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

### **COURSE SYLLABUS**

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**INSTRUCTOR:**

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**SUGGESTED TEXT:**

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

**COURSE DESCRIPTION:**

The course provides an introduction to the fundamental concepts in Geographic Information Systems (GISs) for upper division undergraduate and beginning graduate students in engineering. The course presents GIS theory with an engineering application focus.

This course includes coverage of topics such as:

1. The fundamental concepts and development of geographic information systems;
2. Different models used to represent and characterize spatial data;
3. Data processing components including collection and preprocessing, data management, spatial analysis and manipulation, and data output;
4. The necessity and utility of spatial data in engineering design analysis;
5. Topical issues in geographic information systems.

**COURSE OBJECTIVES:**

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 objectives presented above, this course will contribute to students achieving the following specific outcomes:

- 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 REQUIREMENTS:

**Lecture:** Two hours of lecture per week (topics as shown on Lecture schedule). Three hour exams will be held during the semester.

**Laboratory:** Eight laboratory exercises (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

### COMPUTER USAGE:

Word processing and spreadsheet software packages are considered basic tools in modern life. These types of programs should be used for written and graphic communication and many types of 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.

**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 DISABILITIES:**

SUNY-ESF works closely with the Office of Disability Services (ODS) at Syracuse University in assisting students with learning and physical disabilities. If you believe that you need accommodations for a disability, you may contact the ESF Office of Student Affairs, 110 Bray Hall, for assistance. You may also contact ODS directly to discuss your needs and the process for requesting accommodations. ODS coordinates disability-related accommodations and will issue students with documented Disabilities Accommodation Authorization Letters, as appropriate. 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 2013**

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DATE	LECTURE TOPIC
27 Aug	Introduction to GIS and spatial analysis
29 Aug	Maps and map analysis
3 Sep	Spatial data and data models
5 Sep	Spatial data models – raster model
10 Sep	Spatial data models – vector model
12 Sep	Datums
17 Sep	Coordinate systems
19 Sep	Data collection – data acquisition
24 Sep	<b>** EXAM 1 – Through Datums **</b>
26 Sep	Data collection
1 Oct	Preprocessing
3 Oct	Rectification and registration
8 Oct	Spatial analysis – Data exploration and optimization
10 Oct	Spatial analysis – Location, distance, and area-based analysis
15 Oct	Spatial analysis – Overlays and buffering
17 Oct	Spatial analysis – Interpolation and density estimation
22 Oct	Spatial analysis – Terrain analysis
24 Oct	<b>** EXAM 2 – Through Interpolation **</b>
29 Oct	Uncertainty and error
31 Oct	Data management – Database management systems
5 Nov	Data management – Querying and indexes
7 Nov	Data and project management
12 Nov	Project management and metadata
14 Nov	GIS output
19 Nov	Open source GIS
21 Nov	<b>** EXAM 3 – Through Open Source GIS **</b>
26 Nov	<i>NO CLASS – THANKSGIVING BREAK</i>
28 Nov	<i>NO CLASS – THANKSGIVING BREAK</i>
3 Dec	GIS applications
5 Dec	GIS applications

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**ERE 551: GIS FOR ENGINEERS**  
**LABORATORY SCHEDULE – FALL 2013**

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DATE	LABORATORY EXERCISE	REPORT DUE
28 Aug	Map Interpretation and Geometry	4 Sept
4 Sept	Map Quality and Analysis	11 Sept
11 Sept	Introduction to ArcGIS	18 Sept
18 Sept	Data Acquisition and Generation	25 Sept
25 Sept	Project 1	Prelim: 2 Oct Final: 16 Oct
2 Oct		
9 Oct		
16 Oct	Spatial Analysis	23 Oct
23 Oct	Hydrologic Modeling	30 Oct
30 Oct	Introduction to ArcGIS ModelBuilder	6 Nov
6 Nov	Project 2	Prelim: 14 Nov Final: 6 Dec
13 Nov		
20 Nov		
27 Nov	<i>NO LAB – THANKSGIVING BREAK</i>	
4 Dec	Introduction to Quantum GIS	4 Dec