
ERE 551: GIS FOR ENGINEERS

COURSE SYLLABUS

INSTRUCTOR:

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TEXT:

Geographic Information Systems and Science Longley, Goodchild, Maguire and Rhind, 2nd Edition (available at the Orange Bookstore, Marshall Square Mall)

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 raster (Idrisi) and vector (ArcGIS) GIS packages to perform spatial analysis.

PROGRAM OUTCOMES:

Within the context of the course description and objectives presented above, this course will contribute to graduates achieving the following specific outcomes:

- Have sufficient backgrounds/tools to function effectively
 - Demonstrate spatial skills for problem solving
 - Exhibit effective written communication skills
- Are capable of utilizing an engineering approach to problem solving
 - Effectively manage and analyze spatial data to determine solutions to spatial challenges

- Communicate their ideas and expectations effectively
 - Practice professional communication through preparation of laboratory exercise reports
 - Demonstrate communication skills through developing professional memoranda and reports for class projects
- Exhibit attributes of a competent professional
 - Knowledge: understand and apply basic spatial analysis principles to creatively solve problems
 - Skills: become proficient users of software tools used in geospatial analysis
 - Attitude: demonstrate professional ethics, documentation, self-discipline, and perseverance

COURSE REQUIREMENTS:

Lecture: Two hours of lecture per week. Reading assignments will be made throughout the semester. 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 use raster-based GIS software; the second will use vector-based GIS software.

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	50%
8 laboratory exercises	25%
2 projects	25%

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. Computer clusters at ESF and at SU provide access to the Internet for those who do not have home access.

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 can contact the Office of Student Life and they will contact all your instructors for you. Supportive documentation may be required.

ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES:

If you have an identified disability and will need accommodations, you should contact the Office of Student Life in 110 Bray Hall. Counselors will discuss the ESF process and work with you to access supportive services. If you have a learning disability, the College requires you to provide supportive documentation and will develop an approved accommodation sheet for you. Accommodations cannot be provided until this sheet is established and we meet to discuss its applicability to this course. Accommodations cannot be established retroactively.

GIS FOR ENGINEERS
LECTURE SCHEDULE – FALL 2010

DATE	LECTURE TOPIC	READINGS
31 Aug	Introduction to GIS and spatial analysis	1.1-1.4, 2.2, 2.3, 3.1-3.3
2 Sep	Maps	3.7, 3.8, 12.1-12.3, box 4.3
7 Sep	Map Analysis	5.6, 5.7
9 Sep	Spatial data	3.4, 3.5, 3.9, 4.1-4.4, 6.1, boxes 3.3, 4.1, 4.2
14 Sep	Spatial data models – raster model	3.6, 8.1, 8.2, box 8.1
16 Sep	Spatial data models – vector model	8.2
21 Sep	Spatial data models – other models	8.2-8.4, box 8.2
23 Sep	Coordinate systems	5.1-5.10
28 Sep	** EXAM 1 – Through Spatial Data Models **	
30 Sep	Datums	5.6
5 Oct	Data collection – data acquisition	4.4, 9.1, 9.2, 9.5, 9.6
7 Oct	Data collection	5.8, 9.3, 9.4
12 Oct	Preprocessing	3.8, 4.4, 9.4.1
14 Oct	Rectification and registration	
19 Oct	Uncertainty and error	3.1, 4.4, 4.6, 4.7, 6.2-6.5
21 Oct	Data management – Database management systems	10.1-10.3, 10.6
26 Oct	** EXAM 2 – Through Uncertainty and Error **	
28 Oct	Data management – Querying and indexes	10.4, 10.5, 10.7
2 Nov	Data management – GIS project design	17.1-17.4
4 Nov	Metadata	11.2, 20.3
9 Nov	Spatial analysis – Querying and measurements	14.1-14.3
11 Nov	Spatial analysis – Terrain analysis	14.3
16 Nov	Spatial analysis – Transformations	14.4.1-14.4.3
18 Nov	Spatial analysis – Spatial interpolation	14.4.4
22 Nov	Spatial analysis – Data exploration and optimization	15.1-15.5
25 Nov	<i>No class – THANKSGIVING BREAK</i>	
30 Nov	GIS output	12.1-12.3, 13.1, 13.2
2 Dec	** EXAM 3 – Through GIS Output **	
7 Dec	GIS applications	
9 Dec	GIS applications	

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LABORATORY SCHEDULE – FALL 2010

DATE	LABORATORY EXERCISE	REPORT DUE
1 Sept	Map Interpretation and Geometry	8 Sept
8 Sept	Map Quality and Analysis	15 Sept
15 Sept	Introduction to Raster GIS	22 Sept
22 Sept	Raster GIS – Analysis of global change data	29 Sept
29 Sept	Raster GIS – Soil loss modeling	6 Oct
6 Oct	Raster project	Prelim: 13 Oct Final: 27 Oct
13 Oct	Raster project	
20 Oct	Raster project	
27 Oct	Introduction to Vector GIS	3 Nov
3 Nov	Vector GIS – Spatial analysis	10 Nov
10 Nov	Vector GIS – Hydrologic modeling	17 Nov
17 Nov	Vector project	Prelim: 23 Nov Final: 10 Dec
24 Nov	<i>No Lab – Thanksgiving Break</i>	
1 Dec	Vector project	
8 Dec	Vector project	