery, and presentation of final geospatial products.

GIS 510 Introduction to Spatial Analysis (3)
An overview of geographic information systems and a foundation in map coordinate systems, map projections, and map scale. (GIS 510 is cross-listed with BY 510, and only one course may be taken for credit.)

GIS 516 Web-based GIS: Technologies and Applications (3)
This course introduces students to the theoretical frameworks and practical applications of web mapping technologies. This course equips students with the skills needed to design, develop, and implement interactive web mapping applications. Students will gain hands-on experience by creating a fully-fledged web-GIS application hosted on a GIS server and published to the World Wide Web. The curriculum aims to facilitate high-level research capabilities and integrates advanced geospatial analytics, methodological considerations, and ethical guidelines.

GIS 517 Spatial Statistics (3)
Spatial Statistics provides a survey of the methods used to describe, analyze, and model spatial data. This class will explore the application of spatial statistics to everyday issues that might be faced in the field. The major topics of this course will include how to collect, manage, and analyze point pattern data and geostatistical data. In the semester, we will explore regression models, autocorrelation, and Kriging. We will also include Bayesian models throughout the course to review their fit with spatial data.

GIS 519 Geospatial Programming (3)
This course explores the use of scripting languages, such as Python and R, to create applications that perform fundamental spatial statistical analysis, such as geoprocessing, spatial autocorrelation, database management, spatial regression, and map creation. Students will explore data analysis and data modeling. Students will demonstrate knowledge of programming concepts and approaches and develop solutions to problems by automating geoprocessing tasks. Graduate-level credit for this course will require a larger research question and dataset that will be analyzed using methods discussed in class. The student will provide their code and data in an open-source platform for reproducibility.

GIS 520 Spatial Data Collection and Management (3)
Prerequisite(s): GIS 510.
Methods of capturing data, acquiring and importing existing spatial data into geographic information systems, and deriving spatial information from remotely sensed data and storing spatial data.

GIS 530 Analyzing Spatial Networks (3)
Prerequisite(s): GIS 451 or GIS 510 or permission of the department head. This course offers the opportunity to study and understand topology theory and employ it in GIS network analyst. The Network Analyst allows one to solve common network problems, such as finding the best route across a city, finding the closest emergency vehicle or facility, identifying a service area around a location, or choosing the best facilities to open or close. The student will create a network dataset. The course cover best routes for multi-nodal networks, how to find proximity and closest entity, the creation of models for route analysis and servicing orders for a fleet of vehicles, and will also teach students to perform network analysis using traffic data and restricted attributes.

GIS 540 Site Location Analysis (3)
Location is considered one of the most important factors leading to the success of a private- or public-sector organization. In the course, we will emphasize evaluating existing site locations efficiencies, determine appropriate point site and area site locations for organizational entities, and analyze environmental impacts using GIS and business analyst software. Location can help keep fixed and overhead costs low and accessibility high. Public-sector facilities, such as schools, hospitals, libraries, fire stations, and emergency response services centers can provide high-quality service to the community at a low cost when a good location is chosen. Using site location analysis, students will learn to minimize impedance and maximize coverage area, attendance, market share, and target market areas.

GIS 550 Organization and Management of Spatial Systems (3)
Prerequisite(s): GIS 451 or GIS 510 or permission of the department head. This course includes the basics for developing a project plan. Defining and confirming the project goals and objectives, identifying tasks and quantifying the resources needed, and determining budgets and timelines for project completion. The program includes the implementation of the project plan and regular controls to ensure that there is accurate and objective information on performance relative to the plan. GIS projects follow stages of development and production for accurate execution.

GIS 560 Spatial Data, Layout, and Design (3)
Prerequisite(s): GIS 510 or permission of the department head.
This course provides graduate students with an in-depth examination of cartographic design, principles, and theory for effectively visualizing and communicating geographic information. Students will synthesize knowledge from empirical data and apply advanced visualization techniques to create original and innovative map products. Topics covered include: map projections, generalization, symbology, layout, and design. Students will complete an independent research project applying innovative geo-visualization techniques to a real-world problem or creating maps for their thesis or capstone project. Students will critically evaluate and provide peer feedback on map products. Students are assigned supplemental readings and lead a class discussion on an advanced mapping technique.

GIS 570 Advanced Topics in Spatial Analysis (3)
Advanced GIS instruction and work in a variety of topics. Topics may include imagery interpretation, imagery classification, surface modeling, spatial manipulation, spatial languages, and statistical analysis of spatial data. This course may be taken twice for credit.

GIS 590 Internship (3)
Prerequisite(s): Permission of program director or Department Head. Supervised work experience in an approved field with a business, non-profit organization, or governmental agency. A minimum of 100 hours should be completed by the end of the internship. The student is required to attend a preannounced orientation meeting prior to beginning the internship. The student will gain practical experience and relevant skills at a public or private institution in the GIS field to develop knowledge and experience in the practical application of skills to actual problems in a non-classroom situation. Only students in the GIS Master's program are eligible to sign up for this course.

GIS 591 Capstone Project (3)
Prerequisite(s): permission of capstone advisor.
A GIS capstone project is the final course in the MS in Geographic Information Science and Technology. It gives the student the opportunity to apply the skills learned/refined in the course of studies. A GIS capstone project immerses the student in a wide range of tasks, which are associated with GIS application. The student's program advisor will review and guide the project. This course may be duplicated for credit for a total of six credit hours, if needed.

GIS 599 Thesis (3)
The master's thesis gives students the opportunity to design and produce an original, independent professional work on a compelling topic of their choice (approved by the thesis advisor). Students work closely with a faculty advisor who serves as the thesis committee chair and two committee members from the Department of Chemistry and Geosciences faculty to produce an abstract and the thesis. The proposal for the thesis project must be reviewed and approved by the thesis advisor and the thesis committee. Defense of the completed thesis to the committee will serve as the comprehensive exam.