GIS 575.001
Geographic Information System (GIS) and Geospatial Applications
Spring 2020

Instructor: Dr. I-Kuai Hung
Office: Forestry 106
Phone: 468-2464
Email: hungi@sfasu.edu
Website: http://www.faculty.sfasu.edu/hungikua

Lectures:
Thursday 4:30-6:20PM, Forestry 205

Laboratories:
Thursday 6:30-9:00PM, Forestry 108

Course Description:
GIS 575 GIS and Geospatial Applications. 3 semester hours, 2 hours lecture and 3 hours lab per week. Application of GIS technology to building and maintaining data bases and analyzing spatial and temporal problems.

Program Learning Outcomes:
GIS has become commonplace in a multitude of disciplines. This class outlines the foundations of spatial analysis in a geographic information system environment with focus on the universal aspects of spatial data and their analysis.
GIS 553 is an elective for Spatial Science majors as well as those including Geospatial Analyst Certificate, Environmental Science, and Forestry who are interested in advanced level of GIS skills. The course is designed to address the Program Learning Outcomes in demonstrating proficiency in statistical analysis in spatial science at advanced level, as well as preparation to pursue a professional career and/or Ph.D. degree and competency in oral and written communication skills at mastery level.

Student Learning Outcomes:
Students are introduced key spatial concepts from point pattern to continuous field. Analytical techniques in GIS environment are discussed. As the semester develops, students will apply spatial analytical tools to model real-world problems and present their findings in a geospatial context. They will demonstrate competency in oral and written communication skills through project preparation and presentation where the professional ethics is emphasized.

Textbooks:
Required:
Recommended:

Software:
Esri ArcGIS for Desktop 10.6.1 with the Advanced (ArcInfo) license level, ArcGIS Pro 2.2, and Python.

Lecture Topics:
Course Overview: General descriptions on the course structure, content, schedule, and requirement. Introduction to the online learning management system, Desire2Learn. Review of the elements of statistics.

Geographic Information Analysis: Discussion on the definition of geographic information analysis and the difference between spatial data manipulation, spatial data analysis, spatial statistical analysis and spatial modeling. Discussion on different types of spatial objects and different levels of measurement.

The Properties of Spatial Data: Discussion on problems about spatial data including spatial autocorrelation, modifiable areal unit problem, ecological fallacy, scale, and nonuniformity of space vs. the favorable properties of measurable distance, adjacency, interaction, and neighborhood.

GIS Programming: Introduction to the fundamentals of computer programming and discussion on building customized GIS applications using different programming interfaces including ArcGIS ModelBuilder and the script language of Python.

Maps: Discussion on cartographic traditions and the use of map for scientific visualization, using maps for the exploration of different spatial objects, and the relationship between process and pattern in a map.

Point Pattern Analysis: Discussion on point pattern analysis with different approaches including point density based, point separation based, and the one using both density and distance, and the interpretation of point patterns through statistical analysis.

Spatial Autocorrelation: Discussion on the different types of area object and the definition of spatial autocorrelation. Exploration on different techniques for measuring spatial autocorrelation including global and local approaches.

The Statistics of Fields: Discussion on the different techniques for spatial interpolation including deterministic and stochastic approaches. Exploration on accuracy assessment for spatial interpolation through validation and cross validation.

Map Overlay: Discussion on possible types of map overlay from a geometric view and the use of map overlay for GIS modeling including index model, binary model, and weight of evidence with work examples.
GIS Tools for Map Overlay: Discussion on existing tools for map overlay analysis in GIS software packages with focus on the Fuzzy Overlay and Weighted Overlay in ArcGIS.

Lab and Assignments:

Ten lab assignments will be given throughout the semester. They include data processing in GIS and geospatial data visualization etc.

The assignments will be given online and should be submitted in electronic format onto Desire2Learn. It is the individual student’s responsibility to access his/her D2L account. When uploading an assignment, the name of the student’s file should include the student’s mySFA ID at the end following an underscore, e.g. assignment1_hungikua.doc. Failure to follow this filename convention will result in penalty on the grade. A corrected version of assignment can be resubmitted by the deadline. However, no late submission will be accepted.

Important information will also be announced through the email in D2L. It is the student’s responsibility to check his/her email on a regular basis.

Term Project:

Toward the end of the semester, each student will complete an independent project presented to the class. The product will be a poster with the dimension of 42 by 36 inch. While presenting the work, a talk facilitated with PowerPoint along with the poster is required. The talk should run about 20 minutes, with a five-minute question and answer time.

Examination:

A final exam will be given. It will include both concepts and lab works.

Grading Policy:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>A 90+ %</td>
</tr>
<tr>
<td>30%</td>
<td>B 80-89%</td>
</tr>
<tr>
<td>20%</td>
<td>C 70-79%</td>
</tr>
<tr>
<td></td>
<td>D 60-69%</td>
</tr>
<tr>
<td></td>
<td>F &lt; 60%</td>
</tr>
</tbody>
</table>

Attendance Policy:

According to the University’s policy, regular and punctual attendance is expected at all classes, laboratories, and other activities for which a student is registered. Even though attendance is not a factor for the course grades, accurate attendance will be recorded. When an absence is unavoidable, make sure you catch up on what was missed. If a student has excessive absences, the instructor reserves the right not to give individual tutoring, special consideration regarding make-up work, or other help the student needs because of missing class. Plan your time as best as possible and make the commitment to spend the amount of time needed for you to be successful.

Acceptable Classroom Behavior:
Classroom behavior should not interfere with the instructor’s ability to conduct the class or the ability of other students to learn from the instructional program (see the Student Code of Conduct, policy 10.4). Unacceptable or disruptive behavior will not be tolerated. Students who disrupt the learning environment may be asked to leave class and may be subject to judicial, academic or other penalties. This prohibition applies to all instructional forums, including electronic/online forums, classroom meetings, labs, discussion groups, field trips, etc. The instructor shall have full discretion over what behavior is appropriate/inappropriate in the classroom. Students who do not attend class regularly or who perform poorly on class projects/exams may be referred to the Early Alert Program http://www.sfasu.edu/judicial/earlyalert.asp. This program provides students with recommendations for resources or other assistance that is available to help SFA students succeed.

Responsible Use of Technology:

It is expected that all students will only use cell phones, PDAs, laptop computers, MP3 players, and related devices outside of class time or when appropriate in class. Answering a cell phone, texting, listening to music or using a laptop for matters unrelated to the course may be grounds for dismissal from class or other penalties.

Academic Integrity:

It is the instructor’s hope that academic dishonesty will not be a problem in this class. However, academic integrity is a responsibility of all university faculty and students. Faculty members promote academic integrity in multiple ways including instruction on the components of academic honesty, as well as abiding by university policy on penalties for cheating and plagiarism.

Definition of Academic Dishonesty

Academic dishonesty includes both cheating and plagiarism. Cheating includes but is not limited to (1) using or attempting to use unauthorized materials to aid in achieving a better grade on a component of a class; (2) the falsification or invention of any information, including citations, on an assigned exercise; and/or (3) helping or attempting to help another in an act of cheating or plagiarism. Plagiarism is presenting the words or ideas of another person as if they were your own. Examples of plagiarism are (1) submitting an assignment as if it were one's own work when, in fact, it is at least partly the work of another; (2) submitting a work that has been purchased or otherwise obtained from an Internet source or another source; and (3) incorporating the words or ideas of an author into one's paper without giving the author due credit. Please read the complete policy at http://www.sfasu.edu/policies/4.1-student-academic-dishonesty.pdf.

Withheld Grades Course Grades Policy (5.5):

At the discretion of the instructor of record and with the approval of the academic chair/director, a grade of WH will be assigned only if the student cannot complete the course work because of unavoidable circumstances. Students must complete the work within one calendar year from the end of the semester in which they receive a WH, or the grade automatically becomes an F, except as allowed through policy [i.e., Active Military Service (6.14)]. If students register for the same course in future semesters the WH will
automatically become an F and will be counted as a repeated course for the purpose of computing the grade point average.

**Students with Disabilities:**
To obtain disability related accommodations, alternate formats and/or auxiliary aids, students with disabilities must contact the Office of Disability Services (ODS), Human Services Building, Room 325, 468-3004 / 468-1004 (TDD) as early as possible in the semester. Once verified, ODS will notify the course instructor and outline the accommodation and/or auxiliary aids to be provided. Failure to request services in a timely manner may delay your accommodations. For additional information, go to http://www.sfasu.edu/disabilityservices/.

**Ph.D. Students:**
If necessary, Ph.D. students should schedule a meeting with the instructor to discuss special course content deemed required to support their research.
<table>
<thead>
<tr>
<th>Month</th>
<th>Day</th>
<th>Lecture</th>
<th>Lab</th>
<th>Readings</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>16</td>
<td>Course Overview</td>
<td>Orientation</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>23</td>
<td>Geographic Information Analysis</td>
<td>Elements of Statistics</td>
<td>Chapter 1</td>
</tr>
<tr>
<td>3</td>
<td>30</td>
<td>The Properties of Spatial Data</td>
<td>Modifiable Areal Unit Problem</td>
<td>Chapter 2</td>
</tr>
<tr>
<td>February</td>
<td>6</td>
<td>GIS Programming</td>
<td>Geoprocessing with ArcGIS</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>13</td>
<td>GIS Programming</td>
<td>From Model to Script</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>20</td>
<td>GIS Programming</td>
<td>Python Scripting with ArcGIS</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>27</td>
<td>Maps</td>
<td>More Python Scripting</td>
<td>Chapter 3, 4</td>
</tr>
<tr>
<td>March</td>
<td>5</td>
<td>Point Pattern Analysis</td>
<td>Point Pattern Analysis</td>
<td>Chapter 5, 6</td>
</tr>
<tr>
<td>9</td>
<td>12</td>
<td><strong>Spring Break</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>19</td>
<td>Spatial Autocorrelation</td>
<td>Distance Equations</td>
<td>Chapter 7, 8</td>
</tr>
<tr>
<td>11</td>
<td>26</td>
<td>Describing and Analyzing Fields</td>
<td>Spatial Autocorrelation</td>
<td>Chapter 9</td>
</tr>
<tr>
<td>April</td>
<td>2</td>
<td>The Statistics of Fields</td>
<td>Spatial Interpolation</td>
<td>Chapter 10</td>
</tr>
<tr>
<td>13</td>
<td>9</td>
<td><strong>Easter Holiday</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>16</td>
<td>Map Overlay</td>
<td></td>
<td>Chapter 11</td>
</tr>
<tr>
<td>15</td>
<td>23</td>
<td>GIS Tools for Map Overlay</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>30</td>
<td>Term Project</td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>4</td>
<td><strong>Final Exam</strong> (4:30 - 7:00 PM)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*The instructor reserves the right for the modification of this syllabus.*