Las Positas College
3000 Campus Hill Drive
Livermore, CA 94551-7650
(925) 424-1000
(925) 443-0742 (Fax)

Course Outline for GEOG 22

ADVANCED GIS APPLICATIONS

Effective: Spring 2018

I. CATALOG DESCRIPTION:
GEOG 22 — ADVANCED GIS APPLICATIONS — 3.00 units

Practical, hands-on survey of some of the more advanced applications of GIS, integrating vector, grid, and digital image data formats. Emphasizes environmental applications of GIS industry-standard software tools to analyze spatial problems quantitatively, including network analysis, watershed modeling, digital elevation modeling, digital image processing, and digital rectification of multi-layered thematic data. Includes integration of Global Positioning System (GPS) operational characteristics, collection and interfacing GPS data with GIS. Field trips may be required.

3.00 Units Lecture

Prerequisite
GEOG 15 - Introduction to GIS
with a minimum grade of C

Grading Methods:
Letter Grade

Discipline:
- Geography

	MIN
Lecture Hours:	54.00
Expected Outside of Class Hours:	108.00
Total Hours:	162.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:
Before entering the course a student should be able to:

A. GEOG15

IV. MEASURABLE OBJECTIVES:
Upon completion of this course, the student should be able to:

A. Identify major application area of GIS in urban and regional planning, business, land and resource management, and environmental analysis;
B. Compare and contrast the appropriate uses of map projections and coordinate systems;
C. List major mapping and navigation tools frequently accessed on the worldwide web that incorporate GIS tools;
D. Select appropriate spatial analysis tools to analyze distributions and answer geographic questions;
E. Select appropriate symbols for relating meaning on maps and charts;
F. Identify common methods of classifying data distributions;
G. Identify the particular techniques and technical problems in handling vector, grid, and digital remotely sensed image data;
H. Evaluate the quality and accuracy of digital elevation models for scale-specific applications;
I. Produce 3-D surface models from grids of Z-value magnitude data;
J. Cite the most commonly applied digital image enhancement operations;
K. Perform spatial registration on digital images, raster grids, and vector data;
L. Construct a digital terrain model from elevation point data;
M. List important steps in creating, digitizing, and/or georeferencing new data for a GIS project;
N. Conceive, design, develop, and present a GIS applications study;
O. Demonstrate advanced skills in designing well-organized presentations, including detailed maps, digital imagery, and graphic charts and diagrams

V. CONTENT:
A. The uses of GIS in solving spatial problems and making maps
1. Overview of the history of GIS applications
2. Advantages of GIS in performing spatial analyses
3. Topology of features and spatial relationships

4. Linkage of features with their characteristics (attributes)

B. GIS applications overview
   1. GIS in land use and resource planning
   2. Municipal government cadastral and utilities databases
   3. GIS uses in natural resources conservation
   4. GIS in transportation planning and network analysis
   5. GIS in retail marketing and market area analysis
   6. Internet applications and interfaces using GIS components
   7. Common map projections in regions of the world

C. Advanced tools and extensions in GIS desktop systems
   1. Network analysis
      a. Routing
      b. Least-cost paths
   2. Digital image integration
   3. Geoprocessing
      a. Thematic sub-setting operations
      b. Thematic intersection operations
   4. External database access
   5. Problems in data downloading
   6. Spatial and tabular data joining and linking

D. Methods of feature data classification and symbolization
   1. Classification of discrete and continuous data for mapping and spatial statistics
      a. Natural breaks
      b. Equal area and equal interval
      c. Quantiles
      d. Standard deviation
   2. Symbolizing feature types on maps
      a. Point symbol selection and scaling
      b. Line symbol selection
      c. Polygon symbol selection
      d. Multi-layered symbols
      e. Charts as symbols on maps
      f. Creating customized symbols
      g. Principles of annotating features

E. Creating and viewing 3-D surface models
   1. Structure of digital elevation models (DEM)
   2. Conversion of DEM to 3-D surfaces
   3. Editing DEM and multi-thematic 3-D map displays

F. Exploring tools and functional operations in GIS systems
   1. Working with data retrieval, query, and statistical analysis tools
   2. Constructing 3-dimensional surfaces with triangular lattices and grids
   3. Watershed modeling

G. Image and thematic feature data registration
   1. Digital image formats
   2. Spatial registration techniques
   3. Digital image rectification
   4. Image spectral classification techniques

H. Design and development of applications projects
   1. Steps in designing, developing, editing, and documenting GIS products
   2. Using and maintaining good cartographic design principles
   3. Communicating meaning in maps and graphics

VI. METHODS OF INSTRUCTION:

A. Hands-on computer experience with desktop GIS software, tutorials, and image processing software
B. Active learning
C. Lectures and learning modules (on a need-to-know basis)
D. **Demonstration** - including animations of GIS operations
E. Interactive Web Sessions
F. **Field Trips** - (some instructors may have field trips to government and commercial sites so students can experience “GIS at work”)

VII. TYPICAL ASSIGNMENTS:

A. Describe or list some typical GIS applications. Choose one or two to compare and contrast GIS methods with traditional mapping. B. Describe a spatial problem that could be analyzed and potentially solved with GIS techniques. Design and develop a series of steps, using GIS tools, to analyze the problem and illustrate possible solutions. C. Display geographic information in three (3) or more map projections; compare and contrast the projections in their preservation or distortion of spatial properties: conformality, distance, direction, and area. D. Produce a set of thematic maps using online (Internet) GIS applications interfaces (e.g.; the online National Atlas). E. Digitally register and enhance a raster image, maximizing sharpness, contrast, and interpretability. F. Design and develop a “Final” pilot project, integrating several components of desktop GIS, including a suite of themes, grids, and digital images for analyzing a spatial problem or testing an hypothesis.

VIII. EVALUATION:

A. **Methods**

   1. Projects
   2. Other:
      a. Methods
         1. Performance-based evaluations will be structured around specific competency-based learning modules that focus on particular system components of GIS. Each module will include: goals/objectives, background reading assignments, a sequence of operational procedures, and output products (maps, charts, tables, documentation)
         2. Demonstration of GIS procedural skills to instructor
         3. Completion of module-based exercises and/or mini-projects
         4. Instructor review of the “Final” project

B. **Frequency**

   1. Frequency
      a. Daily modular based exercises in class

b. One final project due at the end of the term

IX. TYPICAL TEXTS:

1. Bettinger, Pete, and Michael G. Wing *Geographic Information Systems: Applications in Forestry and Natural Resources Management.*, McGraw-Hill, 2003.
2. Kennedy, Michael, John Wiley *Introducing Geographic Information Systems with ArcGIS.*, -, 2006.
3. Obermyer, Nancy, and Jeffrey Pinto *Managing Geographic Information Systems.*, Guilford Press, 2007.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

A. R/W compact discs
B. USB flash drive