GIST 11: INTRODUCTION TO MAPPING & SPATIAL REASONING

Foothill College Course Outline of Record

Heading	Value
Units:	4
Hours:	4 lecture per week (48 total per quarter)
Advisory:	Elementary Algebra or equivalent; not open to students with credit in GEOG 11.
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Area V: Communication & Analytical Thinking
Transferable:	CSU/UC
Grade Type:	Letter Grade (Request for Pass/No Pass)
Repeatability:	Not Repeatable
Cross-Listed:	GEOG 11

Student Learning Outcomes

- Demonstrate the use of geographic technologies to analyze real world problems and make informed, data driven decisions.
- Describe how to access different sources of data, describe the process of creating data with different geographic technologies, and discuss the fundamental concepts of data quality
- Evaluate cartographic products in terms of their aesthetic design and ability to communicate information.
- Identify, explain, and interpret spatial patterns and relationships, such as how places are similar and different, the nature of transitions between places, and how places are linked at local, regional, and/or global scales.
- Describe how paper maps and Geospatial Technology can be used for geographic inquiry.
- Describe how GIS&T helps to solve problems of a spatial context.
- Interpreting maps and data.

Description

Introduction to the fundamental concepts of GeoSpatial Technology, including Geographic Information Systems (GIS), Remote Sensing (RS) and Global Positioning Systems (GPS), map reading, and cartography. Exploration of how geospatial technologies are used in addressing human and environmental issues and can promote sustainability.

Course Objectives

The student will be able to:
A. Describe how paper maps and Geospatial Technology can be used for geographic inquiry.
B. Describe the historical development of GIS&T.
C. Describe how GIS&T helps to solve problems of a spatial context.
D. Interpret maps and mapped data.
E. Evaluate cartographic products in terms of their aesthetic design and ability to communicate information.
F. Demonstrate the use of geographic technologies to analyze real world problems and make informed, data driven decisions.
G. Describe how to access different sources of data, describe the process of creating data with different geographic technologies, and discuss the fundamental concepts of data quality.
H. Identify, explain, and interpret spatial patterns and relationships, such as how places are similar and different, the nature of transitions between places, and how places are linked at local, regional, and/or global scales.

Course Content

A. Introduction to Geospatial Technology
1. Describe and provide examples of how geospatial technologies are being applied in the areas of transportation, the environment, local government, business, and other areas.
2. Discuss the components of geospatial technology (for example, remote sensing, GIS, and GPS) and its relationship to other fields.
3. Describe the fundamental concepts and applications of GIS, including the problems and challenges of representing change over time.
4. Describe and explain the historical development of GIS and how GIS helps to solve problems of a spatial context.
5. Demonstrate awareness of the various stakeholders (for example, the private sector, non-profit organizations, and government agencies) and their respective roles that comprise the geospatial technology industry.
6. Discuss the historical origins of the geospatial technology industry.
7. Compare the capabilities and limitations of different types of geospatial software.
8. Identify legal, ethical, and business considerations that affect an organization's decision to share geospatial data.
9. Discuss codes of professional ethics and rules of conduct for geospatial professionals.
B. Introduction to Spatial Reasoning
1. Identify, explain, and interpret spatial patterns and relationships, such as how places are similar and different, the nature of transitions between places, and how places are linked at local, regional, and/or global scales.
2. Discuss how people, places, and regions are linked by global networks and processes (for example, globalization, international trade, immigration, sustainability, internet technology, global climate system).
3. Describe the scientific method, including the formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of a hypothesis.
C. Projections and Coordinate Systems
1. Describe characteristics and appropriate uses of common geospatial coordinate systems.
2. Describe the importance of generalization methods and the concept of representational scale.
3. Discuss the roles of several geometric approximations of the earth's shape, such as geoids, ellipsoids, and spheres.
4. Describe characteristics and appropriate uses of common map projections.
5. Describe the relationship of horizontal datums to coordinate system grids and geometric approximations of the earth's shape.
6. Describe how the Earth is measured and modeled for the purposes of positioning.
D. Cartography
1. Demonstrate proficiency in map reading and interpretation.
2. Demonstrate how the selection of data classification and/or symbolization techniques affects the message of the thematic map.
3. Critique the design of a given map in light of its intended audience and purpose.
4. Analyze the relationship between scale and the level of geographic detail in a representation.

5. Employ cartographic design principles to create and edit visual representations of geospatial data, including maps, graphs, and diagrams.
E. Geospatial Data
1. Identify and describe basic types of maps and geographic data used with a GIS.
2. Compare and contrast raster and vector data structures and operations.
3. Compare advantages and disadvantages of standard spatial data models, including the nature of vector, raster, and object-oriented models.
4. Compare vector and raster representations of terrain elevation.
5. Describe and demonstrate the procedure for collecting, locating, and accessing data to be used in a GIS.
6. Describe how address-referenced census data are matched to specific geographic locations.
7. Give examples of how GIS has been used in the modeling of physical and human processes, including environmental and sustainability issues.
8. Discuss the art and science of representing real-world phenomena in GIS.
F. Data Quality
1. Discuss the elements of geospatial data quality, including topology, geometric accuracy, thematic accuracy, resolution, precision, and fitness for use.
2. Be familiar with the problems associated with place-names, street addresses, and other systems.
3. Discuss the concept of uncertainty, and the ways in which it arises from imperfect representation of geographic phenomena.
G. Methods of Spatial Analysis
1. Describe examples of geospatial data analysis in which spatial relationships such as distance, direction, and topologic relationships (e.g. adjacency, connectivity, and overlap) are particularly relevant.
2. Describe the use of overlaying, buffering, and basic spatial statistics to analyze feature and spatial relationships.
3. Use geospatial software tools to perform basic GIS analysis functions.
4. Demonstrate the use of web mapping tools to study and develop possible solutions to real world problems.
5. Describe the process of geocoding addresses and identify its value.
H. Satellite Positioning and Other Measurement Systems
1. Describe the principles behind GPS, and some of its applications, including recreational, mapping, and surveying.
2. Describe the basic components and operations of the Global Navigation Satellite System (GNSS), including the Global Positioning System and similar systems.
3. Describe how radio signals broadcast by Global Positioning System satellites are used to calculate positions on the surface of the Earth.
4. State the kinds and magnitude of error associated with uncorrected GPS positioning.
5. Identify and explain methods used to improve the accuracy of GPS positioning.
I. Remote Sensing and Photogrammetry
1. Explain the difference between active and passive sensors, citing examples of each and how they are deployed.
2. Describe the electromagnetic spectrum and the fundamental principles of electromagnetic radiation.
3. Differentiate the several types of resolution that characterize remotely-sensed imagery, including spatial, spectral, radiometric, temporal, and extent.
4. Compare and contrast the characteristics of image data produced by photography and digital remote sensing systems.
5. Use the concept of the "electromagnetic spectrum" to explain the difference between optical sensors, microwave sensors, multispectral and hyperspectral sensors.
6. Define "orthoimagery" in terms of terrain correction and georeferencing.
7. Explain the use of sampling ground truth data for quality assurance in remote sensing.
J. Trends in Geospatial Technology
1. Explain how the relationship between GIS and other technologies have an impact on future developments.
2. Explore the capabilities of mobile devices, including cell phones, with regards to mobile GIS.
3. Describe how 3-D geovisualization and virtual reality improve our ability to understand the world.
4. Discuss the technologies that support real-time acquisition and distribution of geographic information.
5. Explore the service-oriented architectures and mashups that combine GIS services from different websites.
6. Discuss how GIS can be distributed instead of centralized.
7. Describe geoportals that allow remotely stored data to be discovered and accessed.
8. Explore the concept of augmented reality, and its relationship to location-based services.

Lab Content

Not applicable.

Special Facilities and/or Equipment

A. Classroom with individual student computers with internet access
B. Instructor workstation with internet access and digital projector
C. When offered via distance learning, a course management system such as ETUDES

Method(s) of Evaluation

A. Quizzes
B. Problem Sets
C. Tests
D. Projects

Method(s) of Instruction

A. Lecture
B. Cooperative learning exercises
C. Hands-on exploratory computer activities
D. Discussions

Representative Text(s) and Other Materials

Kimerling, Jon, Aileen R. Buckley, Phillip C. Muehrcke, and Juliana O. Muehrcke. Map Use: Reading Analysis Interpretation. 8th ed. ESRI Press, 2016.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

A. Weekly reading assignments from the textbook and objective quizzes

B. Written assessments that determine student's mastery of course learning outcomes (SLOs)

C. Map analysis based project

Discipline(s)

Geography, Drafting/CADD, Environmental Technologies, Forestry/Natural Resources