

GEOSPATIAL SYSTEMS ENGINEERING, MS

Program Description

The Geospatial Systems Engineering Program will prepare graduates with advanced knowledge and skills focusing on research, design, development, and use of technologies in the field of geospatial systems engineering. This program satisfies regional, state, and national need for master's-level graduates in geospatial systems engineering.

The program offers two tracks, Track 1 - Geosensing Systems and UAS for Geomatics or Track 2 - Geospatial Data Science and Analytics. Both tracks require a minimum of 30 semester-credit hours. This must include 6 semester credit hours in the geospatial systems engineering core, 9 semester credit hours in each track, and 15 semester hours in the Graduate Thesis option or the Graduate Creative Project option as described in Section II.

Objectives of the Program

Student Learning Outcomes

Graduates of the GSEN Program will:

- Develop, manage, and analyze geospatial data using spatial analysis, computational, and geomatics engineering techniques.
- Develop the capacity for continued learning, research, and professional application.
- Creatively apply geomatics engineering techniques and technologies to solve real-world problems.

Program Outcomes

Graduates of the Master of Science in Geospatial Systems Engineering will have:

1. The ability to lead teams and apply problem-solving skills that include oral and written communication skills to effectively manage geospatial information.
2. An awareness and utilization of external organizations and institutions that provide useful geospatial data sets and their relationships to traditional and contemporary societal issues.
3. A recognition of the need for continued learning and development of leadership skills through involvement in volunteer professional organizations and societies.

Chronological Procedure Leading to the MS Degree

1. Completion of a degree plan
Upon admission to the MS degree program in Geospatial Systems Engineering, and prior to enrollment in any course, *the student must contact the Graduate Academic Advisor in the College of Science and Engineering to have a degree plan completed.* Students must arrange to see their advisor/mentor each semester until graduation to have their semester course schedules approved.
2. Progress toward the degree
Once admitted to the graduate degree program in Geospatial Systems Engineering, a student must complete at least six semester credit hours per year toward the degree until the degree is completed. Failure to make this minimum progress will result in dismissal

from the degree program with possible readmission based on the catalog in effect at the time of re-admission. A student who is actively pursuing a Graduate Creative Project and has completed all other course work for the degree will be required to register for a minimum of three credit hours continuously until the project is completed. A student who is actively pursuing a Graduate Thesis and has completed all other course work for the degree will be required to register for thesis credit hour(s) continuously until the project is completed.

3. Graduate Thesis and Graduate Creative Project procedure
Following a consultation with and permission of the advisor/mentor, the student may register for GSEN 5395 Graduate Research Design (3 sch) to develop a proposal for the Graduate Thesis or Graduate Creative Project. After the proposal is approved by the thesis or creative project chairperson, the proposal must be submitted to the full thesis or creative project committee. This three-member committee shall consist of at least two full-time Texas A&M University-Corpus Christi graduate faculty members. The committee chairperson must be a graduate faculty member in the geospatial systems engineering program. The second committee member may be a graduate faculty member in geospatial systems engineering, geographic information science, or computer science. The third member may be a graduate faculty member having distinguished professional status and expertise in the discipline of the proposed Graduate Thesis or Graduate Creative Project.
After the approved Graduate Thesis proposal is placed in the student's file, the student may register for GSEN 5698 Graduate Thesis (1-6 sch). After approval of Graduate Creative Project proposal, a student may register for GSEN 5393 Graduate Creative Project (1-3 sch). Once a student has registered for Graduate Thesis or Graduate Creative Project, he or she must continue to register in each consecutive semester until the thesis or creative project is completed. A student who does not complete a thesis or creative project in the semester for which he or she has registered will receive a grade of IP (In Progress). Failure to register for an incomplete thesis or creative project in the next semester will terminate the thesis or creative project and will require that the entire thesis or creative project process be repeated starting with the submission of a new thesis or creative project proposal.
4. Final examination and thesis or project report
After completion of all other requirements for the MS degree in Geospatial Systems Engineering, the student must schedule an oral exam over his/her graduate program of study. The oral exam may include any material from the program of study and will be administered by the graduate committee. It will focus heavily on the thesis or creative project.
The Graduate Thesis or Graduate Creative Project (see GSEN 5698 Graduate Thesis (1-6 sch) or GSEN 5393 Graduate Creative Project (1-3 sch)) may be completed in one semester; however, with continuous registration, a student will be allowed up to one calendar year to complete the thesis or creative project. Any extension beyond one year will require written justification on a semester-to-semester basis, to be approved by each member of the committee and the coordinator of the Geospatial Systems Engineering program.

For Additional Information

Website:
<http://gisc.tamucc.edu>

Campus Address:
Conrad Blucher Institute

Phone: 361-825-5850

Mailing Address:
 Geospatial Systems Engineering
 Program, Unit 5868
 Texas A&M University-Corpus
 Christi
 6300 Ocean Drive
 Corpus Christi, TX 78412-5868

Admission Requirements

Students seeking admission to the graduate degree program in Geospatial Systems Engineering must hold a bachelor's degree from a regionally accredited institution of higher education in the United States (or an equivalent foreign institution). In addition to meeting all University requirements, students seeking admission to the graduate degree program in Geospatial Systems Engineering must submit the following to the Office of Recruitment and Admissions:

1. An application and application fee.
2. Transcripts from regionally accredited institutions (international students will be required to submit relevant international transcripts).
3. At least two reference letters.
4. Official GRE scores (within five years of the date of application).
5. Admission Essay discussing why you wish to get a master's degree and your area of interest.
6. A 60 hr. GPA of 3.0 or higher is standard.

Persons seeking admission to the MS Program in Geospatial Systems Engineering should first contact the program and identify a faculty member willing to serve as the graduate advisor. Applicants will not be admitted to the program without a graduate advisor.

Program Requirements

The course of study leading to a MS degree in Geospatial Systems Engineering is composed of five components:

- General prerequisites (must be satisfied before the student can be formally and unconditionally accepted to the MS program).
- Options
- Core Courses
- Required Courses for Tracks
- Elective Courses
- Additional Courses.

The program normally requires 15 semester-credit hours of required courses, including 6 semester-credit hours of core courses and 9 semester-credit hours of required courses for tracks. Justification for exceptions to this rule should be prepared by students, approved by students' graduate advisor, and attached to the degree plan when submitted for the department head's signature.

General Prerequisites

1. Geospatial Systems Engineering
 Every student is expected to have achieved certain minimum competencies in geospatial science before being formally admitted to the MS degree program. Students who have not earned a baccalaureate degree in Geographic Information Science, Surveying, or a similar field must consult with the coordinator of the Geospatial Systems Engineering Program to design a plan of appropriate leveling

courses. Leveling courses are not counted in the above 30 semester-credit hours requirements.

2. Mathematics
 Every student must have minimum level of knowledge in mathematics equivalent to the mathematics courses in the BS in Geographic Information Science Program and will be evaluated on an individual basis by Geospatial Systems Engineering faculty.
3. English
 Every student is expected to have minimum competencies in English composition, especially in technical writing. In preparation for reports that are required in the workplace, numerous reports are required during the course of study for the degree. The proposal, the creative project and the thesis require technical writing. Students may consider taking writing-intensive courses such as ENGL 3301 Technical and Professional Writing (3 sch) to satisfy the writing requirement.

Options

Students must choose one from the following tracks:

- Track 1 Geosensing Systems and UAS for Geomatics
- Track 2 Geospatial Data Science and Analytics

The student can chose either a project or a thesis option under their chosen track.

Thesis Option

A Graduate Thesis based upon original research, supported by the scientific literature, and proved statistically, will be required under this option. The thesis option master's degree will allow a person to pursue advanced graduate study, or to obtain employment in most areas requiring a detailed knowledge of specific aspects of geospatial systems engineering. The Geospatial Systems Engineering Graduate Thesis requires a minimum of 6 hours of GSEN 5698 Graduate Thesis (1-6 sch) and formal publishable thesis.

GSEN 5395 Graduate Research Design (3 sch) and GSEN 5698 Graduate Thesis (1-6 sch) (Total 9 hours)

Thesis Option Track 1 or 2

Code	Title	Hours
	Core Courses	9
	Required Courses for Each Track	9
	Electives (approved by faculty advisor)	6
GSEN 5698	Graduate Thesis	6
Total Hours		30

Project Option

The project option is a Graduate Creative Project designed for students who desire a more detailed study into a specific geospatial systems engineering project. The curriculum will especially benefit individuals employed in scientific or technical fields who seek advancement or additional training to enhance their knowledge and skills. The Graduate Creative Project requires 3 hours of GSEN 5393 Graduate Creative Project (1-3 sch) and a formal publishable project report.

GSEN 5395 Graduate Research Design (3 sch) and GSEN 5393 Graduate Creative Project (1-3 sch) (Total 6 hours)

Project Option Track 1 or 2

Code	Title	Hours
Core Courses		9
Required Courses for Each Track		9
Electives (approved by faculty advisor)		9
GSEN 5393	Graduate Creative Project	3
Total Hours		30

Degree Requirements

Track 1: Geosensing Systems and UAS for Geomatics - Thesis Option

Code	Title	Hours
Core Courses		
GSEN 5395	Graduate Research Design	3
GSEN 6383	Advanced Geospatial Analytics	3
GSEN 6386	Remote Sensing and Image Analysis *	3
Required Courses		
GSEN 6370	UAS for Surveying and Mapping *	3
GSEN 6371	Geopositioning Systems and Autonomous Navigation *	3
GSEN 6385	Photogrammetric Engineering and Lidar Scanning *	3

Electives		
Select 6 hours of the following: ¹		6
GSEN 6330	Spatial Systems Science *	
GSEN 6355	Geospatial Programming Techniques *	
GSEN 6356	Programming for Geospatial Data Science *	
GSEN 6365	Spatial Database Design *	
GSEN 6367	Geospatial Data Mining *	
GSEN 6380	Applied Geospatial Statistics *	
GSEN 6381	Cadastral Information Systems Design *	
GSEN 6382	Policy and Legal Aspects of Spatial information Systems *	
GSEN 6384	Geospatial Visualization Design *	

Thesis Option		
GSEN 5698	Graduate Thesis	6

Additional Courses		
The following may be offered and substituted for any of the courses above subject to approval by the student graduate mentor or committee chair.		
GSEN 6390	Advanced Topics	
GSEN 6396	Directed Independent Study	
Total Hours		30

¹ Electives may be selected from other interdisciplinary courses, as selected in consultation with their advisory committee, to provide a broad background in geospatial systems engineering or related fields.

* Online offering

Track 1: Geosensing Systems and UAS for Geomatics - Project Option

Code	Title	Hours
Core Courses		
GSEN 5395	Graduate Research Design	3
GSEN 6383	Advanced Geospatial Analytics	3

GSEN 6386	Remote Sensing and Image Analysis *	3
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Required Courses		
GSEN 6370	UAS for Surveying and Mapping *	3
GSEN 6371	Geopositioning Systems and Autonomous Navigation *	3
GSEN 6385	Photogrammetric Engineering and Lidar Scanning *	3

Electives		
Select 9 hours of the following: ¹		9
GSEN 6330	Spatial Systems Science *	
GSEN 6355	Geospatial Programming Techniques *	
GSEN 6356	Programming for Geospatial Data Science *	
GSEN 6365	Spatial Database Design *	
GSEN 6367	Geospatial Data Mining *	
GSEN 6380	Applied Geospatial Statistics *	
GSEN 6381	Cadastral Information Systems Design *	
GSEN 6382	Policy and Legal Aspects of Spatial information Systems *	
GSEN 6384	Geospatial Visualization Design *	

Project Option		
GSEN 5393	Graduate Creative Project	3

Additional Courses		
The following may be offered and substituted for any of the courses above subject to approval by the student graduate mentor or committee chair.		
GSEN 6390	Advanced Topics	
GSEN 6396	Directed Independent Study	
Total Hours		30

¹ Electives may be selected from other interdisciplinary courses, as selected in consultation with their advisory committee, to provide a broad background in geospatial systems engineering or related fields.

* Online offering

Track 2: Geospatial Data Science and Analytics - Thesis Option

Code	Title	Hours
Core Courses		
GSEN 5395	Graduate Research Design	3
GSEN 6383	Advanced Geospatial Analytics *	3
GSEN 6386	Remote Sensing and Image Analysis	3
Required Courses		
GSEN 6365	Spatial Database Design *	3
GSEN 6367	Geospatial Data Mining *	3
GSEN 6384	Geospatial Visualization Design *	3

Electives		
Select 6 hours of the following: ¹		6
GSEN 6330	Spatial Systems Science *	
GSEN 6355	Geospatial Programming Techniques *	
GSEN 6356	Programming for Geospatial Data Science *	
GSEN 6370	UAS for Surveying and Mapping *	
GSEN 6371	Geopositioning Systems and Autonomous Navigation *	
GSEN 6380	Applied Geospatial Statistics *	

GSEN 6381	Cadastral Information Systems Design *
GSEN 6382	Policy and Legal Aspects of Spatial information Systems *
GSEN 6385	Photogrammetric Engineering and Lidar Scanning *

Thesis Track

GSEN 5698	Graduate Thesis	6
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Additional Courses

The following may be offered and substituted for any of the courses above subject to approval by the student graduate mentor or committee chair:

GSEN 6390	Advanced Topics
GSEN 6396	Directed Independent Study

Total Hours **30**

¹ Electives may be selected from other interdisciplinary courses, as selected in consultation with their advisory committee, to provide a broad background in geospatial systems engineering or related fields.

* Online offering

Track 2: Geospatial Data Science and Analytics - Project Option

Code	Title	Hours
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Core Courses

GSEN 5395	Graduate Research Design	3
GSEN 6383	Advanced Geospatial Analytics *	3
GSEN 6386	Remote Sensing and Image Analysis	3

Required Courses

GSEN 6365	Spatial Database Design *	3
GSEN 6367	Geospatial Data Mining *	3
GSEN 6384	Geospatial Visualization Design *	3

Electives

Select 9 hours of the following: ¹ 9

GSEN 6330	Spatial Systems Science *
GSEN 6355	Geospatial Programming Techniques *
GSEN 6356	Programming for Geospatial Data Science *
GSEN 6370	UAS for Surveying and Mapping *
GSEN 6371	Geopositioning Systems and Autonomous Navigation *
GSEN 6380	Applied Geospatial Statistics *
GSEN 6381	Cadastral Information Systems Design *
GSEN 6382	Policy and Legal Aspects of Spatial information Systems *
GSEN 6385	Photogrammetric Engineering and Lidar Scanning *

Project Track

GSEN 5393	Graduate Creative Project	3
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Additional Courses

The following may be offered and substituted for any of the courses above subject to approval by the student graduate mentor or committee chair:

GSEN 6390	Advanced Topics
GSEN 6396	Directed Independent Study

Total Hours **30**

¹ Electives may be selected from other interdisciplinary courses, as selected in consultation with their advisory committee, to provide a broad background in geospatial systems engineering or related fields.

* Online offering

Courses

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 statute 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 STATISTICAL SOFTWARE IS AVAILABLE TO CONDUCT MULTIVARIATE STATISTICAL ANALYSIS, HOWEVER, THE INTERPRETATION OF THE RESULTS RELY ON SOLID UNDERSTANDING OF STATISTICAL 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 STATUTE 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.