

Fall 2009

CEIE 410/510 Geographic Information Systems in Engineering

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Course Outline

CEIE 410/510 Geographic Information Systems in Engineering (3:2:3) Prerequisites: CS 112, CEIE 360; CEIE 355.(credit is not given to both CEIE 410 and CEIE 510). Introduces geographic information systems (GIS) and their application in environmental, transportation, land-use planning, and other situations. Explores methods, technologies for spatial data acquisition, specification, storage, manipulation, query, thematic analysis, presentation, and application in the design process. Introduces relationships, integration of GIS with computer aided design and global positioning system. Hands-on projects. f

Books:

- *Text book (recommended):* Concepts and Techniques of Geographic Information Systems" by CP Lo and Albert KW Yeung. Printice Hall. ISBN 0-13-080427-4. Second Edition.
- *Required:* Getting to know ArcGIS, ESRI Press, 2009

Software: ArcGIS (mainly ArcView 9.3.1) Spreadsheets; and Microsoft Access

- ArcGIS 9.3.1 is site licensed and can be installed on any computer that is owned by the university and the license is valid only on the university premises.
- ENG 1203 has ArcGIS 9.3.1 installed. This facility has designated student hours with a TA help.
- ArcGIS 8.3 is installed on all the machines in Rooms 17 and 137 of Science and Tech II. For most part, 8.3 will work just the same as ArcView9.
- AutoCAD and TransCAD may also be used for diversification and for specialized applications.
- You may also be using Microsoft Access RDBMS for completing these course requirements. It is not essential for you to know Access, but it will help. At the appropriate time, I will give a quick overview of Access. It will help immensely if you can attend one or more DOIIT tutorials on Access. For a schedule of DOIIT sessions on Access, check their website.

Course Theme:

- Main focus of the course is just as the course suggests - GIS for Engineering Applications.
 - For about 60-70% of the course we will learn the basics of GIS
 - The remainder we will touch on two or more specific engineering applications.
- The course is not meant to be a skill development course
 - Most of the skills are only introduced to you via laboratory exercises. It is up to you to get motivated and learn all there is to learn about the software.

- Though I will try to introduce theory and applications in parallel, some of the theoretical aspects may not be covered in the lab.

Homework:

- There will be a minimum of 7 graded homework assignments.
- Assignments will be mostly based on the topics covered. At times, I may give some assignments on topics that are yet to be covered in the class. This means that you should try to get a head-start by reading appropriate material and/or learning that particular aspect of the software.
- As a general rule, assignments requiring hands-on GIS application will be covered in the class. However, some HW assignments may require use of GIS software, but I will try to avoid this. Most homework assignments will be given two weeks time to complete. However, unless otherwise mentioned, every homework assignment is due back in the following class.
- All homework assignments may not have equal weightage.
- Homework is due on the indicated day before the class begins. **LATE HOMEWORK WILL NOT BE ACCEPTED.** If you so desire, late homework will be graded but no credit will be given.

Tests and Quizzes:

- There will be up to FIVE pop quizzes –
 - The main purpose of these quizzes is to test how well you have grasped the concepts.
 - No advance notice will be given, but you may expect a quiz or test on in every 3rd class.
 - All quizzes will be closed book
 - Format of the quizzes
 - Multiple choice and/or true/false type – 15 to 20 questions; maximum time 15 minutes;
 - Questions will be on the topics covered in class.
 - Equal weight to all quizzes
- There will be **two** tests (one mid-term and one final) –
 - The main purpose of the tests is if you apply the knowledge to solving problems using GIS.
 - Most likely format will be as follows:
 - About 20-25 short answer questions (T/F, multiple choice)
 - About 6 questions related to concepts (quantitative and qualitative)
 - Up to two questions requiring GIS for problem solving.
 - There will be room for making mistakes
 - For now, I am anticipating that both tests will be open book. (I may change my mind about it later)
 - Equal weight to both tests
 - **Final examination will be comprehensive**

Class Project:

- In the 2nd or 3rd class, I will outline the requirement for a class project(s). The topic and problem will likely be on data collection using GPS equipment and using the data and GIS software to conduct some analysis. I am checking out on a couple of options. If you have other projects in mind with this theme, please bring them to my notice.

Grading

- The following are the weights to various grading elements
 - GIS Exercise reports – 30%
 - Homework – 16%
 - Class Project – 14%

- Quizzes – 12%
- 2 Tests – 24%
- Class Participation – 4%

Grading Scale

I follow a grading scale. I do not like to publicize it for two reasons. First, if and when the whole class needs a curve, the scale I follow needs substantial modification. There is no way to know in advance if the whole class grades need to be curved. Second, it is possible that some students may put undue pressure on themselves to shoot for a target grade. Worse, some students may feel contented with what they may or may not get and may completely stop trying. If you must know my grading scale, I will make a mention of it circa 12th class meeting.

CEIE 410 vs. CEIE 510

In this class, undergraduates are registered for CEIE 410. Grading for CEIE 410 will be based on a 5.25% curve (i.e. if the final average is 88, a B+, the curved score will be $1.0525 * 88 = 92.62$ or A-). For graduate students, there is no special curve.

Use of Electronic Media

- GIS is data intensive. Most assignments will require electronic submission. You may want to make use of zip disks and zip drives. If you have access to a CD-RW drive, it is even the better
- My plan is to put data files for homework assignments on the server so that you can download or use them directly. While I am still looking in to this alternative, I will also make the necessary data available on CD-ROM disk for each of you.
- **Please do not e-mail me your homework GIS files.** Due to their typical size, they may clog-up my server space and I will penalize you if you do so. **Yes, I am not kidding about penalizing for e-mailing large files.**

Miscellaneous:

- In consideration to other students and the instructor, please, NO FOOD during the class period. If you must eat, please leave the class and finish your snack outside.
- Also, officially, **no food or drink allowed in this class-room!**

Lab-style exercises:

We offered this course as a lecture + lab course during 2003-2007 offerings. Lab section was removed from 2008 offering. The main reason for this is change in availability of software for students. However, in current offering exercises will be modeled like a lab, they will only be introduced in class. You will have to spend time to do these exercises. You cannot and will not learn GIS without doing these exercises.

GIS features were demonstrated only via in class tutorials

HW assignments required use of GIS

Objectives of the lab-style exercises:

- To facilitate the development of deeper knowledge of the subject by applying GIS principles learned in the lectures
- To develop marketable GIS skills such as map preparation and problem solving
- BY NO MEANS, these exercises is a substitute to comprehensive training on GIS

Fall 2009: CEIE 410/510
(TENTATIVE) Schedule

31 August 2009

Date	Topics
August 31	Introductions; Course orientation; Expectations and concerns Introduction; Mapping and GIS
September 14	Georeferencing / Map basics (ISM) <ul style="list-style-type: none"> - coordinate systems and transformations - grid systems - projections
September 21	Georeferencing / Map basics (continued) GIS data models <ul style="list-style-type: none"> - databases; RDBMS - graphical representation of data - essential GIS data elements - Vector vs. Raster
September 28	Data input <ul style="list-style-type: none"> - Input devices; reference framework; digitizing; what and how to input; vector and raster input; field data collection; and meta data Storage and Editing
October 5	GIS data sources (ISM) Example of GIS data
October 13 (Tuesday)	Elementary spatial analysis Integrating GPS and GIS (ISM) Review/Catch-up
October 19	Measurement Mid-term
October 26	Classification Statistical surfaces Spatial Arrangements
November 2	GIS output Review/Catch-up
November 9	GIS design GIS Applications in General
November 16	GIS Applications in Engineering
November 23	GIS Applications in Engineering
November 30	GIS Applications in Engineering
December 7	Review/Catch-up
December 14	7:10 PM – 10:00 PM Final Examination
ISM – Instructor supplied material	

CEIE 410/510 GIS in Engineering Lab-Style Exercises (Fall 2009)

Schedule

August 29, 2005

Date	Exercise #	Description
Aug 31	1	Getting your feet wet with ArcGIS. Topics: layers, attributes, navigation, map scale, finding help, adding new layers, changing layer names, layer attributes, searching/selecting map features;
Sept 14	2	Map scale, labeling; Elementary cartography (map making); Basics understanding of data vs. map vs. layout; Fine tuning maps; thematic mapping;
Sept 21	3	Mastering Map making; Importing CAD; Georeferencing images Catch-up
Sept 28	4	Fundamentals of computer graphics, file and data organization; ArcCatalog, Projections; distance and shape measurements; Registering coordinates; Playing with projections
Oct 5	5	Role of databases in GIS; Linking external data; Manipulating data; integrating GPS data into GIS; Digitizing and editing;
Oct 13 (Tues)	6	Elementary spatial analysis; Geoprocessing; Buffers;
Oct 26	No lab	Project data collection (fieldwork)
Nov 2	No lab	Project data collection (fieldwork)
Nov 9	7	Exercises in Raster GIS (Mike Casey)
Nov 16	8	A challenging problem in Vector GIS - intro
Nov 23	9	Exercises in Raster GIS (Mike Casey)
Nov 30		Open for your project meeting/questions/catch-up
Dec 7		Projects due; Project presentations
Dec 14	7:10 PM – 10:00 PM Final Examination	
All exercises will be laid out before the start of the lab period. The material will be a combination of the ESRI exercises, and my own.		