Doctor of Philosophy in Geospatial Information Sciences

http:www.gis.utdallas.edu

This degree program is jointly offered by the School of Economic, Political and Policy Sciences, the School of Natural Sciences and Mathematics (specifically in the Department of Geosciences) and the Eric Jonsson School of Engineering and Computer Science, and is administered by the School of Economic, Political and Policy Sciences.

Faculty

Professors: Carlos Aiken (Geosciences), Brian J. L. Berry (Economic, Political and Policy Sciences), Ronald Briggs (Economic, Political and Policy Sciences), Daniel Griffith (Economic, Political and Policy Sciences), James Murdoch (Economic, Political and Policy Sciences), Edwin Sha (Computer Science), Robert Stern (Geosciences)

Associate Professors: Tom Brikowski (Geosciences), John Ferguson (Geosciences), Paul Jargowsky (Economic, Political and Policy Sciences), Michael Tiefelsdorf (Economic, Political and Policy Sciences), Fang Qiu (Economic, Political and Policy Sciences)

Assistant Professors: Timothy Bray (Economic, Political and Policy Sciences), Kevin Curtin (Economic, Political and Policy Sciences), Karen Hayslett-McCall (Economic, Political and Policy Sciences), Weili Wu (Computer Science)

Objectives

Powerful new technologies have emerged in recent years to collect, store, manage, and analyze information regarding the features of the Earth's surface and to combine these with other types of environmental, social and economic information. These technologies, which include geographicl information systems (GIS), the global positioning system (GPS), and satellite-based remote sensing, are used in many ways from digital maps in rental and delivery vehicles, to the management and maintenance of city infrastructure, regional agriculture and forest lands, to the policing of communities, and to the conduct of modern warfare. The objective of the PhD in Geospatial Information Sciences is to develop individuals capable of advancing this field by developing new knowledge or capabilities relevant to it.

The degree program is jointly offered by the School of Economic, Political and Policy Sciences, the School of Natural Sciences and Mathematics (specifically in the Department of Geosciences) and the Eric Jonsson School of Engineering and Computer Science. This unique structure reflects geospatial information science's origins as the

confluence of work in multiple disciplines including geography, computer science, engineering, geology, and various social, policy and applied sciences. It is anticipated that many students will enter the program with a bachelor's or master's degree (and/or work experience) in an application area (such as public administration, geology, or economics) or in a technical specialization (such as engineering, computer science, or statistics) with the intent of advancing existing practice with geospatial information sciences in that application area or expanding the technological or theoretical base for geospatial information sciences.

The curriculum requires students to have mastery of Geospatial Information Sciences Technologies and Theory, have a Technological Specialization, have a Specific Application area (possibly derived from their master's degree), and evidence research skills through a Ph. D. dissertation for a total of 90 semester credit hours beyond the bachelors degree.

Facilities

Students have access to state-of-the-art GIS computing facilities housed at the Bruton Center in the School of Economic, Political and Policy Sciences and the NASA Center for Excellence in Remote Sensing in the Department of Geosciences. The University's extensive instructional computing facilities, including those in the Eric Jonsson School of Engineering and Computer Science, are also available. Facilities are open extended hours including evenings and weekends. Enrollment in hands-on courses is controlled to ensure that a station is available for every student. All industry-standard GIS and remote sensing software is available. The University is a an Oracle Center of Excellence for Spatial Data Management and a member of the University Consortium for Geographic Information Science (UCGIS)

Admission Requirements

The University's general admission requirements are discussed here.

The PhD program in Geospatial Information Sciences seeks applications from students with a baccalaureate, Master of Arts, Master of Science or professional masters-level degree in any field relevant to geospatial information science including, but not limited to, computer science, economics, engineering, geography, geology, management information systems, marketing, natural resource management, public affairs and public administration, statistics, and urban and regional planning,. Applicants will be judged and evaluated by the existing admission standards as set forth by the University in its Graduate Catalog and by the standards set forth here by the Geospatial Information Sciences program. A bachelor's degree from an accredited institution or its equivalent and fluency in written and spoken English are required. A grade average of at least 3.25 in undergraduate and graduate course work, and a combined verbal and quantitative score of 1150 on the GRE are desirable.

Students must submit transcripts from all higher education institutions attended, three letters of recommendation, and a one-page essay outlining the applicant's background, education, and personal objectives as they specifically relate to a Ph.D. in Geospatial Information Sciences.

Prerequisites

The following pre-requisites/co-requisites will also be required for admission to the PhD program: (i) college mathematics through calculus, (ii) competence in at least one modern programming language equivalent to GISC 5317 *Computer Programming for GIS*, or CS 5303 and CS 5330 *Computer Science I & II* or MIS 5321 *Computer Programming* or MIS 6322 *Visual Basic* or MIS 6323 *Java*, or their equivalents, and (iii) at least one course in inferential statistics through to regression analysis equivalent to POEC 5313 *Descriptive and Inferential Statistics* or GEOS 5306 *Data Analysis for Geoscientists*. Graduate courses taken at UTD to meet these pre-requisites may be counted as electives toward the 90 credit hours for students entering the Ph.D. program directly from a B.A. or B.S. degree, but they shall not be considered substitutes for any other specified course.

Transfer Policies

Students may transfer up to 36 hours of course work from another institution and have them apply to degree requirements set out below.

Advising

Because of the cross-disciplinary nature of this doctoral program, to ensure adequate preparation and appropriate course sequencing, every doctoral student is required to consult with the student's designated advisor and/or the GIS Doctoral Program Director prior to registration in every semester.

Degree Requirements

The University's general degree requirements are discussed here.

To receive the PhD in Geospatial Information Sciences, students must complete the Geospatial Science Core (15 SCH) to achieve a mastery of appropriate Geospatial Information Science technologies and theory, have a Geospatial Specialization Area (15 SCH), have a Specific Application area or Technical field (12 SCH), evidence research skills through successful completion and defense of a Ph. D. dissertation, and take related electives as necessary for a total of 90 semester credit hours. In addition, students must satisfy a set of exams and qualifiers. Other courses may be substituted for those listed below with the written permission in advance of the Director of the GIS Doctoral program.

Geospatial Science Core (15 SCH)
GISC 6381 GIS Fundamentals
GISC 6382 Applied GIS
GISC 6384 Spatial Analysis and Modeling
GISC 6385 GIS Theories, Models and Issues
GISC 6387 GIS Workshop

Geospatial Specialization Area selected from <u>one</u> of the following, with a minimum of 15 SCH:

    I. Geospatial Computing and Information Management
        CS 6359 Object Oriented Analysis and Design
        CS 6360 Database Design
        CS 6364 Artificial Intelligence
        CS 6366 Computer Graphics
        CS 6375 Neural Nets and Machine Learning
        CS 6378 Advanced Operating Systems
        CS 6V80 Spatial Data Management
        CS 6381 Combinatorics and Graph Algorithms
        CS 6384 Computer Vision
        GISC 6383 GIS Management and Implementation
        GISC 6388 GIS Application Development
        GISC 7363 Internet Mapping and Information Management
        * MISC 6326 Databse Management Systems
        (* may not be used in conjunction with certain other courses. Consult GIS Doctoral Program Director)
    II. Spatial Statistics and Modeling
        CS 5343 Data Structures
        *ECO 6309 Econometrics I
        *ECO 6310 Econometrics II
        *ECO 6311 Statistics for Economists
        *ECO 6314 Structural Equation and Multilevel (Hierarchical) Modeling
        *ECO 6315 Time Series Econometrics
        *ECO 6316 Spatial Econometrics
        *GEOS 5306 Data Analysis for Geoscientists

        GISC 7360 Pattern Analysis

        GISC 7361 Spatial Statistics

        GISC 7363 GIS Network Modeling

        GISC 7364 Demographic Analysis and Modeling

        GISC 7368 Spatial Epidemiology

GISC 7384 Advanced Raster Modeling

*POEC 5313 Descriptive and Inferential Statistics
*POEC 5316 Advanced Regression Analysis

POEC 7371/ECO 6315 Time Series Analysis

(* may not be used in conjunction with certain other courses. Consult GIS Doctoral Program Director)

III. Remote Sensing and Satellite Technologies

GEOS 5322 GPS Surveying Techniques

GEOS 5324 3-D GIS Data Acquisition
GEOS 5389 GIS Applications to Geoscience
GEOS 5325 Intro to Remote Sensing
GEOS 5328 Radar Remote Sensing
GEOS 5329 Applied Remote Sensing
GEOS 5326/GISC 7365 Remote Sensing Digital Image Processing

GEOS 7327 Remote Sensing Workshop

EE 6360 Digital Signal Processing I

EE 6363 Digital Image Processing

IV. Customized Geospatial Specialization (15 SCH)

Identified by the student with approval in advance by the Director of the GIS Doctoral Program.

Application Area or Technical Field (12 SCH)

Twelve semester-credit hours of specialized course work in an *application area* or *technical field* relevant to GIScience. Normally, these will derive from the student's masters degree. These hours may be transferred from another institution, or taken at UTD in an existing master's program area and may be applied toward a master's in that area.

Application area examples: planning, public affairs, criminal justice, health and epidemiology, geoscience, forestry, hydrology, marketing, real estate, economics, civil engineering.

Technical field examples: statistics, computer science, software engineering, management information systems, image analysis, operations research/location science, instrumentation.

Research and Dissertation (24 to 48 SCHs)
GEOS 6205 Geoscience Presentations
GEOS 8V21 Research in Remote Sensing, GIS and GPS
GISC 7389 GIS PhD Research Project Qualifier
GISC 7387 GIS Research Design
GISC 8V29 Research in GIS
POEC 5310 & 6342 Research Design I & II
GISC 8v99 or GEOS 8v99 or CS 8v99 Dissertation

Other Related Electives (0 to 24 SCH)

Students may choose up to 24 SCHs in related electives with consent of the GIS Doctoral Program Director.

Exams and Qualifiers

- **Ph.D. Research Project Qualifier**
The student must register for and complete **GISC 7389** Geospatial Information Sciences *PhD Research Project Qualifier* according to uniform guidelines established by the GIS program.
- **Grade Point Qualifier**
The student must have a GPA of at least 3.25, and preferably 3.5, in courses taken at UT-Dallas at the time they register for GISC 7389 Ph.D. Qualifier, or they must petition the GIS faculty for an exemption for extenuating circumstances beyond the student's control.
- **Qualifying Examination and Defense of Proposal**
After meeting the Research Project Qualifier, the student must (1) demonstrate through a general exam his/her competency in the area chosen for their dissertation, and (2) successfully present and defend a dissertation proposal through an oral examination, according to uniform guidelines established by the GIS program.

4. **Defense of Dissertation**
A dissertation must be prepared and defended successfully following the procedures established by the Dean of Graduate Studies.