Syllabus: Introduction to Geospatial Technology – GST 101

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COURSE DESCRIPTION:

Introduction to the fundamentals of Geospatial Technology including concepts and use of Geographic Information Systems (GIS), and brief introductions to the use of Global Positioning Systems (GNSS/GPS), cartography and visualization, remote sensing, and spatial analysis through use of professional grade GIS software exercises. Participants will learn how geospatial technology is used in business, industry and government. This course is designed to be used as an entry-level first course into a geospatial program (Certificate or Degree) or can be used as a stand-alone course to complement other disciplines.

Note: Course content is based upon the United States Department of Labor's Geospatial Technology Competency Model (as updated in 2014) for entry-level geospatial occupations including Geospatial or GIS Technicians and Technologists and Remote Sensing Technologists and the updated (2014) MetaDACUM and Program Content Tool. Learning Objectives keyed to competencies listed in the Course Content Tool are included in the Course Content Tool for GST 101 Introduction to Geospatial Technology.

PREREQUISITES: Basic computer literacy required.

COURSE LEARNING OUTCOMES:

After completing this course, a student will be able to:

1. Describe the fundamental concepts of Geospatial Technology including Geographic Information Science and Technology (GIS&T) by being able to:
    a. Discuss the geospatial technology industry and its uses. (U1)
    b. Describe the major technological systems that the geospatial industry relies upon (GIS, GNSS, Remote Sensing, etc.) and its components. (UO1)
    c. Discuss the professional opportunities within the geospatial technology industry. (UO1)
2. Demonstrate proficiency in the basic functions of geospatial software and hardware by being able to:
    a. Identify the major software applications and its uses (UO1)
    b. investigate and demonstrate their understanding of various types of data, sources of data and data quality; (UO2)
    c. demonstrate their understanding of different data models; and (UO2)
    d. add and view data in a GIS application. (UO2)
3. Demonstrate basic proficiency in map creation and cartographic design principles, including thematic map display, employment of map projections, coordinate systems and by being able to:
    a. create cartographic products and visualizations (UO3)
    b. apply cartographic principles. (UO3)
    c. recognize and select the appropriate projections, datum and coordinate system for a given task (UO5)
    d. answer spatial questions and produce cartographic outputs and visualizations (UO8)
4. Demonstrate proficiency in the creation and acquisition of spatial data by being able to:

a. create vector datasets from address information through geocoding (UO4)
b. learn to project or re-project data acquired as needed (UO5)
c. Learn to transform data from one data model to another (i.e. Vector to Raster) (UO5)
d. discuss the fundamental concepts of data quality (UO5)
e. collect data using a GPS receiver and use the collected data in GIS applications (UO5)
f. describe how GNSS systems and GPS works (UO5)

5. Demonstrate the use of spatial analysis techniques by being able to:
    a. describe the basic concepts of spatial analysis. (UO8)
    b. describe basic geoprocessing techniques and be able to apply them (UO8)
    c. create, query, edit and maintain geospatial data contained in databases and other formats. (UO7)
    d. acquire appropriate data and apply basic geospatial analysis techniques (UO8)
6. Demonstrate awareness of fundamental concepts and use of remote sensing by being able to
    a. describe the basic concepts of remote sensing and use of imagery. (UO6)
    b. describe how remote sensing imagery can be acquired (U06)
    c. describe how information from remote sensing imagery can be integrated in a GIS (U06)
7. Demonstrate how to use geospatial technology and professional grade GIS software to solve simple problems that have a spatial location. (UO9)

COURSE FRAMEWORK:

Specific content/exercises/data/assessments are at the discretion of the instructor/developer and are offered as samples; not mandatory components in the course. The objective of the GeoTech Center is to provide the content for a complete model course as possible without being too prescriptive on the method of delivery (Face to Face, online or hybrid). It is expected that faculty who adopt the content will modify the material to meet their own local needs under a creative commons license with prominent attribution to the GeoTech Center and NSF DUE#1304591 and reference to the GeoTech Center as the source for content. Exercises are not currently provided, but can be located by using tutorial online courses or books from Esri and other vendors.

Caution to users of this content: please insure that related materials or references may be referred to throughout this course and that using portions (and not the entire course) may constitute use out of context. The GeoTech Center will not be responsible for any content used out of its original context within this course.

Unit	Unit Learning Objectives
1. What is Geospatial Technology?	Students will be able to: 1) Describe the major technological systems that the geospatial industry relies upon (GIS, GNSS/GPS, Remote Sensing, etc.) and its components. 2) Discuss the geospatial technology industry and its uses. 3) Describe professional opportunities and careers within the geospatial technology industry. 4) Identify the major software applications and its uses (CLO 1)
2. Understanding Geospatial Data	Students will be able to: 1) Investigate and demonstrate their understanding of various types and sources of data 2) Describe how data can be created, found and the importance of data quality; 3) Demonstrate their understanding different data models; and 4) Add and view data in different models for a GIS application. (CLO 2)

3. Displaying Geospatial Data: Coordinate Systems, Map Projections, Datums, and Cartography and Cartographic Design	Students will be able to: 1) Recognize and select the appropriate coordinate system, map projection and datum for a given task 2) Learn to project or re-project data acquired as needed 3) Apply basic cartography principles 4) Create cartographic products and visualization for different audiences and delivery methods (CLO 4, and 5)
4. Creating Geospatial Data	Students will be able to: 1) Create vector datasets from address information through geocoding 2) Transform data from one data format to another 3) Collect data using a GPS receiver and use the collected data to in geospatial projects 4) Understand and describe the components of a GNSS 5) Describe specific details of the GPS system. (CLO 5, 6)
5. Managing Geospatial Data	Students will be able to: 1) Create, query, edit and maintain geospatial data contained in databases and other formats. (CLO 6)
6. Spatial Analysis Techniques	Students will be able to: 1) Understand the basic concepts of spatial analysis. 2) Acquire appropriate data and apply basic geospatial analysis techniques 3) Answer spatial questions and produce cartographic outputs. (CLO 3, 4, and 5)
7. Introduction to Remote Sensing and Aerial Imagery	Students will be able to: 1) Describe basic concepts of remote sensing and use of imagery. 2) Acquire and display imagery in a GIS application (CLO 3)
8. Final Project	Investigate a spatial problem using geospatial technology: 1) Define a spatial problem that can be studied 2) Set up a study workspace (computer and database) 3) Acquire or create data for study 4) Project data into appropriate coordinate system, projection and datum 5) Display geospatial data and observe patterns 6) Edit, query, and maintain metadata 7) Perform basic analysis and geoprocessing 8) Present outcomes using cartographic design and visualization (CLO 3, 4, 5, 7, 8)

METHODS OF EVALUATION:

A student's grade will be based on multiple measures of performance unless the course requires no grade. Multiple measures may include, but are not limited to, the following:

I. Quizzes
II. Lab Exercises
III. Exams

IV. Final Project

METHODS OF INSTRUCTION:

Methods of instruction may include, but are not limited to, the following:

* Lecture/Discussion
* Online Learning Modules
* Audio-Visual (online videos and screencasts)
* Collaborative Learning
* Lecture-Lab Combination (Hybrid)
* Computer-Assisted Active Learning

REQUIRED TEXTS AND SUPPLIES:

1. Reading materials may include, but are not limited to:

    a. Textbook:
    GIS Fundamentals, A First Text on Geographic Information Systems, 4th Ed, Paul Bolstad, Eider Press, ISBN 978-0-9717647-3-6.

    b. Online Tutorials:
        i. *Fundamentals of Remote Sensing* from Natural Resources Canada: http://www.nrcan.gc.ca/earth-sciences/geomatics/satellite-imagery-air-photos/satellite-imagery-products/educational-resources/9309

    c. Periodicals:
        i. *ESRI ArcNews*, http://www.esri.com/news/arcnews/index.html
        ii. *ESRI ArcUser*, http://www.esri.com/news/arcuser/index.html

2. Exercise Manuals:
        i. **Exercises from *GIS Fundamentals, Paul Bolstad, Eider Press, ISBN 978-0-9717647-3-6***
        ii. ***GIS Tutorial***, Esri Press, 4th ed., ISBN: 9781589482593 and other Esri Press Tutorials books or online elearning courses.
        iii. GeoTech Center Exercises

3. SOFTWARE: Access to industry standard GIS software such as ArcGIS Desktop or QGIS.

4. SUPPLIES: Computer with an Internet connection. Access to handheld GPS receiver.

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