Fall 2009 Syllabus for Geol452/552 – Geographic Information Systems for Geoscientists I

Geol 452/552 (same as Agron 452, EnSci 452)
Credits: 3 (2 hrs lecture, 2 hrs lab)
Prerequisites: some geoscience background (such as geology, water resources, environmental science, soil science or related earth and life sciences).
Time: Tuesdays/Thursdays 9.00 to 9:50, lab from 10:00 to 10:50
Place: Rm. 248 in Durham Center
Instructor: Chris Harding (charding@iastate.edu)
Teaching assistant: Nick Vreeland (nickvree@iastate.edu)
Office Hours: by appointment, send email first

Course description
GIS for Geoscientists I is an introduction to GIS operations and analyses of vector data in a geoscience context and will prepare students for more advanced GIS courses (such as its follow-up course, GIS for Geoscientists II, which deals with raster data). We will use ESRI's ArcGIS 9 Desktop software application. This hands-on course will be taught at a senior undergraduate (400) level; students taking the course at the graduate (500) level will also work on additional exercises and projects. The 500-level version of the course, which includes a class project, counts as part of the "Foundations of GIS" requirements for the College of Design's GIS certificate.

Course objectives:
This course will help you to acquire basic GIS theory and practical knowledge. It will allow you to work with geo-spatial data in the form of computerized 2-D maps and the spatial attributes behind them. At the conclusion of the course you should be able to:

1. Develop an understanding of typical GIS operations as part of GIS project management.
2. Understand the architecture of ESRI's ArcGIS program, its historical development and its main data types.
3. To classify and visualize vector data (points, lines, polygons), raster data and table data within different layers using colors, symbols and labels.
4. Be able to use the most common coordinate systems (geographic and projected) and understand the different distortions inherent in map projections.
5. Be able to import simple text files and manipulate non-spatial data tables, perform simple statistics and create relationships across tables (join/relate).
6. Use the Structured Query Language (SQL) to find data with certain attributes and select data based on location and spatial relationships to other data.
7. Create new compound data based on common spatial relations ships (spatial join)
8. Use map overlay processing to locate areas fitting multiple spatial criteria and perform data clipping and buffering.
9. Create maps that effectively present spatial data.
10. Be able to interactively edit (digitize) the shape of vector data and manipulate its underlying attributes.
11. For graduate students: create a compelling poster on a topic of your choice that could be presented at a conference.

Required texts:
Mastering ArcGIS, *4*. ***Edition from 2009*** **(!)**, by Maribeth H. Price, ISBM0-07-298417-1, 607 pages, spiral-bound with Video Clips on CD-ROM, McGraw Hill Higher Education.
Check www.isubookstore.com -> Order Textbooks

Course Structure:
There will be a lecture in the first hour followed by one hour of practical lab exercises on the computers. Before each lecture I will provide you with a printout of my powerpoint slides - this will include sufficient space for your comments and questions. Prior to the lecture, I expect that you have read the relevant part of the textbook and that you can answer the review questions. I will go over some of these review questions during the lecture, some lectures will include short "follow along" exercises, which may be part of the homework.

We will go over roughly ten of the textbook's chapters. Each chapter's practical work consists of a tutorial part ("Mastering the skills") and a set of practical (lab) exercises. You should be able to get through the practical parts during the 1 hour lab following the lecture but you may need to finish them on your own time. The GIS lab opening hours are posted on the door to Rm 248.

Expectations of students:
I expect you to participate in class and take responsibility for your learning. Your attendance in class provides you with the very important opportunity to ask questions! Ordinarily, no "make-ups" will be provided for exams missed due to absence from class. If you are going to miss a class, I'd appreciate letting me know a day in advance. I expect you to treat the instructor and other students with respect (be on time, turn off cell phones, don't talk with classmates during lectures, don't read the newspaper during class, etc.).

I realize that sitting in front of a computer during my lecture may tempt you into all kinds of online activities. While I understand the importance of checking your email and maintaining your Facebook page, please limit any non-course activity to the breaks. I strongly suggest that you write notes about the material during the lecture on the handout and/or the textbook, as those notes will serve you well later.

Practical (lab) exercises:
Each chapter's practical contains a step-by-step tutorial and several short exercises. These practical exercises are vital for you to be able to successfully (and quickly) work the system for the midterm, the final and the projects.

Several textbook exercises from each chapter will be graded as *homework* assignments (typically worth 0 - 4 points each). For example, I may require you to work on exercises 1,2, 6 and 7 of a certain chapter. For each assignment you will create a Word (.doc) file containing the solution, a short description of how you found the solution, and several screenshots. This will be submitted into WebCT (as an attachment). As part of the solution is usually given at the end of the text book, the number of points given depends largely on *how well you can document* your work and the solution via text and screenshots. A "good" description that covers all major points and is clear to follow is worth 3 points. A "very good" description that presents additional aspects, is worth 4 points; 2 points are given for work with minor flaws; and work with major flaws is worth 1 point.

You should be able to get through most of these exercises during the lab phase, during which the TA and I will be available for questions. You are encouraged to work in groups during the lab but the results must reflect your own work. Exercises you do not finish during the lab phase will have to be completed outside the course (lab) period, typically within one week for homeworks. Solutions to exercises will be posted on WebCT after this week has passed, exercises handed in too late will receive only 50% of the points (some exceptions, such as instructor and/or WebCT failures, may apply). If you got through all this so far, email me with code 1789 during the first week to get an additional point for your first exercise.

Midterm and Final:
Both tests will consist of a multiple-choice question part (answer 12 of 15 questions in 15 minutes, open book) and a practical part (90 min., of which I expect you need only 60 min.)

where you will use ArcGIS to analyze and process GIS data given to you (similar to the practical exercises in the book). Both will test the entire material presented to this point!

Quizzes:
There will be two written quizzes. You will be given 10 min. to answer 3 out of 4 questions on paper. These will be questions that test your knowledge about the immediately proceeding chapters. These will NOT be multiple-choice. You may use your textbook and your notes but you cannot use the internet or anything else!

GIS projects:
In addition to the book's tutorial and exercises we will work on 2-3 larger, non textbook exercises that will deal with bigger chunks of material. For these "mini-projects" the relevant data and a list of questions will be given to you, the deliverables are one ore more simple maps that show your answer these questions. We will go through the material together in class and you will have a week to hand in the project.

A larger, final project is mandatory for *graduate students* (those taking Geol 552). The topic is up you but should, if possible, involve your graduate/thesis work. The final project will require a short proposal, stating the purpose of the project, the target audience as well as the data and GIS methods to be used. The actual project work will include: the acquisition of suitable data (from ISU databases or other sources), the preparation of data to suit the ArcGIS software package, computational work with and analysis of the data and presentation of your results. The final project's deliverables are: a poster (that shows good layout), plus a 10 min. oral presentation of the results to the class. You will create 10 power point slides from the poster for the oral presentation. Clarity of presentation and content will be graded equally. The final project is optional for undergrads and will count as extra credit.

Class participation:
Your class participation score will be based on attendance and participation during class. I will give you a "participation point" every time you give me good feedback (via WebCT) about the material presented in class: something you did absolutely not understand and why this was a problem ("Today's muddiest point") or the single most important point you learned today (the clearest point you took away from today's class). I'll also reward an intelligent question about the day's material.

WebCT Gold:
We'll be using WebCT Gold (webct.its.iastate.edu/webct/) for some aspects of the course, please familiarize yourself with WebCT if you've never used it before, see www.celt.iastate.edu/webct/student_support.html . You can find an updated version of this syllabus on WebCT. Each session's plan will be listed as announcements before the lecture starts. You will hand-in your homework assignments via WebCTs "assignments" functions. Test dates and assignment due dates for will show up on your WebCT calendar. WebCT's journal-type discussion function (which is private between student and instructor) allows you to give me direct feedback such as best-of-lecture, worst-of-lecture, questions, etc.
I don't see a need for using the internal WebCT email, please use charding@iastate.edu to contact me. I will make the slides of past lectures available in WebCTs "Slides" folder (as pdfs) and also keep a collection of relevant Web links. After grading, I will put the solutions to assignments and tests in WebCT's "solutions" folder.

Grading:
All grading will be in percent (0%-100%), that I will convert to letter grades for the final grade according to this scale: A: >95%, A-: > 90%, B+: >85%, B: > 80%, B-: > %75%, etc.

Undergrads: Homework 20%, mini-projects %15, Midterm 20%, Final 25%, Quizzes 10%, Participation 10%. Extra credit: lecture feedback, weblinks, final project
Grads: Homework 10%, mini-projects %10, Final project 20%, Midterm 20%, Final 20%, Quizzes 10%, Participation 10%. Extra credit: lecture feedback, web links

Course files on the Delphi server
We will use the GIS center's Delphi server, which is administered by Robin McNeely (4-2087, mobes@iastate.edu, www.gis.iastate.edu)). Course files are stored at \\delphi.gis.iastate.edu\GEOL552. Each student has a personal folder \\delphi.gis.iastate.edu\GEOL552\students to put exercises, project data, etc. Note that anything stored on the GIS-lab computer's C: drive will be deleted when you log out, do NOT use this drive to store permanent data (such as your project data). A (non-temporary) bonus point awaits you if you email me code 1848 within the first week.

The MGIS text book data needed for tutorials and exercises has been copied into the mgisdata folder in your student folder (a fresh version is under \\delphi.gis.iastate.edu\GEOL552\data\mgisfiles). To watch the video help for the textbook's tutorials and the skills references, load data/MGIS_video_index.htm in a browser. *To listen to the video in the GIS lab, you need to bring your own headphones!* During the semester I will provide more GIS data, you will first need to copy the data from the GEOL552\data folder to your Delphi student folder.

Supplemental texts:
Designing Better Maps A Guide for GIS Users (ESRI, 2005) Cynthia A. Brewer, 220 pages, ISBN: 1-58948-089-9, $24.95. Written by a cartographer, this book focuses on the effective design of maps: what colors are the best for what kind of data, layout, fonts, symbols, etc. Highly recommended!

Cartography: Thematic Map Design, (Slocum et al.), Fifth Edition, Borden D. Dent, Boston: WCB McGraw-Hill, 1999).

The ESRI Guide to GIS Analysis Volume 1: Geographic Patterns & Relationships, Paperback: 186 pages, ISBN: 1879102064, ~$20

The ESRI Guide to GIS Analysis, Volume 2: Spatial Measurements and Statistics, ISBN: 1-58948-116-X, 2005, 252 pages, $34.95

Non-Discrimination Policy: Iowa State University is "dedicated to fostering an environment in which differences in people such as nationality, race, gender, religion, cultural background, physical ability, and sexual orientation, are respected and mutual understanding is promoted." (from the ISU Bulletin)

Disability Accommodation: Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Disability Resources Office at 515-294-6624 in room 1070 Student Services Building to coordinate reasonable accommodations for students with documented disabilities.

Academic Dishonesty
I expect students to follow the ISU rules regarding Academic Dishonesty (see www.iastate.edu/~catalog/2007-2009/geninfo/dishonesty.html) This will be strictly enforced!

(Last modified: Aug. 19, 2009)