CIVE 577: GIS IN CIVIL AND ENVIRONMENTAL ENGINEERING  
Spring 2009

Objectives: Provide comprehensive instruction in the underlying concepts and principles of geographic information system (GIS) technology and its application to the design and analysis of civil and environmental engineering systems. The focus is on gaining a fundamental understanding of spatial data structures in GIS, geo-spatial data acquisition, geoprocessing, geostatistical methods; visualization, exploration of spatial data; network analysis, terrain mapping, spatial analysis, and modeling. Students are trained to become proficient in usage of ESRI ArcGIS 9.3 software through extensive computer lab sessions, including GIS applications in urban hydrologic modeling, urban stormwater management, flood plain management, nonpoint source pollution control, ecological assessment, utility and infrastructure management; and water distribution network analysis.

Prerequisites: CIVE 300 and CIVE 322 or ENVE 322, or equivalent

| Time/Place: | Lecture: TR 11:00-11:50; C205 Engineering  
Lab: TR 11:50-12:50; C205 Engineering |
| Grading: (Approx. only) | Homework and Lab Exercises 30%  
Midterm Examination 30%  
Class Project 40% |
| Course Web Page: | [http://www.engr.colostate.edu/CIVE577/restricted/](http://www.engr.colostate.edu/CIVE577/restricted/)  
User Name: cive577_res  
Password: Geqk1: |
CIVE 577: GIS IN CIVIL AND ENVIRONMENTAL ENGINEERING
Spring 2009

<table>
<thead>
<tr>
<th>Instructor:</th>
<th>J. W. Labadie</th>
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<tbody>
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<td></td>
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Class Policies:

1. This course focuses on modeling in GIS, so students mainly interested in a basic course on GIS knowledge and map creation should not enroll in this class.
2. The difficulty in creating unique problem sets for homework, quizzes and exams every year requires the instructor to reuse portions of problem sets from previous classes. For this reason it is wrong and considered as cheating to view or use any past homework/quizzes/tests as study information for this class that were not distributed by the instructor to the entire class.
3. Although the exercises in the Textbook will be completed in 3 to 4 weeks, it will continue to be an important source of information since the concepts learned are applied throughout the remainder of the course. Also, for students wanting to work at home, the Textbook includes a trial copy of ArcGIS Desktop which can be used to complete the exercises in the Textbook, but not for the remaining exercises in the class.
4. Since the high ceiling of the GIS Lab produces an echo effect where even whispered conversation can be heard throughout the room, there can be no discussions between students during lectures and lab sessions directed by the instructor. The exception is lab sessions not directed by the instructor where students are allowed to work individually or in groups. Otherwise, any questions or comments should be directed to the instructor and not your neighbors.
5. Although the instructor encourages students to help each other in understanding concepts required for completing the homework and lab assignments, mutual copying of homework is considered as cheating. Collaboration is allowed for assignments and labs designated as group efforts, where one assignment is turned in for that group.
6. Late homework and lab assignments will not be accepted, except for emergencies such as illness, etc. The instructor should be made aware of these situations before the due date of the assignment.

7. Since ArcGIS Desktop is a complex software package with a vast range of features, please be patient if technology problems arise during lab exercises--we try to minimize them, but they are generally unavoidable. Any students feeling they are unable to tolerate these annoyances should not enroll in this class.
# CIVE 577: GIS IN CIVIL AND ENVIRONMENTAL ENGINEERING
## Spring 2009

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
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| 1 Jan 20-22 | Introduction to GIS  
Applications of GIS in Civil and Environmental Engineering  
Introduction to ArcGIS 9.3 Desktop GIS |
| 2 Jan 27-29 | Spatial Data Structures  
- GIS spatial data models: raster, vector, other models  
- Geodatabase in ArcGIS  
- Topology  
| 3 Feb 3-5 | Representing Data in Raster Models; Terrain Representation  
Integration of CAD and GIS Data  
Map Projections and Coordinate Systems |
| 4 Feb 10-12 | Data Sources for GIS  
GIS Data Preparation and Integration  
Data Accuracy in GIS |
| 5 Feb 17-19 | Spatial Operations and Analysis  
Surface Analysis in ArcGIS  
- Digital elevation model (DEM) analysis  
- Watershed delineation and drainage networks  
- Flow accumulation and DEM filtering |
| 6 Feb 24-26 | Urban Hydrologic Modeling using GIS  
- Time-area mapping in GIS  
- Development of spatially distributed synthetic unit hydrographs  
- Image Georeferencing and Rectification |
| 7 Mar 3-5 | Least-Cost Flow Routing  
- Dijkstra's algorithm  
Urban Stormwater Runoff Modeling and GIS  
- EPA Stormwater Management Model (SWMM)  
- Rainfall excess, infiltration, overland flow, channel routing |
| 8 Mar 10-12 | Urban Stormwater Runoff Modeling and GIS (cont.)  
- Development of base map coverages; derived maps  
- Application of ArcGIS; zone-risk analysis |
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<tr>
<th>Date</th>
<th>Events</th>
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<tr>
<td>9 Mar 24-26</td>
<td>Image Processing and Classification</td>
</tr>
<tr>
<td>10 Mar 31 Apr 2</td>
<td>Midterm Examination [Mar. 31] Image Processing and Classification (cont.)</td>
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<tr>
<td>11 Apr 7-9</td>
<td>Introduction to Network Analysis</td>
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<td>12 Apr 14-16</td>
<td>ArcHydro Data Model</td>
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<tr>
<td>13 Apr 21-23</td>
<td>ArcHydro Data Model (cont.)</td>
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<td>14 Apr 28-30</td>
<td>Geostatistical Analysis and Interpolation</td>
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<td>15 May 5-7</td>
<td>Automating GIS Applications with Model Builder</td>
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<td>Finals Week</td>
<td>Presentations of Student Class Projects</td>
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- Remote sensing and digital image processing
- Unsupervised classification

- Supervised classification
- Accuracy assessment in image classification
- Image resampling
- Automatic digitizing of scanned images—ArcScan

- Geometric and logical networks
- Network Utility Analyst extension in ArcGIS
- Developing network connectivity rules
- Water distribution network editing and analysis

- Development of hydrofeatures: drainage network, hydrography
- Extraction of watershed characteristics

- Creating ArcHydro geodatabase
- Example application

- Trend surface analysis; data smoothing
- Inverse distance weighted interpolation; kriging
- Application to analysis of impacts of river operations on endangered species habitat

- Terrain analysis with Model Builder
- Development of Rainfall-Runoff model with Model Builder

- Reports due by May 15