GeoTech Center Model Courses and Certificate

This document contains the suggested Model Courses to be included in a Model Certificate including additional optional electives. A complete description of the development of the Models is included in the PowerPoint PDF titled "ModelCoursesandCertificateDevelopment" included on the Moodle Server. Also included is a short description of each course including their titles and Student Learning Objectives. Note: these are model courses and model certificate and should serve as guidelines and be adapted to serve the local geospatial program. The department hosting the program will provide the three letter code attached to each course. It is recommended that courses be cross listed in multiple departments.

Model Certificate Course Recommendations

The five Core Courses include:

- 101 Introduction to Geospatial Technology: (3 units)
- 102 Spatial Analysis and Modeling: (3 units)
- 103 Data Acquisition and Management: (3 units)
- 104 Cartographic Design and Visualization: (3 units)
- 110 Internship: (1-3 units)

Recommended Elective Courses include:

- 120 Introduction to Remote Sensing: (3 units)
- 121 Introduction to Programming for Geospatial Technologies (including web/server): (3 units)
- 122 Introduction to Field Data Collection (GPS) : (3 units)
- 123 Introduction to Web Application and Development: (3 units)
- 111 Capstone Project - (1-2 units)

Additional electives* options include:

- 100 "Geospatial Awareness Course" – a General Education "Spatial Thinking and Geospatial Technologies" course that some students take that leads them to continue on and earn the certificate: (3 units)
- 130 Advanced Field Data Collection (GPS) : (3 units)
- 131 Advanced Spatial Analysis and Modeling: (3 units)
- 132 Introduction to Surveying: (3 units)
- 133 Computer Aided Design (CAD) course: (3 units)

It is highly recommended that the 100 Geospatial Awareness course be included as an elective so that students do not loose credits. The Awareness course is an excellent feeder course for programs as it has qualified as a General Education Course and transfers between some two year and 4 year programs in California.

*The additional elective options were recommendations made during a California Community College study to develop curriculum guidelines. For a full discussion of the recommendations see http://c3gis.net.

GeoTech Center Model Courses - Titles, Descriptions and SLO's

Awareness Course – Stand Alone

Geo 100 - Seeing the World: The Fundamentals of Geospatial Science and Spatial Reasoning

Course Description: Introduction to the fundamental concepts of Geographic Information Science and Technology (GIS&T) including Geographic Information Systems (GIS), Global Positioning Systems (GPS), cartography, remote sensing, and spatial analysis. Exploration of how geospatial technologies are used in addressing human and environmental issues.

Student Learning Outcomes (SLO's):

1. The student will describe the fundamental concepts and applications of Geographic Information Science and Technology (GIS&T), including the problems and challenges of representing change over space and time.
2. The student will demonstrate the use of web mapping tools to study and develop possible solutions to real world problems.
3. The student will describe and explain the historical development of GIS&T and how GIS&T helps to solve problems of a spatial context.
4. The student will demonstrate basic proficiency in map reading, interpretation, and design principles, including map projections and the geographic grid.
5. The student will describe the fundamental concepts and applications of remote sensing and Global Positioning Systems.
6. The student will describe and demonstrate how to access different sources of data, describe the process of creating data, and discuss the fundamental concepts of data quality.
7. The student will identify, explain, and interpret spatial patterns and relationships.

Certificate Courses

GST 101 - Introduction to Geospatial Technology

Course Description: Introduction to the fundamentals of Geospatial Technology, including Geographic Information Systems (GIS), Global Positioning Systems (GPS), cartography, remote sensing, and spatial analysis through a series of hands-on computer-based exercises. Participants will learn how to utilize geospatial technology to address social and environmental issues. This course is designed to be used as a stand-alone course to complement other disciplines or as an entry level course into a geospatial program. Course content is based upon the United States Department of Labor's Geospatial Technology Competency Model for entry level geospatial occupations including Geospatial or GIS Technicians and Technologists.

Student Learning Outcomes (SLOs):

1. The student will describe the fundamental concepts of Geographic Information Science and Technology.
2. The student will demonstrate proficiency in the basic functions of geospatial software and hardware.
3. The student will demonstrate awareness of fundamental remote sensing and spatial analysis techniques.
4. The student will demonstrate basic proficiency in map creation and design principles, including thematic map display, employment of map projections and cartographic design.
5. The student will demonstrate proficiency in the creation and acquisition of spatial data including the use of the Global Position System.
6. The student will demonstrate how to access different sources of data, demonstrate the process of creating data, and discuss the fundamental concepts of data quality.

GST 102 - Spatial Analysis

Course Description: This course introduces students to problem-solving and decision making using geospatial analysis techniques, applicable to a range of disciplines.

Student Learning Outcomes (SLOs):

1. The student will be able to prepare data for use in analysis.
2. The student will be able to determine an appropriate approach to solving a problem or answering a question using geospatial tools and methods.
3. The student will be able to run geoprocessing tools individually and implement a model to run several tools in sequence.
4. The student will be able to organize the data sets resulting from analysis.
5. The student will be able to present the results of a geospatial analysis using appropriate terminology and visualizations.

GST 103 - Data Acquisition & Management

Course Description: This course addresses the interpretation and understanding of a variety of data formats available in GIS. It introduces the fundamental concepts of primary GIS data creation and discusses quantitative techniques for collection, classification, and management of geographical data.

Student Learning Outcomes (SLOs):

1. The student will describe the collection of field data, digital conversion of existing hardcopy maps, and the construction of spatial data from known locations.
2. The student will demonstrate basic proficiency to collect, record, and utilize spatial data and databases.
3. The student will demonstrate an ability to collect, create, and process spatial data within a variety of environments.
4. The 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. The student will describe the concepts and applications of remote sensing, GPS, and affiliated data capture technologies.
6. The student will demonstrate an understanding of the fundamentals of GIS data storage and interoperability.

GST 104 - Cartographic Design

Course Description: This course introduces fundamental cartographic concepts. Successful students will be able to employ design principles to create and edit effective visual representations of data (e.g. maps, graphs and diagrams) in different formats (e.g. hardcopy, digital, web). Specific topics include the ethical and appropriate application of map scale, map projections, generalization and symbolization. Course content is based upon the United States Department of Labor's Geospatial Technology Competency Model for entry level geospatial occupations including Geospatial or GIS Technicians and Technologists.

Student Learning Outcomes (SLOs):

1. Categorize and describe different types of maps (thematic, reference…) and be able to give examples of how they are used.
2. Describe the components of a map (map elements).
3. Employ an appropriate geographic referencing system (datum, projection, coordinate system) for a given purpose.
4. Select and apply ethical and appropriate data model, map scale, map elements, symbolization and color to produce maps that effectively communicate quantitative and qualitative geographic data.

5. Design professional quality maps, including map elements such as text, graphs, charts and diagrams, employing cartographic principles.
6. Produce maps and related products in a variety of formats (hardcopy, digital and web).
7. Critique maps for appropriate use of cartographic design principles.

GST 105 - Introduction to Remote Sensing

Course Description: This course is an introduction to remote sensing of the Earth. Topics include the physical principles on which remote sensing is based, history and future trends, sensors and their characteristics, image data sources, and image classification, interpretation and analysis techniques.

Student Learning Outcomes (SLOs):

1. Describe basic physics concepts on which remote sensing is based (i.e. Electromagnetic Spectrum, etc.)
2. Describe the fundamentals of Photogrammetry
3. Select appropriate data set for remote sensing application based on spectral, temporal, radiometric and spatial resolution.
4. Describe characteristics of passive and active remote sensing systems (such as multispectral, LiDAR and Radar).
5. Perform basic remote sensing workflows to solve problems (such as acquiring data, feature extraction, change detection, pre- and post-processing, create composite images and image classification).
6. Describe future trends in remote sensing.
7. Apply basic concepts, methods and uses of accuracy assessment and ground truthing to the results of remote sensing workflows.
8. Interpret, analyze and summarize results of a remote sensing workflow.

GST 106 - Introduction to Geospatial Programming

Course Description: The course provides an understanding of how to customize GIS software applications by way of modified toolbars, menus, and buttons. Topics include the theory and implementation of the various scripting languages currently in use. Upon completion, students will be able to solve geospatial problems and streamline GIS workflows through the creation and modification of scripts.

Student Learning Outcomes (SLOs):

1. produce solutions to automate geoprocessing functions using a variety of programming methods, structures, and data sources
2. Use a scripting language to modify and create geoprocessing scripts
3. construct, compile, and troubleshoot computer code according to best practices
4. solve geospatial problems and streamline GIS workflows through the design and development of custom GIS applications
5. Modify user interfaces to increase productivity

GST 107 - Geospatial Web Applications and Development

Course Description: The course involves the design, creation, configuration, optimization of geospatial servers and applications to deliver content across the Internet. The student will construct application to be developed as services with a variety of user interfaces.

Student Learning Outcomes (SLOs):

1. Build a basic Web-based geospatial application
2. Perform basic customization of a Web-based geospatial application

3. Create and\or modify a basic interactive Web-based geospatial user interface
4. Publish geospatial resources to a web service
5. Design, configure, optimize, and maintain Internet mapping and application servers
6. Explain the use of SDKs in the development of mobile mapping applications

GST 108 - Capstone in Geospatial Technology

Course Description: The capstone is a learning experience resulting in a consolidation of a student's educational experience and certifies mastery of entry level workplace geospatial competencies. The capstone experience should occur during the last semester of the student's educational program. Methods of providing a capstone experience include:

- A final learning experience that allows a student to apply broad knowledge of the discipline.
- A comprehensive examination prepared by the faculty of the geospatial education program and administered at the conclusion of the program.
- A course involving simulation of the workplace, case studies, portfolios, and employment scenarios.
- A summative project involving the integration of various teams of students performing activities to simulate the situations which may occur in the workplace. Students will learn how to compile, analyze, and present geospatial data while emphasizing the value of visual communication.

Student Learning Outcomes (SLOs):

1. Apply critical-thinking skills to solve problems by generating, evaluating, and implementing geospatial solutions.
2. Demonstrates knowledge of professional code of ethics, such as the GISCI GISP or ASPRS.
3. Demonstrate knowledge of standard professional practices and organizations (URISA, ASPRS, GITA, USGIF, resumes).
4. Develop, manage, complete, and evaluate a comprehensive geospatial project.
5. Demonstrate ability to work collaboratively in a team setting.
6. Present data and project results in a meaningful format (i.e., digital, written, verbal, graphical).

GST 109 - Internship in Geospatial Technology

Course Description: A structured experience in a supervised setting that is related to the student's major and career interests. Practical experience is under the guidance of faculty and the internship supervisor. Students will work under the direction of a qualified professional with a focus on geospatial technology. The internship provides students with an overview of procedural, professional, and ethical issues faced by a geospatial technician on the job. Students will prepare a summary presentation.

Student Learning Outcomes (SLOs):

1. Apply critical-thinking skills to solve problems by generating, evaluating, and implementing geospatial solutions.
2. Demonstrate geospatial skills associated with professional, competent, and ethical behaviors associated sound project management.
3. Demonstrate soft skills that are needed in the geospatial technology workplace.
4. Write an effective resume and demonstrate successful job interview skills.
5. Evaluate and assess how organizational structure and culture impacts relationships, production, and communication among team members.
6. Evaluate professional interest through reflection on the internship experience through knowledge and awareness of range of various geospatial occupations.