

UNIVERSITY OF MASSACHUSETTS AT AMHERST  
 OFFICE OF THE SECRETARY  
 THE FACULTY SENATE

UNDERGRADUATE COURSE APPROVAL FORM  
 (Courses Numbered 001-599)

15 Copies Required for Courses Numbered 001-499  
 20 Copies Required for Courses Numbered 500-599

1. DEPARTMENT, COURSE NUMBER AND TITLE: CE-ENGIN 570 Geographic Information Systems (GIS) for Engineers
2. SCHOOL OR COLLEGE: School of Engineering
3. Proposer's Name, Telephone and Email: Mi-Hyun Park, (413) 545-5390, mpark@ecs.umass.edu
4. Proposed Instructor: Mi-Hyun Park
5. Course Credits: 3
6. Are there Prerequisites? No If yes, please specify \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
7. What is the intended clientele? Lower Division \_\_\_\_\_ Upper Division ✓  
 Department majors only \_\_\_\_\_ Departmental/related majors ✓ Non-Majors \_\_\_\_\_  
 If course is intended for majors, what role will it play in the curriculum? Required \_\_\_\_\_ Elective ✓
8. Complete Course Catalog Description (30 Words):  
 Principles of geographic information systems (GIS) and spatial analysis for engineering application. Topics include data structures and manipulation, topology, and attribute information. Use of spatial data for mapping and spatial analysis to address real world problems
9. Please attach the following materials:  
 \_\_\_\_\_ Week-by-week outline of topics covered in course (or syllabus)  
 \_\_\_\_\_ List of Required readings  
 \_\_\_\_\_ Description of required assignments (papers, exams, projects, reports, presentations, etc.)  
 \_\_\_\_\_ Summary of course grade criteria  
 \_\_\_\_\_ Selected bibliography of works used by instructor in developing course, especially recent works (as appropriate)  
 \_\_\_\_\_ If the course number is above 200 and there are no prerequisites, please explain  
 This course requires only basic knowledge of computers
10. If course has been offered as an experimental or special topics course, please comment (on an attached page) on its evolution.

*Upon approval of the course by the department head, one copy of this form shall be sent from the departmental office to the Faculty Senate Office to allow for the course to be published on the University's Web Site for comment.*

**For courses numbered 500-599, the "Guidelines for Course Approval Form" from the Graduate Council must accompany the new course proposal.**

**This course has been offered as a special topics course to provide students principles of GIS and its application to engineering areas**

**Although a similar course is offered in the Departments of Geo Science and Natural Resources Conservation, this course is tailored into engineering applications (especially our own major, Civil and Environmental Engineering) because there is an increasing demand in industry.**

**The course has been evolved so that students can be involved in hands-on projects and the seminar by guest instructor who is working on the GIS project.**

**Anticipated enrolment is 15.**

**Department of Civil and Environmental Engineering**  
**University of Massachusetts Amherst**  
**CEE 470/570: Geographic Information Systems (GIS) for Engineers**  
**Spring 2010**

**Lecture:** TuTh 1:00 - 2:15 pm  
23 Marston Hall

**Office hour:** TuTh 2:15 - 3:15pm or by appointment

**Instructor:** **Mi-Hyun Park**  
16D Marston Hall  
(413) 545-5390  
[mpark@ecs.umass.edu](mailto:mpark@ecs.umass.edu)

**Course Description:**

Principles of geographic information systems (GIS) and spatial analysis for engineering application. Topics include data structures and manipulation, topology, and attribute information. Use of spatial data for mapping and spatial analysis to address real world problems.

**Prerequisite:**

Basic knowledge of computers

**Required textbook:**

Introduction to Geographic Information Systems by Kang-tsung Chang, 4<sup>th</sup> Edition, McGraw-Hill  
*- available in Textbook Annex*

**Reference books:**

Fundamentals of Geographical Information Systems, **Michael N. DeMers**, 4<sup>th</sup> Edition, Wiley  
Getting Started with ArcGIS, ESRI Press

**Course Objectives:**

The objectives of this course are to introduce students the concepts and principles of GIS; to provide students with a comprehensive overview of GIS technologies and applications; and to familiarize students with GIS hardware and software, and prepare students to advanced GIS application in engineering fields.

**Course Outcomes:**

At the completion of this course students should:

- understand the role of the engineer in interpreting and organizing spatial data, formulating solution strategies, building models and making decisions;
- identify elements of spatial problems and that can be used for planning, management, operation, and decision making in civil and environmental engineering;
- use ArcGIS to solve engineering problems using graphical and computational methods;
- perform spatial analysis for planning, management, operation, and analysis of engineering systems and facilities

**Grading:**

Assignments	30%
Midterm	30%
Final project	40%

**Policies:**

- Attendance is required in the class.

- All assignments must be turned in by the due date. No late submission will be accepted without advance permission by the instructor.

- Do not miss an exam or report due date. If you have an extreme emergency (e.g., hospitalized illness, family emergency), then you must contact the instructor **BEFORE** the exam. If you do not contact the instructor before the exam, your effort will receive a zero grade.

### **Final Project:**

All students are required to complete a project either individually or with other students. All students are encouraged to define the objective of their project, collect all necessary data and perform spatial analysis. All students will present their project at the end of the semester and a final report is due on December 15, 2008.

### **Class Schedules** (subject to change):

<b>Week</b>	<b>Topic</b>	<b>Reading</b>
1	Introduction to GIS	Ch. 1
2	Introduction to ArcGIS Coordinate Systems	Ch. 2
3	Map projection	
4	Vector Data Models	Ch. 3 & 4
5	Raster Data Models	Ch. 5
6	Data Input and Editing	Ch. 6 & 8
7	GIS Database	Ch. 9
8	Midterm	
9	Spatial Exploration	Ch. 11
10	Spatial Analysis	Ch. 12
11	Spatial Analysis	Ch. 13
12	GIS Output	Ch. 10
13	Real World Application and Future Issues	
14	Final Project Lab	
15	Final Project Presentation	

### **Accommodation Policy Statement**

The University of Massachusetts Amherst is committed to providing an equal educational opportunity for all students. If you have a documented physical, psychological, or learning disability on file with Disability Services (DS), Learning Disabilities Support Services (LDSS), or Psychological Disabilities Services (PDS), you may be eligible for reasonable academic accommodations to help you succeed in this course. If you have a documented disability that requires an accommodation, please notify me within the first two weeks of the semester so that we may make appropriate arrangements.

### **Graduate School Interim Statement on Academic Honesty**

It is expected that all graduate students will abide by the Graduate Student Honor Code and the Academic Honesty Policy (available at the Graduate Dean's Office, the Academic Honesty Office (Ombud's Office) or online at [http://www.umass.edu/gradschool/handbook/univ\\_policies\\_regulations\\_a.htm](http://www.umass.edu/gradschool/handbook/univ_policies_regulations_a.htm)). Sanctions for acts of dishonesty range from receiving a grade of F on the paper/exam/assignment or in the course, loss of funding, being placed on probation or suspension for a period of time, or being dismissed from the University. All students have the right of appeal through the Academic Honesty Board.

## Supplemental Information for the Graduate Council Course Approval Forms (Forms B & C) For Courses Numbered 500-999

The following is a detailed checklist of requirements that must be submitted in support of any course to be approved by the Graduate Council. This checklist is an addendum to Forms B (courses numbered 500-599) and C (courses numbered 600-999).

1. Is this course part of a program revision or a new program? If yes, please indicate how this course fits into this program, including whether it is a core or elective course.

*This course is not part of a program revision or a new program.*

2. Has this course been taught in another department before? If yes, please indicate the reasons why the course has been moved, including information on changes between this and the previous course. If the course is cross-listed, what is the department and course number?

*This course has not been taught in another department before.*

3. Is there a possibility that a course similar to this one is available and taught in another school/college/department or campus? If yes, please indicate the reasons why this new course is necessary. Also, include documentation of consultation with other schools/colleges/departments on this matter.

*A similar course has been taught in GeoScience and Natural Resource Conservation Departments but this course is tailored to engineering applications and the demand of GIS skills for civil and environmental engineers has been increasing in their future career.*

4. Would this course substitute for another course currently in the curriculum? If yes, please indicate whether the original course will be discontinued.

*This course will not substitute for another course currently in the curriculum.*

5. Would this course count for your own major? If no, please indicate its function such as service to a particular population, etc.

*Yes, this course will count for our own major.*

6. Is the proposed instructor a member of the graduate faculty? If no, please explain why non-graduate faculty would teach this course.

*The proposed instructor is a member of the graduate faculty.*

7. Within course submission, include the Syllabus, along with the following:

*Attached is a syllabus when it was taught as CE-ENGIN 597G*

- New course number: CEE470/570
- Course description specific to the new course  
Principles of geographic information systems (GIS) and spatial analysis for engineering application. Topics include data structures and manipulation, topology, and attribute information. Use of spatial data for mapping and spatial analysis to address real world problems.
- Clearly specified course objectives  
The objectives of this course are to introduce students the concepts and principles of GIS; to provide students with a comprehensive overview of GIS technologies and applications; and to familiarize students with GIS hardware and software, and prepare students to advanced GIS application in engineering fields.
- Week-by-week outline of topics covered in the course with a brief description of each of these topics & assignments for the week

Week	Topic	Reading
1	Introduction to GIS	Ch. 1
2	Introduction to ArcGIS Coordinate Systems	Ch. 2

3	Map projection	
4	Vector Data Models	Ch. 3 & 4
5	Raster Data Models	Ch. 5
6	Data Input and Editing	Ch. 6 & 8
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8	Midterm	
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12	GIS Output	Ch. 10
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- Readings associated with each of the topics in the outline

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Getting Started with ArcGIS, ESRI Press

- Description of required assignments -- guidelines for papers or projects  
The required assignments include lab assignments, midterm exam and final project presentation and reports. Lab assignments include hands-on ArcGIS exercises in each lab session on Thursday. Midterm exam covers the fundamental GIS concepts and principles. Final project presentation and reports are either individual or team projects. All students are encouraged to define the objective of their project, collect all necessary data and perform spatial analysis. All students will present their project at the end of the semester and submit a final report
- Grading policy and specific grading criteria associated with each of the required assignments (with % or points converted to letter grades)  
The grade is based on lab assignments (30%), midterm exam (30%) and final project (40%).
- Anticipated enrollment  
15 students
- Selected bibliography of works used in developing the course  
Introduction to Geographic Information Systems by Kang-tsung Chang, 4<sup>th</sup> Edition, McGraw-Hill  
Fundamentals of Geographical Information Systems, Michael N. DeMers, 4<sup>th</sup> Edition, Wiley  
GIS Fundamentals, a First Text on Geographic Information Systems, Paul Bolstad, 3rd Edition  
Mastering ArcGIS, Maribeth Price, McGraw-Hill Science/Engineering/Math; 3rd edition  
Mastering ArcGIS, Maribeth Price, McGraw-Hill Science/Engineering/Math; 4th edition  
Getting to Know ArcGIS Desktop: The Basics of ArcView, ArcEditor, and ArcInfo Updated for ArcGIS 9, Tim Ormsby, Eileen Napoleon, and Robert Burke, ESRI Press  
Getting Started with ArcGIS, ESRI Press  
Using ArcGIS Desktop, ESRI Press  
Using ArcMap, ESRI Press
- Accommodation policy (stated below)
- Academic honesty statement

If the course has been offered as an experimental (seminar) course, also include:

- Experimental (seminar) course syllabus
- Teaching evaluations (Note: Teaching evaluations are confidential and if included must be accompanied by a signed release from the instructor.)

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