City College of San Francisco
Course Outline of Record

I. GENERAL DESCRIPTION

A. Approval Date	February 2011
B. Department	Engineering and Tech & Earth Sci
C. Course Number	GIS 111, GEOG 111
D. Course Title	GIS Analysis and Modeling
E. Course Outline Preparer(s)	Gordon Ye
F. Department Chairperson	Fabio Saniee, Katryn Wiese
G. Dean	David Yee

II. COURSE SPECIFICS

A. Hours	Lecture: 2.5 weekly (43.75 total) Laboratory: 1.5 weekly (26.25 total)
B. Units	3.0
C. Prerequisites	GIS/GEOG 110
Corequisites	None
Advisories	None
D. Course Justification	Provides students with varying backgrounds and work experiences the opportunity to learn the basic concepts and practical applications of Geographic Information Systems (GIS) as they apply to various fields.
E. Field Trips	No
F. Method of Grading	Letter
G. Repeatability	0

III. CATALOG DESCRIPTION

Foundational use of GIS software. GIS database design, data collection, sophisticated analysis. Production of professional maps. Interface customization. Hands-on training using industry-standard GIS software (ESRI's ArcView™ version 9). Introduces Global Positioning Systems (GPS) as they relate to GIS.

IV. MAJOR LEARNING OUTCOMES

Upon completion of this course a student will be able to:

A. Design simple GIS databases utilizing entity relationships.
B. Formulate GIS queries using built-in software tools.
C. Use Visual Basic scripts to execute mass edits.
D. Formulate GIS spatial analysis algorithms using buffering and spatial overlay operations.
E. Identify GIS applications that require data collection using a GPS.
F. Set up digitizing procedures for GIS data capture.
G. Formulate GIS terrain modeling algorithms for specific applications.
H. Assess the appropriateness of using raster or vector GIS format to store a type of geographic information.

I. Design professional-quality GIS maps utilizing Thiessen polygons (Voronoi diagrams).
J. Identify GIS applications that lend themselves to the use of interactive maps.

V. CONTENTS

A. Spatial database design
   1. What is a database – difference between databases and spreadsheets/reports
   2. Basic attribute data types
      a. text data types
      b. precision of numeric fields
   3. Entity relationships and coded-value domains
   4. Spatial index and attribute indexes
   5. Creating metadata

B. GIS database operations
   1. Selection queries using built-in software tools
      a. graphic select
      b. attribute select
   2. Manual attribute editing – using forms
   3. Attribute calculations using Visual Basic expressions
   4. Joining tables using built-in software tools
   5. Data aggregation – creating summary reports

C. Spatial analysis (vector)
   1. Topological relationships
      a. Editing with topology
   2. Proximity query and buffering
   3. Spatial overlay operations – intersect, union, spatial join
   4. Effect of polygon splitting on quantitative data values

D. Capturing data for GIS
   1. remote sensing
   2. photogrammetry
   3. ortho-rectification
   4. global positioning systems (GPS)
   5. using a data dictionary
   6. Earth coordinate systems
      a. geodetic datum
      b. map projection

E. GIS data collection – digitizing
   1. Geo-referencing raw data
   2. Manual vectorization (digitizing) – key role of human interpretation
   3. Specialized editing tools
      a. bearing/distance
      b. snapping
      c. tracing

F. GIS terrain modeling
   1. Digital Elevation Model (DEM) vs. Triangulated Irregular Network (TIN)
   2. Deriving contour lines, slope, and aspect

3. Cut/fill analysis, hill shading, view-shed analysis
4. 3D visualization

G. Raster analysis
1. Raster resampling
2. Map projections for raster
3. Raster overlay analysis (map algebra)
4. Raster to vector conversion – interfacing continuous and discrete data
5. Neighborhood and zonal statistics
6. Path finding analysis

H. GIS cartographic techniques
1. Generalization and spatial aggregation (dissolve)
2. Using Thiessen polygons (Voronoi diagrams)
3. Using stored annotation

I. Creating interactive maps
1. Customizing the graphical user interface (GUI)
2. Setting up map scale-based display triggers
3. Creating pop-up labels and hyperlinks

VI. INSTRUCTIONAL METHODOLOGY

A. Assignments
1. Out-of-class reading assignments from the textbook as well as selected journal articles.
2. In-class lab assignments that produce reports and maps describing results of GIS analysis.
3. In-class lab assignments that involve independent design and problem-solving.
4. Out-of-class final project where the student will independently develop a GIS modeling project, locate appropriate data from the internet, develop analysis questions and implementation algorithms.

B. Evaluation
1. Lab assignments – evaluated on whether the student completed the lab task correctly.
2. Written reports – evaluated on completeness of lab task, clearness of communication style, and accuracy of the analysis.
3. Short quizzes – on topics such as understanding of database concepts, uses of spatial analysis tools, procedures for capturing data through remote sensing, uses of terrain analysis techniques, etc.
4. Final exam – written, in-class exam covering all topics taught in the course.
5. Final project – evaluated on completeness of model, accuracy of data, correctness of analysis.

C. Textbooks and other instructional materials
1. An Introduction to Geographical Information Systems by Ian Heywood, Sarah Cornelius, Steve Carver, published by Prentice-Hall Upper Saddle River, NJ, 2006 or latest edition.
2. Articles from journals and industry newsletters. Journals include GIS World and Geo Info Systems.

VII. TITLE 5 CLASSIFICATION
CREDIT/DEGREE APPLICABLE (meets all standards of Title 5. Section 55002(a)).