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## **ERE 551: GIS FOR ENGINEERS**

### **COURSE SYLLABUS: FALL 2014**

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#### **INSTRUCTOR:**

Lindi Quackenbush

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#### **SUGGESTED TEXTS:**

*Geographic Information Systems and Science* Longley, Goodchild, Maguire, and Rhind, 3<sup>rd</sup> Edition

*An Introduction to Statistical Problem Solving in Geography*, Chapman McGrew, Lembo, and Monroe, 3<sup>rd</sup> Edition

#### **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 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:

- Ability to apply knowledge of mathematics, science, and engineering:
  - Mathematically manipulate spatial data;
  - Understand and apply basic spatial analysis principles to creatively solve problems.
- Ability to design and conduct experiments, as well as to analyze and interpret data:
  - Analysis spatial data.
- Ability to communicate effectively:
  - Exhibit effective written communication skills;
  - Practice professional communication through preparation of laboratory exercise and project reports, and memoranda.
- Ability to identify, formulate, and solve engineering problems:
  - Demonstrate spatial skills for problem solving;

- Manage and analyze spatial data to determine solutions to spatial challenges.
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice:
  - Become proficient users of software tools for spatial analysis.

### COURSE COMPONENTS:

**Lecture:** Two hours of lecture per week: Tuesday/Thursday 3:30–4:25 PM (topics as shown on Lecture schedule). Three hour exams will be held during the semester.

**Laboratory:** Eight laboratory exercises: Wednesday 1:50–4:50 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 final exam 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%
8 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.

**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.

**RELIGIOUS OBSERVANCE:**

ESF recognizes the diversity of faiths represented among the campus community and 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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**ERE 551: GIS FOR ENGINEERS**  
**LECTURE SCHEDULE – FALL 2014**

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DATE	LECTURE TOPIC
26 Aug	Introduction to GIS and spatial analysis
28 Aug	Maps and map analysis; metadata
2 Sep	Spatial data and data models
4 Sep	Spatial data models – raster model
9 Sep	Spatial data models – vector model
11 Sep	Datums
16 Sep	Coordinate systems
18 Sep	Data collection – primary data acquisition
23 Sep	<b>** EXAM 1 – Through Coordinate Systems **</b>
25 Sep	Data collection – secondary data acquisition
30 Sep	Preprocessing
2 Oct	Rectification and registration
7 Oct	Spatial analysis – Data exploration and optimization
9 Oct	Spatial analysis – Location, distance, and area-based analysis
14 Oct	Spatial analysis – Overlays and buffering
16 Oct	Spatial analysis – Interpolation and density estimation
21 Oct	Spatial analysis – Terrain analysis
23 Oct	<b>** EXAM 2 – Through Interpolation **</b>
28 Oct	Uncertainty and error
30 Oct	Correlation analysis
4 Nov	Regression
6 Nov	Data management – Database management systems
11 Nov	Data management – Querying and indexes
13 Nov	GIS output
18 Nov	Open source GIS
20 Nov	<b>** EXAM 3 – Through Open Source GIS **</b>
25 Nov	<i>NO CLASS – THANKSGIVING BREAK</i>
27 Nov	<i>NO CLASS – THANKSGIVING BREAK</i>
2 Dec	GIS applications
4 Dec	GIS applications

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**ERE 551: GIS FOR ENGINEERS**  
**LABORATORY SCHEDULE – FALL 2014**

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DATE	LABORATORY EXERCISE	REPORT DUE
27 Aug	Map Interpretation and Geometry	3 Sep
3 Sept	Map Quality and Analysis	10 Sep
10 Sept	Introduction to ArcGIS	17 Sep
17 Sept	Data Acquisition and Generation	24 Sep
24 Sept	Project 1	Prelim: 1 Oct Final: 15 Oct
1 Oct		
8 Oct		
15 Oct	Spatial Analysis	22 Oct
22 Oct	Hydrologic Modeling	29 Oct
29 Oct	Introduction to ArcGIS ModelBuilder	5 Nov
5 Nov	Project 2	Prelim: 12 Nov Final: 5 Dec
12 Nov		
19 Nov		
26 Nov	NO LAB – THANKSGIVING BREAK	
3 Dec	Introduction to Quantum GIS	3 Dec