GST 103: Data Acquisition & Management

COURSE DESCRIPTION: This course addresses the interpretation and understanding of a variety of data formats used by geospatial professionals. It introduces the fundamental concepts such as primary GIS data creation, database creation, data management, and discusses quantitative techniques for the collection, classification, integration, and management of geographical data.

PREREQUISITES: Introductory Geospatial Technology course using Geographic Information Systems Software.

STUDENT LEARNING OUTCOMES (SLOs):

1. Student will describe the collection of field data, digital conversion of existing hardcopy maps, and the construction of spatial data from known locations.
2. Student will demonstrate basic proficiency to collect, record, and utilize spatial data and databases.
3. Student will demonstrate an ability to collect, create, and process spatial data within a variety of environments.
4. Student will describe and explain the similarities and differences between data models as well as how data is treated differently within each format, to include the conversion of data between different formats.
5. Student will describe the concepts and applications of remote sensing, GPS, and affiliated data capture technologies.
6. Student will demonstrate an understanding of the fundamentals of GIS data storage and interoperability.
7. Student will demonstrate an understanding of different types of spatial databases and their applications.
8. Student will describe and apply best practices in data organization and management.
9. Students will learn about advanced configurations at the feature and database levels and their applications.

COURSE OUTLINE AND RESOURCES:

Specific material/exercises/data/exams are at the discretion of the developer and are offered as samples, not mandatory components in the course. Our objective is to provide as complete a model course outline as possible without being too prescriptive on the precise course content. It is expected faculty that adopt these outlines will modify the material to meet their own local industry needs.

Week	Unit	Unit Objectives
1.	1. Data models and data formats	Students will learn the basics of geospatial data organization, file management, and data format. They will be introduced to the differences between spatial and attribute data. (SLO 4, 6, 8)
2.	2. Projection and coordinate systems	Students will learn about data interoperability. They will be introduced to the concept of spatial reference system and its significance. They will also learn methods used in preprocessing and integrating spatial data. (SLO 3, 4, 6)
3.	3. Database and Database Management Systems overview	Students will receive a brief overview of database terminologies, and learn the difference between hierarchical, network, and relational databases. They will also learn about the various components of a database management system, and some examples of spatial database systems. (SLO 7,8)
4.	4. Vector data structure	Students will learn the different vector data. They will understand the nature of geometry and its relationship to both topological and non-topological features. Students will appreciate the value of topological relationships within a vector dataset. (SLO 4, 6)
5.	5. Raster data structure	Students will learn the methods of storing (cell-by-cell, run-length encoding, and quad tree) raster data. They will understand how attributes are managed within a raster model, to include the differences between integer and floating point values. (SLO 4, 6)
6.	6. Digitization and geocoding	Students will learn how to build or collect primary spatial data by way of scanning, digitizing (on-screen or traditional), geocoding text files, or similar methods. Students will be introduced to acquiring data from public or private third-party sources. (SLO 1, 5)
7.	7. GPS data collection and data integration	Students will learn how to capture primary spatial data using GPS, and anticipate common issues associated with GPS data collection. They will also be introduced to common geospatial data portals. (SLO 1, 2, 5)
8.	Examination I (Unit 1-7)	
9.	8. Database types	Students will learn about database design and construction. They will be introduced to importing and exporting an existing database schema. Students will understand the limitations and capabilities of different types of geodatabases. (SLO 6, 7, 8)
10.	9. Database and data structure	Students will learn how to construct joins and relationship feature classes. They will understand related concepts such as primary and foreign keys, as well as simple and composite relationships. (SLO 6, 8, 9)
11.	10. Feature and database behaviors	Students will build on the basics of spatial database design, learning how to implement subtypes and domains, topology, and data validation tools. (SLO 6, 7, 8, 9)
12.	11. Multiuser environments	Students will learn about spatial data workflows within multiuser work environments. Students will understand database concepts such as replication, versioning, and archiving. (SLO 6, 7, 8, 9)

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13.	12. Spatial data quality	Students will compile data in accordance with the National Standard for Spatial Data Accuracy. They edit locational errors from primary/secondary data sources, recognizing the challenges associated with raster and vector data aggregation. (SLO 2, 3)
14.	Examination II (Unit 8-12)	
15.	Final Project	Students will create their own data using electronic methods and solve a problem using geospatial technology from goals and data acquisition to analysis and processing to cartographic presentation and publishing. (SLO 1, 2, 3, 4, 5, 6, 7, 8, 9)
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*Refer to the GST101: Introduction to Geospatial Technology Model Course Outline for unit alignment with the Geospatial Technology Competency Model

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:

- Quizzes
- Lab Exercises
- Examinations
- Final Project

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

- Lecture Discussion
- Class Demonstrations
- Learning Activities
- Audio-Visual
- Collaborative Learning
- Lecture-Lab Combination
- Computer Assisted Instruction

REQUIRED TEXTS AND SUPPLIES:

1. Reading materials may include, but are not limited to:
   a. TEXTBOOKS:
      i. Shekhar, Shashi, Chawla, Sanjay. 2003. Spatial Databases: A Tour. 1st Edition. Prentice Hall.
      ii. El-Rabbany, Ahmed, 2006. Introduction to GPS: The Global Positioning System. 2nd Edition. Artech House.

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iii. Thurston, Jeff, et. al. 2003. Integrated Geospatial Technologies: A Guide to GPS, GIS, and Data Logging. 1st Edition. Wiley & Sons..
iv. Devillers, Rodolphe, Jeansoulin, Robert. 2006. Fundamentals of Spatial Data Quality, 1st Edition. Wiley & Sons.
v. Decker, Drew. 2000. GIS Data Sources. 1st Edition. Wiley & Sons.
vi. Chang, Kang-tsung. Introduction to Geographic Information Systems. 2011. 6th Edition. McGraw-Hill.
vii. Zeiler, Michael. 2010. *Modeling Our World.* 2nd Edition. Esri Press.

b. OTHER:
i. GeoTech Teaching Resources, http://www.geotechcenter.org

2. SOFTWARE: Access to industry standard geospatial software.
3. SUPPLIES: Computer with an internet connection. Access to GPS receiver.

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