GEOGRAPHIC INFORMATION SCIENCE (GIS)

GIS 2170 - GIS in Civil Engineering
Credit(s): 3 Credits
This course discusses the fundamental concepts of GIS, and the methods and software used to solve civil engineering programs. The course also covers skills to deal with remote sensing data, basic and differential GPS surveying to prepare students for today's growing business needs in civil engineering companies and government agencies. Students may only apply credits toward their graduation requirements from one of the following courses: EAS 2170, BIOL 4170, EAS 4170, or SOC 4650.

GIS 2930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)

GIS 2980 - Independent Study
Credit(s): 1 or 3 Credits (Repeatable for credit)

GIS 4010 - Introduction to GIS
Credit(s): 3 Credits
This class introduces concepts, science, and theory of GIS and provides hands-on learning experiences. After successful completion of the course, students will be able to demonstrate fundamental techniques of geospatial analysis and mapping. (Offered every fall.)

GIS 4020 - Intermediate GIS
Credit(s): 3 Credits
This course covers intermediate and advanced topics in GIS, including remote sensing for GIS, geospatial statistics and social, economic, and environmental aspects of GIS. Each subject is presented by a professor who specializes in the subject area. (Offered every spring.)

GIS 4040 - Introduction to Remote Sensing
Credit(s): 3 Credits
This course include fundamental knowledge on the physics of remote sensing; photogrammetry; multispectral, hyperspectral, and thermal imaging; RADAR; and LIDAR. Principles are reviewed in lectures, and lab assignments cover image processing, environmental modeling, and analysis. The course objective is to demonstrate applications of remote sensing in environmental sciences with software training in ENVI&IDL and SARscape. (Offered every fall.)

GIS 4060 - Geospatial Methods in Environmental Studies
Credit(s): 3 Credits
For students and professionals in Environmental Sciences, this course explores an integrated GIS and remote sensing approach to solve real-world environmental problems. Through hands-on projects, the course will also prepare students for today’s growing business needs in innovative server-based GIS solutions, relational databases and web mapping in an enterprise environment. Geospatial methods to be discussed include: spatial analysis, web GIS, database design, management and data mining with integration of GIS, remote sensing and GPS, and varies applications of the techniques with special attention in environmental studies such as risk assessment and mitigation, environmental modeling, natural resource management, water/air pollution & control, forest fire mapping, health and environmental change analysis etc.

GIS 4090 - Introduction to Programming for GIS and Remote Sensing
Credit(s): 3 Credits
This course will introduce students to Python programming and its applications to remote sensing and GIS. Through completing this course, students will be able to use Python to perform common GIS and remote sensing analysis tasks, automate workflows, and develop custom Python tools. Topics will include describing data, manipulating data, automating spatial analysis tasks, creating Python scripts and tools, and using Python for imagery analysis."

GIS 4091 - Advanced Programming for GIS and Remote Sensing
Credit(s): 3 Credits
In this class, students will learn how to publish, consume, and analyze web services using Python, Javascript, and HTML. They will be introduced to more powerful, more advanced Python libraries such as Pandas, Numpy, ArcGIS, and Folium in addition to learning advanced geographic data visualization techniques that leverage Python, Javascript, and web APIs. They will also learn how to use the Javascript to create their first stand-alone web applications. This class builds on what students learned in GIS 4090 and helps them develop knowledge and skills that they will use throughout their careers.
Attributes: Natural Science Req (A&S)

GIS 4100 - Microwave Remote Sensing: SAR Principles, Data Processing and Applications
Credit(s): 3 Credits
The course covers principles of synthetic aperture radar (SAR), SAR satellites and data sources, SAR image processing, interpretation and applications. Popular data processing techniques, including SAR intensity processing, InSAR and DInSAR techniques, polarimetry tools/ classification methods, Persistent Scatterer Interferometry are discussed through detailed step-by-step lab work on the processing chain including measuring earthquake deformation, land subsidence, landslides, building sinking, and tree height/health estimation, DEM generation, and various environmental applications. Students will have experience on ordering, processing and interpreting SAR data, and an opportunity to discuss advantages and limitations of SAR remote sensing for their specific research, and to explore RADAR w/ LiDAR for its common applications in vegetation assessment and terrain characterization.

GIS 4110 - Interferometric Synthetic Aperture Radar
Credit(s): 3 Credits
This course focuses on providing application oriented forum on InSAR for geoscientists. Principles of InSAR, DInSAR, timeSAR are introduced through hands-on lab work on measuring earthquake deformation, volcanic unrest, land subsidence due to extraction of groundwater, oil, gas, and coal mining using both commercial and open-source software tools.

GIS 4930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)

GIS 4960 - GIS Capstone
Credit(s): 3 Credits
In this course, students will consolidate their coursework and demonstrate their mastery of professional remote sensing and/or GIS competencies through ongoing research projects. Depending on whether students' interests are in remote sensing or GIS, topics will cover spatial analysis, web GIS, database design, management and data mining with integration of GIS, remote sensing and GPS, InSAR, and various applications of techniques. (Offered as needed.)

GIS 4980 - Independent Study
Credit(s): 1 or 3 Credits (Repeatable for credit)

GIS 5010 - Introduction to Geographic Information Systems
Credit(s): 3 Credits
This class introduces concepts, science, and theory of GIS and provides hands-on learning experiences. After successful completion of the course, students will be able to demonstrate fundamental techniques of geospatial analysis and mapping. (Offered every fall.)

GIS 5020 - Intermediate Geographic Information Systems
Credit(s): 3 Credits
This course covers intermediate and advanced topics in GIS, including remote sensing for GIS, geospatial statistics and social, economic, and environmental aspects of GIS. Each subject is presented by a professor who specializes in the subject area. (Offered every spring.)

GIS 5040 - Introduction to Remote Sensing
Credit(s): 3 Credits
This course include fundamental knowledge on the physics of remote sensing; photogrammetry; multispectral, hyperspectral, and thermal imaging; RADAR; and LIDAR. Principles are reviewed in lectures, and lab assignments cover image processing, environmental modeling, and analysis. The course objective is to demonstrate applications of remote sensing in environmental sciences with software training in ENVI&IDL and SARscape. (Offered every fall.)

GIS 5060 - Geospatial Methods in Environmental Studies
Credit(s): 3 Credits
For students and professionals in Environmental Sciences, this course explores an integrated GIS and remote sensing approach to solve real-world environmental problems. Through hands-on projects, the course will also prepare students for today's growing business needs in innovative server-based GIS solutions, relational databases and web mapping in an enterprise environment. Geospatial methods to be discussed include: spatial analysis, web GIS, database design, management and data mining with integration of GIS, remote sensing and GPS, and varies applications of the techniques with special attention in environmental studies such as risk assessment and mitigation, environmental modeling, natural resource management, water/air pollution & control, forest fire mapping, health and environmental change analysis etc.

GIS 5070 - Research Methods
Credit(s): 3 Credits
Analysis of research procedures as practiced in geospatial science. Research objectives, literature searches and review, data collection design, data analysis techniques, and modes of presentation. Offered every fall.

GIS 5080 - Digital Cartography and Geovisualization
Credit(s): 3 Credits
Readings, discussion, and hands-on investigation of advanced cartography topics and contemporary geovisualization issues. Analytic cartography, spatial analysis, and visualization techniques. Offered every spring.

GIS 5090 - Introduction to Programming for GIS and Remote Sensing
Credit(s): 3 Credits
This course will introduce students to Python programming and its applications to remote sensing and GIS. Through completing this course, students will be able to use Python to perform common GIS and remote sensing analysis tasks, automate workflows, and develop custom Python tools. Topics will include describing data, manipulating data, automating spatial analysis tasks, creating Python scripts and tools, and using Python for imagery analysis."

GIS 5091 - Advanced Programming for GIS and Remote Sensing
Credit(s): 3 Credits
In this class, students will learn how to publish, consume, and analyze web services using Python, Javascript, and HTML. They will be introduced to more powerful, more advanced Python libraries such as Pandas, Numpy, ArcGIS, and Folium in addition to learning advanced geographic data visualization techniques that leverage Python, Javascript, and web APIs. They will also learn how to use the Javascript to create their first stand-alone web applications. This class builds on what students learned in GIS 5090 and helps them develop knowledge and skills that they will use throughout their careers.
Prerequisite(s): GIS 5090

GIS 5092 - Machine Learning for GIS and Remote Sensing
Credit(s): 3 Credits
This course will introduce applied machine learning techniques for GIS and remote sensing. Topics include machine learning regression, Convolutional Neural Networks, computer vision, nonlinear activation functions and optimization, image recognition and classification, deep learning, extreme learning machine.
Prerequisite(s): GIS 5090

GIS 5100 - Microwave Remote Sensing: SAR Principles, Data Processing and Applications
Credit(s): 3 Credits
The course covers principles of synthetic aperture radar (SAR), SAR satellites and data sources, SAR image processing, interpretation and applications. Popular data processing techniques, including SAR intensity processing, InSAR and DInSAR techniques, polarimetry tools/classification methods, Persistent Scatterer Interferometry are discussed through detailed step-by-step lab work on the processing chain including measuring earthquake deformation, land subsidence, landslides, building sinking, and tree height/health estimation, DEM generation, and various environmental applications. Students will have experience on ordering, processing and interpreting SAR data, and an opportunity to discuss advantages and limitations of SAR remote sensing for their specific research, and to explore RADAR w/ LiDAR for its common applications in vegetation assessment and terrain characterization.

GIS 5110 - Interferometric Synthetic Aperture Radar
Credit(s): 3 Credits
This course focuses on providing application oriented forum on InSAR for geoscientists. Principles of InSAR, DInSAR, timeSAR are introduced through hands-on lab work on measuring earthquake deformation, volcanic unrest, land subsidence due to extraction of groundwater, oil, gas, and coal mining using both commercial and open-source software tools.

GIS 5120 - Geographic Information Science, Society and Sustainability
Credit(s): 3 Credits
Critical perspectives on the evolution of geographic information science and the roles and impacts of geospatial technologies in contemporary society. Offered periodically as needed.

GIS 5930 - Special Topics
Credit(s): 3 Credits (Repeatable for credit)

GIS 5970 - Research Topics
Credit(s): 0-3 Credits (Repeatable for credit)
A non-classroom course in which a student engages in research on a topic that is related to the student's graduate work and career goals. Offered annually.

GIS 5980 - Independent Study
Credit(s): 1 or 3 Credits (Repeatable for credit)

GIS 5990 - Thesis Research
Credit(s): 0-6 Credits (Repeatable for credit)
Research that leads to a Master's Thesis and defense of the Thesis.
Offered every fall and spring.