Geographic Information Systems - CPS (GIS)

GIS 5103. Foundations of Geographic Information Science. (4 Hours)
Introduces geospatial data, technology, visualization, and analysis to support spatial inquiry and decision making. Topics include geospatial principles, geospatial data models and data types, metadata and attribute data, data sources, geospatial software options, quality assurance and quality control, and government/industry application areas. Includes technical knowledge of common geospatial analysis tasks. Offers students an opportunity to obtain hands-on experience using professional-grade platforms (ArcGIS, QGIS) and other geospatial software products.

GIS 5201. Advanced Spatial Analysis. (3 Hours)
Provides an in-depth evaluation of theoretical, mathematical, and computational foundations of GIS. Topics include spatial information theory, database theory, mathematical models of spatial objects, and GIS-based representation. Examines advanced concepts and techniques in raster-based GIS and high-level GIS modeling techniques.

Prerequisite(s): GIS 5103 (may be taken concurrently) with a minimum grade of C- or GIS 5102 (may be taken concurrently) with a minimum grade of C-

GIS 6210. Geospatial Applications. (2 Hours)
Presents a comprehensive exploration of the various geographic information system applications. Offers students an opportunity to obtain the skills and knowledge necessary to leverage geospatial tools for data analysis, visualization, and decision making across different domains. Uses a combination of theoretical understanding and practical exercises to study how to use advanced geospatial applications to solve complex spatial problems and create meaningful solutions.

GIS 6240. Geospatial Predictive Analytics. (2 Hours)
Offers students an opportunity to obtain the skills and knowledge to harness the power of geospatial data for making informed predictions and decisions. Delves into the theory and practical application of predictive analytics techniques using Esri's ArcGIS Insight, a powerful tool for visualizing and analyzing spatial data. Covers data preprocessing, feature selection, model creation, evaluation, and interpretation. Applies predictive analytics techniques to geospatial data and examines how to contribute to data-driven decision making in various domains.

GIS 6320. Use and Applications of Free and Open-Source GIS Desktop Software. (3 Hours)
Intended to expose students to free and open source (FOSS) GIS desktop applications (primarily QGIS GRASS GIS) and implementations for them to gain an understanding of the potential benefits or drawbacks of FOSS GIS alternatives compared to proprietary standards such as ArcGIS. Focuses on practical application over GIS theory but students examine historical development of FOSS GIS as well as case studies regarding FOSS GIS utilization to aid in their understanding and appraisal of these applications. Software used: QGIS (Desktop, Browser, Print Composer, DB Manager), GRASS-GIS, Boundless Suite, PostGIS, Spatialite.

Prerequisite(s): (GIS 5103 with a minimum grade of C- or GIS 5102 with a minimum grade of C-); GIS 5201 with a minimum grade of C-

GIS 6340. GIS Customization. (3 Hours)
Provides an in-depth introduction to the customization of Esri ArcGIS using Python with hands-on experience with ArcGIS, ModelBuilder, Python, geoprocessing, and ArcPy. The focus is on automating tasks and workflows in ArcMap using ModelBuilder; applying Python programming in ArcMap and for ModelBuilder; applying practical methods of debugging, tool input parameters, and tool and code documentation. Students will create a GIS data processing tool, useful to their work or area of interest, using Python or Python and ModelBuilder. The tool must be documented and capable of gracefully handling errors. Software: ArcGIS Desktop, Notepad++, IDLE - Python IDE, other Python IDE according to student choice.

Prerequisite(s): GIS 5103 with a minimum grade of C- or GIS 5101 with a minimum grade of C-

GIS 6345. Geospatial Programming. (3 Hours)
Introduces basic concepts in computer programming for geospatial data with a focus on the Python language. Applies learned approaches to geospatial analysis and accessing Python packages for spatial data science. Examples include shapely, pandas, NumPy, matplotlib, and SciPy.

Prerequisite(s): GIS 5103 with a minimum grade of C- or (GIS 5101 with a minimum grade of C- ; GIS 5102 with a minimum grade of C-)

GIS 6350. Planning a GIS Implementation. (3 Hours)
Emphasizes the process of planning a GIS implementation so an organization ends up with the "right" GIS. GIS has the potential to benefit many different types of organizations in many different ways. Focuses on understanding the planning process and the issues involved in preparing for the implementation of a GIS within a multiuser environment. Assignments help students grasp the various stages of the process, including the understanding of organization strategy, needs assessments, capability definition, data design, system requirements, and organizational impacts. While the class uses enterprise-level GIS as the context for the planning process, the process discussed can also be applied to smaller-scale organizations and systems. This course assumes a basic understanding of GIS and basic information technology concepts. Software: N/A.

Prerequisite(s): GIS 5103 with a minimum grade of C- or GIS 5101 with a minimum grade of C-

GIS 6360. Spatial Databases. (3 Hours)
Offers students an opportunity to develop skills in acquiring and building spatial data and maintaining spatial databases. Emphasizes Personal, Workgroup, and Enterprise ArcSDE geodatabases, topology, and versioned editing. Analyzes fundamental theoretical knowledge about information systems and the unique demands created by geographic information. Material includes data modeling and knowledge representation for spatial data, database schemas and models, and architectural principles for GIS. Students use database documentation (metadata) and SQL tools to query and update database attributes. Requires a final project to create a complete geodatabase representative of a spatial database used to support a real-world application. Software: ArcGIS Desktop Advanced; ArcSDE/Microsoft SQL Server enterprise geodatabase; OSQL application to query and create data in a Microsoft SQL Server database.

Prerequisite(s): GIS 5103 with a minimum grade of C- or (GIS 5101 with a minimum grade of C- ; GIS 5102 with a minimum grade of C-)

GIS 6370. Internet-Based GIS. (3 Hours)
Introduces the basic concepts associated with publishing spatial data and serving maps on the internet. Topics covered include copyright, federal, state, and local laws about spatial data sharing; map creation with web and desktop client applications; web map coding using Open Source and proprietary APIs; publishing advanced geoprocessing services. Offers students an opportunity to create a polished web mapping application that leverages Open Source or proprietary internet GIS technologies on both server and client side. Software: Google Earth, Google Maps, ArcGIS Explorer Desktop, ArcGIS Desktop, ArcGIS Online, GeoServer, SFTP software (e.g., FileZilla, FireFTP, Cyberduck, etc.), and Carto.

Prerequisite(s): GIS 5103 with a minimum grade of C- or GIS 5101 with a minimum grade of C-

GIS 6962. Elective. (1-4 Hours)
Offers elective credit for courses taken at other academic institutions. May be repeated without limit.

GIS 6980. Capstone. (1-4 Hours)
Offers students an opportunity to integrate their course work, knowledge, and experiences into a capstone project. Emphasizes student responsibility, development of individual competencies, and geospatial analytical techniques and methods. Learning strategies encourage self-motivation and autonomy to discover work in a supportive environment with guidance and clear expectations. The class proceeds by outlining key milestones and showing examples of deliverables to visualize the process and the desired outcomes; coaching, feedback, and guidance throughout the learning process; and structured discussions, formative assessments, and journaling via e-portfolio to elicit articulation and reflection—two key processes in effective learning. Students are expected to create a conference-ready poster, present their work orally, and assemble a showcase e-portfolio.

Prerequisite(s): (GIS 5103 with a minimum grade of C- or (GIS 5101 with a minimum grade of C- ; GIS 5102 with a minimum grade of C-)); GIS 5201 with a minimum grade of C- ; RMS 5105 with a minimum grade of C-

GIS 6983. Topics. (1-4 Hours)
Covers special topics in geographic information systems. May be repeated without limit.

GIS 6995. Project. (1-4 Hours)
Focuses on in-depth project in which a student conducts research or produces a product related to the student's major field. May be repeated without limit.