GEOSPATIAL SYSTEMS ENGINEERING (GSEN)

GSEN 5355 DESIGN-ANALYS GIS APPLICATIONS
3 Semester Credit Hours (3 Lecture Hours)
DESIGN-ANALYSIS GIS APPLICATIONS Programming course focusing on the design and implementation of GIS scripts. Topics covered include GIS scripts, GIS tool creation, and user interface design and implementation.

GSEN 5365 SPATIAL DATABASE DESIGN
3 Semester Credit Hours (3 Lecture Hours)
An introduction to spatial database principles and the practical skills of design implement, and use of spatial databases. Topics covered include basic database model, spatial database design and management, spatial indexes, and spatial data mining. Advanced knowledge and skills in spatial databases are also covered.

GSEN 5381 CADASTRAL INFOSYSTEMS DESIGN
3 Semester Credit Hours (3 Lecture Hours)
A review of the evolution of European cadastral systems and land records traditions and alternatives. Examination of the goals and purposes of land tenure systems with attention to social, political, legal, economic, organizational, and technical issues. Exploration of U.S. modernization efforts and the problems of developing countries.

GSEN 5382 PLCY-LEGL ASPECT SPATL INFOSYS
3 Semester Credit Hours (3 Lecture Hours)
POLICY AND LEGAL ASPECTS OF SPATIAL INFORMATION SYSTEMS A study of the current and emerging status of computer law in electronic environments. Covers issues related to: privacy, freedom of information, confidentiality, copyright, and legal liability; the impact of statue and case law on use of digital databases and spatial databases; and research of legal options of conflicts related to spatial data.

GSEN 5383 ADV GEOSPATIAL ANALYSIS DESIGN
3 Semester Credit Hours (3 Lecture Hours)
ADVANCED GEOSPATIAL ANALYSIS AND DESIGN An advanced course that focuses on spatial analysis and modeling in GIS. Topics covered include exploratory analysis of spatial data, network analysis, exploring spatial point patterns, area objects and spatial autocorrelation, spatial interpolation, and spatial regression. New approaches to spatial analysis are also covered.

GSEN 5384 GEOSPATIAL VISUALIZATION DESGN
3 Semester Credit Hours (3 Lecture Hours)
GEOSPATIAL VISUALIZATION DESIGN Basic elements of thematic cartography, cartographic theory, and cartographic projections. Integration of cartographic principles with GIS visualization. Principles of map design with GIS data.

GSEN 5385 ANALY-DIGITAL PHOTOGRAMMET ENG
3 Semester Credit Hours (3 Lecture Hours)
ANALYTICAL AND DIGITAL PHOTOGRAMMETRIC ENGINEERING A study of the mathematical and geometric models of modern photogrammetry. Covers principles of stereoscopic vision, collinearity, coplanarity, epipolar geometry, ground control densification and extension by analytical aerotriangulation. Explores automation in photogrammetric procedures - digital aerotriangulation, automated data capture.

GSEN 5386 PROBLEMS -REMOTE SENSING ENVIR
3 Semester Credit Hours (3 Lecture Hours)
PROBLEMS-REMOTE SENSING OF THE ENVIRONMENT Advanced problems in photo interpretation, photogrammetry and remote sensing within a GIS. Topics include utilization of expert computer systems, knowledge based environmental modeling, macro languages and spatial modeling languages. Operations and laboratories will cover mathematical operations on raster layers, convolution filtering, neighborhood analysis, principal components, proximity, contiguity and descriptor table manipulation. Final project includes the development of a remote sensing of the environment software program with a graphical user interface.

GSEN 5393 Graduate Creative Project
1-3 Semester Credit Hours
AN APPLIED RESEARCH GROUP PROJECT IN GEOSPATIAL SURVEYING ENGINEERING FROM PROBLEM DEFINITION TO IMPLEMENTATION IN AN AREA PROVIDED BY FACULTY IN THE COURSE OF STUDY. FALL, SPRING, AND SUMMER.

GSEN 5395 Graduate Research Design
3 Semester Credit Hours (3 Lecture Hours)
PREPARATORY AND DEVELOPMENTAL RESEARCH FOR THE GRADUATE THESIS OR CREATIVE PROJECT RESULTING IN THE PRELIMINARY DESIGN AND FORMAL PROPOSAL OF THE GRADUATE PROJECT. THIS THESIS OR A CREATIVE PROJECT PROPOSAL MUST BE REVIEWED AND APPROVED BY THE PROJECT CHAIRPERSON TO RECEIVE CREDIT. A GRADE OF CREDIT/NO CREDIT WILL BE ASSIGNED FOR THE CLASS WITH THE POSSIBILITY TO ASSIGN THE GRADE OF IP OR IN PROGRESS. IF A GRADE OF IP IS ASSIGNED, THE COURSE MUST BE REPEATED THE FOLLOWING SEMESTER(S) UNTIL THE COURSE IS PASSED. CREDIT WILL NOT BE RECORDED UNTIL THE GRADUATE PROJECT PROPOSAL IS APPROVED BY THE GRADUATE PROJECT COMMITTEE CHAIR. OFFERED FALL, SPRING, AND SUMMER SEMESTERS.

GSEN 5698 Graduate Thesis
1-6 Semester Credit Hours
AN APPLIED RESEARCH PROJECT IN GEOSPATIAL SYSTEMS ENGINEERING FROM PROBLEM DEFINITION TO IMPLEMENTATION IN AN AREA OF PARTICULAR INTEREST TO THE STUDENT THAT RELATES TO THE COURSE OF STUDY.

GSEN 6330 Spatial Systems Science
3 Semester Credit Hours (3 Lecture Hours)
INTRODUCTION AND ADVANCED USAGES OF MAPPING DATUMS, COORDINATE SYSTEMS, AND ACCURACY REQUIREMENTS FOR GEOGRAPHIC INFORMATION SYSTEMS (GIS). USE OF GIS TOOLS TO INVESTIGATE STATISTICAL PATTERNS AND RELATIONSHIPS AMONG MAPS AND GEO-DATABASES. DERIVATION OF NEW MAPS AND ANALYSIS BASED ON SPATIAL CONTEXT, PATTERNS, SURFACE CONFIGURATION, PROXIMITY, CONNECTIVITY AND FLOWS.
Prerequisite: MATH 6316.

GSEN 6355 Geospatial Programming Techniques
3 Semester Credit Hours (3 Lecture Hours)
COURSE TEACHES PROGRAMMING TECHNIQUES IN GEOSPATIAL FIELDS, SUCH AS HOW TO AUTOMATE GIS TASKS USING PYTHON AND OTHER SCRIPTING LANGUAGES. AUTOMATION CAN MAKE YOUR WORK EASIER, FASTER, AND MORE ACCURATE, AND KNOWLEDGE OF A SCRIPTING LANGUAGE IS A HIGHLY DESIRED SKILL IN GIS ANALYSTS. FALL.

GSEN 6356 Programming for Geospatial Data Science
3 Semester Credit Hours (3 Lecture Hours)
PYTHON IS BECOMING MORE AND MORE POPULAR FOR DOING DATA SCIENCE WORLDWIDE, ESPECIALLY COMPANIES ARE USING PYTHON TO GATHER INSIGHTS FROM THEIR DATA AND GET A COMPETITIVE EDGE. THIS COURSE FOCUSES ON PYTHON SPECIFICALLY FOR GEOSPATIAL DATA SCIENCE. STUDENTS WILL LEARN ABOUT POWERFUL APPROACHES TO STORE AND MANIPULATE DATA AS WELL AS COOL DATA SCIENCE TOOLS TO START THEIR OWN ANALYSES.

GSEN 6365 Spatial Database Design
3 Semester Credit Hours (3 Lecture Hours)
THIS COURSE WILL FOCUS ON SPATIAL DATABASE PRINCIPLES AND THE PRACTICAL SKILLS OF DESIGN, IMPLEMENTATION, AND USE OF SPATIAL DATABASES. THIS COURSE WILL FIRST COVER FUNDAMENTALS OF RELATIONAL DATABASE DESIGN, AND THEN FOCUS ON DESIGN AND MANAGEMENT OF SPATIAL DATABASES UTILIZING GEODATABASE MODELS. IN ADDITION, CASE STUDIES OF GEODATABASE DESIGN MODELS IN SEVERAL APPLICATIONS WILL ALSO BE COVERED. THIS COURSE IS INTENDED FOR STUDENTS WHO WANT TO DESIGN, CREATE, MAINTAIN AND MANIPULATE DATA FROM A GEOSPATIAL DATABASE. SPRING.

GSEN 6367 Geospatial Data Mining
3 Semester Credit Hours (3 Lecture Hours)
GEOSPATIAL DATA MINING IS THE PROCESS OF AUTOMATICALLY DISCOVERING INTERESTING AND USEFUL SPATIAL PATTERNS IN LARGE GEOSPATIAL DATASETS. THIS COURSE BEGINS BY COVERING FUNDAMENTAL CONCEPTS AND TECHNIQUES IN DATA MINING. SPECIFIC TOPICS COVERED INCLUDE CLASSIFICATION, ASSOCIATION ANALYSIS, AND CLUSTER ANALYSIS. IT THEN FOCUSES ON USING THESE DATA MINING TECHNIQUES FOR HANDLING SPATIAL, TEMPORAL AND SPATIAL-TEMPORAL DATA. IN ADDITION, THE DATA MINING TOOLS TO IMPLEMENT APPLICATIONS IN GEOSCIENCE WILL ALSO BE COVERED. SPRING.

GSEN 6370 UAS for Surveying and Mapping
3 Semester Credit Hours (3 Lecture Hours)
INTRODUCES THE FUNDAMENTALS OF MAPPING WITH SMALL UNMANNED AIRCRAFT SYSTEMS (SUAS) USING DIGITAL IMAGING SENSORS TO PRODUCE HIGH RESOLUTION, ACCURATE GEOSPATIAL SURVEYING PRODUCTS. THE COURSE WILL COVER THE FULL SPECTRUM OF UAS MAPPING INCLUDING TECHNOLOGY, CURRENT REGULATIONS, OPERATIONAL FACTORS, FLIGHT DESIGN, PHOTOGRAMMETRIC DATA PROCESSING, AND DATA FIDELITY. SUPPORTING CONCEPTS WILL INCLUDE GEOREFERENCING AND GROUND CONTROL, 3D RECONSTRUCTION WITH STRUCTURE-FROM-MOTION PHOTOGRAMMETRY, ORTHORECTIFICATION AND IMAGE MOSAICKING, ACCURACY ASSESSMENT, AND CURRENT DEVELOPMENTS IN UAS FOR GEOMATICS. PROCESSING AND ANALYSIS WORKFLOWS USING COMMERCIAL AND OPEN-SOURCE SOFTWARE WILL BE CONDUCTED TO TRANSFORM UAS IMAGE SEQUENCES INTO GEOSPATIAL DATA PRODUCTS, EXTRACT ANALYTICS, ASSESS RESULTS, AND OPTIMIZE OUTPUT. SPRING.

GSEN 6371 Geopositioning Systems and Autonomous Navigation
3 Semester Credit Hours (3 Lecture Hours)
ADDRESSES THE FOUNDATIONS AND COMPUTATIONAL TECHNIQUES OF GLOBAL NAVIGATION SATELLITE SYSTEMS (GNSS) AND INERTIAL MEASUREMENT UNITS (IMUS) FOR AUTONOMOUS NAVIGATION APPLICATIONS. SPECIFICALLY, THE COURSE WILL COVER CONCEPTS AND PRINCIPLES OF GNSS SIGNAL STRUCTURES AND THE DERIVATION OF OBSERVABLES; ERROR SOURCES AND CORRECTIONS; POINT, DIFFERENTIAL, AND KINETIC POSITIONING TECHNIQUES; IMU LINEAR AND ANGULAR DYNAMICS MODELING; MECHANIZATION OF INERTIAL NAVIGATION AND ERROR PROPAGATION; GLOBAL/LOCAL COORDINATE FRAMES AND CONVERSION; AND FILTERING TECHNIQUES FOR GNSS/IMU INTEGRATION. THE COURSE ALSO COVERS CURRENT AND FUTURE CAPABILITIES OF EMERGING GEOPOSITIONING SYSTEMS AS THEY RELATE TO AUTONOMOUS NAVIGATION AND MOBILE DEVICES. FALL.

GSEN 6380 Applied Geospatial Statistics
3 Semester Credit Hours (3 Lecture Hours)
THIS COURSE WILL FOCUS ON GEOSPATIAL STATISTICS METHODS PARTICULARLY MULTIVARIATE STATISTICS AND APPLICATIONS OF THE STATISTICAL PROCEDURES TO RESEARCH GEOSPATIAL PROBLEMS. RESEARCH ON GEOSPATIAL PROBLEMS OFTEN REQUIRES THE APPLICATION OF MULTIVARIATE STATISTICAL METHODS TO PRODUCE NEW INSIGHT. VARIOUS EXISTING STATISTIC SOFTWARE IS AVAILABLE TO CONDUCT MULTIVARIATE STATISTICAL ANALYSIS, HOWEVER, THE INTERPRETATION OF THE RESULTS RELY ON SOLID UNDERSTANDING OF STATISTIC PRINCIPLES AND THEORIES. THIS COURSE IS INTENDED FOR STUDENTS WHO WANT TO APPLY STATISTICAL METHODS TO RESEARCH GEOSPATIAL PROBLEMS.

GSEN 6381 Cadastral Information Systems Design
3 Semester Credit Hours (3 Lecture Hours)
A REVIEW OF THE EVOLUTION OF EUROPEAN CADASTRAL SYSTEMS AND LAND RECORDS TRADITIONS AND ALTERNATIVES. EXAMINATION OF THE GOALS AND PURPOSES OF LAND TENURE SYSTEMS WITH ATTENTION TO SOCIAL, POLITICAL, LEGAL, ECONOMIC, ORGANIZATIONAL, AND TECHNICAL ISSUES. EXPLORATION OF U.S. MODERNIZATION EFFORTS AND THE PROBLEMS OF DEVELOPING COUNTRIES. SPRING ODD YEARS.

GSEN 6382 Policy and Legal Aspects of Spatial information Systems
3 Semester Credit Hours (3 Lecture Hours)
A STUDY OF THE CURRENT AND EMERGING STATUS OF COMPUTER LAW IN ELECTRONIC ENVIRONMENTS. COVERS ISSUES RELATED TO: PRIVACY, FREEDOM OF INFORMATION, CONFIDENTIALITY, COPYRIGHT, AND LEGAL LIABILITY; THE IMPACT OF STATUE AND CASE LAW ON USE OF DIGITAL DATABASES AND SPATIAL DATABASES; AND RESEARCH OF LEGAL OPTIONS OF CONFLICTS RELATED TO SPATIAL DATA. FALL.

GSEN 6383 Advanced Geospatial Analytics
3 Semester Credit Hours (3 Lecture Hours)
THIS COURSE WILL FOCUS ON THE THEORY, TECHNIQUES, AND APPLICATIONS OF ADVANCED GEOSPATIAL ANALYTICS. TOPICS COVERED INCLUDE SPATIAL POINT PATTERNS, NETWORK ANALYSIS, AREA OBJECTS AND SPATIAL AUTOCORRELATION, AND SPATIAL INTERPOLATION. NEW APPROACHES TO GEOSPATIAL ANALYTICS WILL ALSO BE COVERED. THIS COURSE EMPHASIZES THE METHODS AND THE APPLIED SIDE OF GEOSPATIAL ANALYTICS THAT CAN BE USEFUL IN STUDENTS' OWN THESES OR PROJECTS FOR THEIR CURRENT OR POTENTIAL EMPLOYERS. FALL.

GSEN 6384 Geospatial Visualization Design
3 Semester Credit Hours (3 Lecture Hours)
THIS COURSE WILL ENSURE THAT STUDENTS UNDERSTAND AND APPLY CARTOGRAPHIC THEORY FOR VISUAL COMMUNICATION AND VISUAL THINKING, AND BE ABLE TO CREATE, EVALUATE, AND CRITIQUE REFERENCE AND THEMATIC MAPS USING GIS SOFTWARE. FALL.

GSEN 6385 Photogrammetric Engineering and Lidar Scanning
3 Semester Credit Hours (3 Lecture Hours)
A STUDY OF THE ANALYTICAL AND SYSTEMS ENGINEERING FOUNDATIONS OF AIRBORNE PHOTOGRAMMETRY AND GEODETIC IMAGING TECHNOLOGIES FOR 2D AND 3D MAPPING OF NATURAL AND BUILT ENVIRONMENTS. THE COURSE COVERS PRINCIPLES OF DIGITAL IMAGING, CAMERA CALIBRATION, STEREO AND MULTI-VIEW PHOTOGRAMMETRY, ANALYTICAL PHOTOGRAMMETRY, STRUCTURE-FROM-MOTION, LIGHT DETECTION AND RANGING (LIDAR) SYSTEMS, AND EMERGENT SCANNING AND IMAGING APPROACHES. THE COURSE ALSO DETAILS PHOTOGRAMMETRIC AND LIDAR DATA PROCESSING, POINT CLOUD ANALYSIS, AND APPLICATIONS.

GSEN 6386 Remote Sensing and Image Analysis
3 Semester Credit Hours (3 Lecture Hours)
ADDRESSES THE INTERPRETATION, PROCESSING AND ANALYSIS TECHNIQUES OF REMOTELY SENSED DATA ACQUIRED BY ORBITAL AND SUB-ORBITAL PLATFORMS. PHYSICAL PRINCIPLES AND IMAGING MECHANISMS, REMOTE SENSING SYSTEMS, DATA CHARACTERISTICS, IMAGE PROCESSING, AND INFORMATION EXTRACTION METHODS WILL BE COVERED. TOPICS INCLUDE PASSIVE OPTICAL IMAGING WITH MULTISPECTRAL, HYPERSPECTRAL, AND THERMAL SENSING; ACTIVE IMAGING WITH RADAR SENSING; IMAGE CORRECTIONS AND RECTIFICATION; SPATIAL/FREQUENCY TRANSFORMS AND IMAGE FILTERING; IMAGE CLASSIFICATION AND FEATURE EXTRACTION; AND IMAGE PROCESSING WITH MACHINE LEARNING TECHNIQUES. APPLICATIONS IN THE COURSE WILL BE FOCUSED ON GEOMATICS AND MONITORING OF NATURAL AND BUILT ENVIRONMENTS. FALL.

GSEN 6390 Advanced Topics
3 Semester Credit Hours (3 Lecture Hours)
VARIABLE CONTENT STUDY OF SPECIFIC AREAS OF GEOSPATIAL SURVEYING ENGINEERING. MAY BE REPEATED FOR CREDIT WHEN TOPICS VARY. OFFERED ON SUFFICIENT DEMAND.

GSEN 6396 Directed Independent Study
3 Semester Credit Hours (3 Lecture Hours)
STUDY IN AREAS OF CURRENT INTEREST.