ERE 551: GIS FOR ENGINEERS
COURSE SYLLABUS: FALL 2016

INSTRUCTOR:

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SUGGESTED TEXTS:

Geographic Information Systems and Science Longley, Goodchild, Maguire, and Rhind, 3rd Ed.
An Introduction to Statistical Problem Solving in Geography, Chapman McGrew, Lembo, and Monroe, 3rd Ed.

COURSE DESCRIPTION:

Introduction to fundamental concepts in geographic information systems (GISs) with a focus on engineering applications. Fundamental concepts and development of geographic information systems including models and georeferencing systems used to represent and characterize spatial data. Data processing including collection and preprocessing, data management, spatial analysis and manipulation, and data output. Necessity and utility of spatial data in engineering design analysis.

COURSE LEARNING OUTCOMES:

At the conclusion of the course, students should be able to:

1. Explain the fundamental concepts in the acquisition, processing, organization, and management of spatial data;
2. Use spatial data and spatial analysis in engineering problem solving;
3. Explain the advantages and disadvantages of using raster vs. vector based GIS;
4. Utilize a GIS software package (ArcGIS) to perform spatial analysis.

PROGRAM LEARNING OUTCOMES:

Within the context of the course description and course outcomes presented above, this course will contribute to students achieving the following outcomes related to the accredited ERE undergraduate degree:

- Apply knowledge of mathematics, science, and engineering:
  - Mathematically manipulate spatial data;
  - Understand and apply basic spatial analysis principles to creatively solve problems.
- Design and conduct experiments, as well as to analyze and interpret data:
  - Analysis spatial data.
- Communicate effectively:
  - Exhibit effective written communication skills;
  - Practice professional communication through preparation of laboratory exercise and project reports, and memoranda.
- Identify, formulate, and solve engineering problems:
  - Demonstrate spatial skills for problem solving;
  - Manage and analyze spatial data to determine solutions to spatial challenges.
- Use the techniques, skills, and modern engineering tools necessary for engineering practice:
  - Become proficient users of software tools for spatial analysis.

COLLEGE LEARNING OUTCOMES:

Within the context of the course description and course outcomes presented above, this course will contribute to students achieving the following College-wide learning outcomes:

- Quantitative Reasoning:
  - Demonstrate spatial skills for problem solving;
  - Manage and analyze spatial data to determine solutions to spatial challenges.
- Basic Communication Skills:
  - Exhibit effective written communication skills;
  - Practice professional communication through preparation of laboratory exercise and project reports, and memoranda.
- Technological and Information Literacy:
  - Become proficient users of software tools for spatial analysis.

COURSE COMPONENTS:

Lecture: Two hours of lecture per week: Monday/Wednesday 11:40–12:35 PM (topics as shown on Lecture schedule). Three hour exams will be held during the semester.

Laboratory: Nine laboratory exercises: Wednesday 2:15–5:05 PM (exercises and due dates as shown on Lab schedule). The lab exercises contribute substantially to the overall work load in the course. The lab exercises should be completed with a high degree of professionalism. A portion of each lab grade is based on professional appearance.

Projects: Two spatial analysis projects (dates as shown on Lab schedule). The first will be defined by the instructor, the second can be student-directed.

GRADING:

Four exams are offered for this course: three hour exams and a comprehensive exam during the scheduled finals period. If all four exams are taken, then the highest three grades are recorded. You must take the final if you miss an hour exam during the semester.

3 exams	60%
9 laboratory exercises	20%
2 projects	20%

The three exam grades, lab exercise grades and project grades are combined using the weighting shown above to provide a final numerical score. Based on the numerical score a final letter grade is assigned based on the table to the right.

LETTER GRADE	NUMERICAL GRADE RANGE
A	93 and above
A-	90 to just less than 93
B+	87 to just less than 90
B	84 to just less than 87
B-	80 to just less than 84
C+	77 to just less than 80
C	74 to just less than 77
C-	70 to just less than 74
F	Less than 70

ATTENDANCE POLICY:

Attendance is not a part of the grade in the class, but students who do not attend lectures or laboratory recitations do so at their own risk. Student participation in lectures and labs is essential to success in this course.

COMPUTER USAGE:

Word processing, presentation, and spreadsheet software packages are basic tools in modern life. These types of programs should be used for written and graphic communication to support quantitative analyses. E-mail will be used frequently for communicating outside class times. All students have access to an e-mail account through the Syracuse University system, which also gives them access to the class Blackboard site. Lecture outlines and homework exercises will be available through Blackboard. Lab submissions will generally be made through Blackboard.

ACADEMIC DISHONESTY

Academic dishonesty is a breach of trust between a student, one's fellow students, or the instructor(s). By registering for courses at ESF you acknowledge your awareness of the ESF Code of Student Conduct (http://www.esf.edu/students/handbook/StudentHB.05.pdf), in particular academic dishonesty includes but is not limited to plagiarism and cheating, and other forms of academic misconduct. The Academic Integrity Handbook contains further information and guidance (http://www.esf.edu/students/integrity/). Infractions of the academic integrity code may lead to academic penalties as per the ESF Grading Policy (http://www.esf.edu/provost/policies/documents/GradingPolicy.11.12.2013.pdf).

SOURCES OF SUPPORT AND CLASS ABSENCE:

If you experience academic or personal difficulties that affect your studies or life, there are people and resources that will help you. There is a website that serves to answer many student questions: http://www.esf.edu/students/success. In addition, the ESF Office of Student Life, 110 Bray Hall (470-6660) will provide academic support, career guidance, personal counseling, or direct you to the proper source of help. If you encounter a situation beyond your control in which you will be missing 3 or more days of classes, you should contact the Office of Student Life and they will get in touch with all your instructors for you. Supportive documentation may be required.

ACCOMMODATIONS FOR STUDENTS WITH LEARNING AND PHYSICAL DISABILITIES:

SUNY-ESF works with the Office of Disability Services (ODS) at Syracuse University, who is responsible for coordinating disability-related accommodations. Students can contact ODS at 804 University Avenue- Room 309, 315-443-4498 to schedule an appointment and discuss their needs and the process for requesting accommodations. Students may also contact the ESF Office of Student Affairs, 110 Bray Hall, 315-470-6660 for assistance with the process. To learn more about ODS, visit http://disabilityservices.syr.edu. Authorized accommodation forms must be in the instructor's possession one week prior to any anticipated accommodation. Since accommodations may require early planning and generally are not provided retroactively, please contact ODS as soon as possible.

INCLUSIVE EXCELLENCE STATEMENT

As an institution, we embrace inclusive excellence and the strengths of a diverse and inclusive community. During classroom discussions, we may be challenged by different ideas. Understanding individual differences and broader social differences will deepen our understanding of each other and the world around us. In this course, all people are strongly encouraged to respectfully share their unique perspectives and experiences. This statement is intended to help cultivate a respectful environment, and it should not be used in a way that limits expression or restricts academic freedom at ESF.

RELIGIOUS OBSERVANCE:

ESF protects the rights of students to observe religious holy days according to their tradition. Students will be provided an opportunity to make up any exam or work requirements that may be missed due to a religious observance provided they give the instructor reasonable advance notification.

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LECTURE SCHEDULE – FALL 2016

DATE	LECTURE TOPIC
29 Aug	Introduction to GIS and spatial analysis
31 Aug	Maps and map analysis; metadata
5 Sep	Spatial data and data models
7 Sep	Spatial data models – raster model
12 Sep	Spatial data models – vector model
14 Sep	Datums
19 Sep	Coordinate systems
21 Sep	Data collection – primary data acquisition
26 Sep	**** EXAM 1 – Through Coordinate Systems ****
28 Sep	Data collection – secondary data acquisition
3 Oct	Preprocessing
5 Oct	Rectification and registration
10 Oct	Spatial analysis – Data exploration and optimization
12 Oct	Spatial analysis – Location, distance, and area-based analysis
17 Oct	Spatial analysis – Overlays and buffering
19 Oct	Spatial analysis – Interpolation and density estimation
24 Oct	Spatial analysis – Terrain analysis
26 Oct	**** EXAM 2 – Through Interpolation ****
31 Oct	Uncertainty and error
2 Nov	Correlation analysis
7 Nov	Regression
9 Nov	Data management – Database management systems
14 Nov	Data management – Querying and indexes
16 Nov	GIS output
21 Nov	*NO CLASS – THANKSGIVING BREAK*
23 Nov	*NO CLASS – THANKSGIVING BREAK*
28 Nov	Open source GIS
30 Nov	**** EXAM 3 – Through Open Source GIS ****
5 Dec	GIS applications
7 Dec	GIS applications

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LABORATORY SCHEDULE – FALL 2016

DATE	LABORATORY EXERCISE	REPORT DUE
31 Aug	Map Interpretation and Geometry	7 Sep
7 Sept	Map Quality and Analysis	14 Sept
14 Sept	Introduction to ArcGIS	21 Sept
21 Sept	Data Acquisition and Generation	28 Sep
28 Sep	Project 1	Prelim: 6 Oct
5 Oct		Final: 14 Oct
12 Oct	Spatial Analysis: Point Data	19 Oct
19 Oct	Spatial Analysis: Polygons and Rasters	26 Oct
26 Oct	Hydrologic Modeling	2 Nov
2 Nov	Introduction to ArcGIS ModelBuilder	9 Nov
9 Nov	Project 2	Prelim: 16 Nov Final: 9 Dec
16 Nov		
23 Nov	*NO LAB – THANKSGIVING BREAK*	
30 Nov	Project 2	
7 Dec	Introduction to Quantum GIS	7 Dec