# GIST 53: ADVANCED GEOSPATIAL TECHNOLOGY & SPATIAL ANALYSIS

## Foothill College Course Outline of Record

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| **Effective Term:** | Summer 2022 |
| **Units:** | 4 |
| **Hours:** | 2 lecture, 6 laboratory per week (96 total per quarter) |
| **Advisory:** | This is an advanced level course in GIS, and assumes in-depth understanding of GIST and data structures and fluency using industry standard software; successful completion of the following courses strongly recommended: GEOG 11 or GIST 11, and GEOG 12 or GIST 12, and GIST 52. |
| **Degree & Credit Status:** | Degree-Applicable Credit Course |
| **Foothill GE:** | Non-GE |
| **Transferable:** | CSU |
| **Grade Type:** | Letter Grade (Request for Pass/No Pass) |
| **Repeatability:** | Not Repeatable |

## Student Learning Outcomes

- Run geoprocessing tools individually and implement a model to run several tools in sequence.
- Organize the data sets resulting from analysis.
- Student will be able to prepare data for use in Geospatial analysis.
- Present the results of a geospatial analysis using appropriate terminology and visualizations.
- Determine an appropriate approach to solving a problem using geospatial tools and methods.

# Description

Introduction to problem-solving and decision-making using geospatial analysis techniques, applicable to a range of disciplines.

# Course Objectives

The student will be able to:

1. Prepare data for use in analysis.
2. Determine an appropriate approach to solving a problem using geospatial tools and methods.
3. Run geoprocessing tools individually and implement a model to run several tools in sequence.
4. Organize the data sets resulting from analysis.
5. Present the results of a geospatial analysis using appropriate terminology and visualizations.

# Course Content

1. Reviewing the basics of geospatial data
    a. Data sources
    b. Data types
    c. Vector and raster data formats
    d. Basic cartographic data presentation techniques
2. Introduction to geospatial analysis
    a. Database joins
    b. Classifying and displaying data with a variety of statistical methods
    c. Presenting results as graphs and maps
3. Using advanced attribute and spatial queries for data exploration
    a. Metadata and data dictionaries
    b. Formulating queries
    c. Types of selections

4. Using advanced attribute and spatial queries for data exploration
    a. Fundamentals of coding for advanced analysis operations
    b. Integrating machine learning tools to GIS analysis
    c. Using GIS to build models
5. Vector data analysis
    a. Overlay techniques
    b. Creating a site selection model
    c. Networks and network analysis
6. Building an automated model
    a. Uses and applications of models
    b. Planning and implementing models
7. Raster data analysis: working with topographic data
    a. Topographic data
    b. Viewshed analysis for site selection
    c. Reclassification
    d. Map algebra
    e. Hydrographic data
    f. Density surfaces
8. Database design and schema implementation
    a. Subtypes
    b. Default values
    c. Importing existing database schema

# Lab Content

1. Reviewing the basics of geospatial data
    a. Acquiring data
    b. Formatting data
    c. Reprojecting data and transforming coordinate systems
    d. Vector and raster data formats

    e. Basic cartographic data presentation techniques
2. Introduction to geospatial analysis
    a. Database joins
    b. Classifying and displaying data with a variety of statistical methods
    c. Presenting results as graphs and maps
3. Using advanced attribute and spatial queries for data exploration
    a. Using metadata and a data dictionary
    b. Formulating queries
    c. Selection by location
4. Using advanced attribute and spatial queries for data exploration
    a. Using data dictionaries to interpret attribute tables
    b. Formulating Boolean queries
    c. Selection by location
    d. Buffering
    e. Implementing a model
5. Vector data analysis: overlay techniques
    a. Union
    b. Intersect
    c. Converting from coverage format to modern GIS data format
6. Vector data analysis: creating a site selection model
    a. Proximity analysis using line and polygon buffering
    b. Geospatial data model flow charts
    c. Creating a model that satisfies multiple location criteria
7. Vector data analysis: network analysis
    a. Building topology
    b. Network routing
    c. Modeling of network impedance
    d. Generating service areas
8. Building an automated model
    a. Setting environmental settings prior to running the model

b. Setting model parameters in order to later model inputs
c. Implementing a multi-step model using automation tools
d. Exporting and editing model script

9. Raster data analysis: working with topographic data
    a. Using elevation data to create slope, aspect, and hillshade surfaces
    b. Analyzing an environmental issue using elevation derived data sets
    c. Reclassifying raster data
    d. Map algebra
    e. Viewshed analysis for site selection
10. Raster data analysis: working with hydrographic data
    a. Generating stream flow direction using accumulation surfaces
    b. Creating watersheds based on topographic data
    c. Using hydrographic data to analyze a scientific question
11. Raster data analysis: density surfaces
    a. Interpolating density surfaces from point data
    b. Converting between vector and raster formats
12. Database design and schema implementation
    a. Subtypes
    b. Default values
    c. Importing existing database schema

# Special Facilities and/or Equipment

Access to industry standard geospatial software and a computer with an internet connection.

# Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Labs

Exams
Portfolio

## Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Lecture presentations and classroom discussion
Demonstrations and hands-on exercises
Laboratory exercises
Reading assignments

## Representative Text(s) and Other Materials

Bolstad, Paul. GIS Fundamentals: A First Text on Geographic Information Systems, 6th ed.. 2019.

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

1. Weekly reading assignments from text and outside sources ranging from 30-60 pages per week.
2. Weekly lecture covering subject matter from text assignment with extended topic information. Class discussion is encouraged.
3. Hands-on exercises and demonstrations: Weekly computer labs. Each exercise covers assigned reading and lecture topics.

## Discipline(s)

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