GEO 214: ENVIRONMENTAL HYDROGEOLOGY SPRING 2010

This course carries F7 and F11 credit and as such will contain both a laboratory component to explore scientific concepts and a service-learning component to allow you to broaden connections between the classroom and the world by connecting with the local Memphis community. We will cover the science of hydrogeology, including atmosphere-surface interactions in the water cycle, surface water quality, and groundwater. We will also explore the role that human-produced chemicals (particularly chlorinated pesticides) continue to play in the watersheds in Memphis and the role that education can play in affected neighborhoods. Over the course of the semester we will make our own analytical measurements both in the lab and in the field, analyze our datasets in relation to the demographics of the City using GIS, and work closely with a class at Douglass High School on joint projects over the course of the semester.

Course Objectives:

1. Improve your understanding of the processes involved in the Earth's water cycle and mankind's impact on them.
2. Apply concepts related to soil pollution and pollution migration through a watershed and practice the scientific method by gathering and analyzing your own datasets.
3. Improve skills of working in groups, critical reading, and teaching your peers.

Course Information:

Prof. Jen Houghton, FJ 116E. Office Hours: Before or after class and Tuesdays 9:00-12 or by appointment. Phone 3089, email: houghtonj@rhodes.edu

Time: Lecture M,W 9:15-10:30am FJ-C
Lab T 12:30-3:30pm FJ 132E

Readings: There are two required books for this class and additional readings will be made available through the Moodle site for this course.

The Control of Nature by John McPhee
The Principles of Hydrology by John C. Manning

Both books are available through the bookstore in used copies, both to reduce cost and to reduce our environmental impact.

My Expectations of you: This course will involve a combination of lecture, hands-on activities, and group work during *both* lecture and lab meetings. I expect you to attend every class meeting and to be engaged and working during class time.

It is essential for you to keep up with the assignments and be prepared for each class. Your ability to understand class material is often dependent upon your preparation. You will notice that class participation is not part of your grade, however, in my experience grades are directly proportional to attendance. Material we will cover in class as well as additional online resources will be available on our Moodle site.

Course Evaluation:

The work in lecture and lab is intertwined as closely as possible. Time in lecture will be an introduction to course material and will also incorporate class discussions, experiments and/or problem solving, and reflections of time spent at Douglass High School. Lab is a chance to practice applications of the concepts from the readings within an overall framework for the semester. You will receive the same grade for lecture and lab.

Quizzes and journal article critiques:	20%
Discussions and written reflections:	15%
Midterm (research project):	15%
Lab exercises/reports:	35%
Final URCAS presentation:	15%

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- Assignments are due on the due date. Late=30% off.

Grades will be posted on Moodle.

Lab:
Lab lasts for 3 hours on Tuesdays from 12:30-3:30. At the beginning of each lab we will have a chance to address questions before we start. Labs will be completed in groups and will consist of a combination of analytical, field, and GIS projects.

Quizzes:
Quizzes will be given to assess your understanding of the basic scientific principles from the readings. Quizzes will be unannounced and will take place at the beginning of the class period. They are designed to be completed in 30 minutes.

Visits to Douglass High School:
We will visit the same class at Douglass High School 7 times during the semester. We will be with the students for 1 hour – this gives us 15 minutes to get there and 15 minutes to get back to Rhodes with plenty of time to spare. You will be completing projects in mixed groups with those students. I do not expect most of you to have prior knowledge of this material (other than what you learn as we go from the readings) – therefore the projects are designed to be completed by your team together. I have 3 goals for our time spent at Douglass: 1) for you to gain experience working as a team with others; 2) for you to learn the science pertaining to that project; 3) for you to build a rapport with your team-mates over the course of the semester and in the process gain an understanding of the culture of these students (which may or may not be different from your own). As such, I intend to keep the teams the same for each Douglass visit, barring illness (it is flu season still for part of this semester). Please keep in mind that we are working within the public school system and there may be occasions where our plans must change to accommodate the needs of the High School.

Final URCAS presentation:
Working in pairs, you will complete your own project within the context of this course. Your project can extend beyond strictly the science, although it must be related to the class content, and it must have a component that represents your own original data collection and/or original analysis of existing data. I encourage you to consider physical science projects that build off of labs we will be completing during the semester, such as investigations of infiltration rates, runoff, water quality, or GIS analyses of existing hydrologic or land use datasets. You may also choose to research a topic that relates to your own major. Some examples (not exhaustive) include issues of public perception, historical issues (particularly in Memphis), issues of public policy, issues of education (either in the school system or within the general public). You may choose whoever you wish to work with, however, I would like to point out that often some of the most creative work comes from collaboration between different disciplines. As you work on this project over the semester, you will be posting your findings on the class Wiki. The Wiki is an excellent tool to share information with your collaborator as well, without having to find times to meet in person.
The format of your final project will follow the same structure as the review readings: that is, it must have an introduction, methods, results and discussion, conclusion section as well as references at the end. Examples of posters in this format will be made available.
You will have the opportunity to receive feedback on your URCAS project on **April 7** in class prior to printing the final version. Each pair of students will have 5 minutes to present their final projects as a powerpoint and receive anonymous feedback from their peers and feedback from the instructor. URCAS takes place on the last Friday of classes (all classes are canceled for this event). You will be required to submit an abstract to the URCAS committee by the deadline, as yet undecided. If you do not submit an abstract, you will not be given a presentation slot and will receive a zero for your final grade.

Midterm research project:
The midterm research project is designed to aid your final URCAS presentation by providing you the opportunity to develop the introduction/background section for your chosen research project in advance. You will have several assignments, primarily before the midterm due date, to practice evaluating scientific peer-reviewed journal articles that are selected for you and that relate to the topics we will be covering. For your midterm research project, you will select at least 3 peer-reviewed journal

articles that relate to your URCAS project. **At least one of these articles must come from a scientific journal.** However, you may find it more appropriate for the remainder to be peer-reviewed articles in other fields, depending on your project. Your midterm will have 3 components:

1. a review of each article
2. write an introduction to your final project
3. a revised plan for the remainder of your project (what data will be collected and what method will be used to analyze it)

The midterm project will be completed individually, so please make sure your articles complement your partner's and are unique.

Your project hypothesis and strategy (what data will be collected and what method will be used to analyze it) is **DUE TO THE INSTRUCTOR BY Feb 1**. The final draft of your midterm with electronic links to the articles chosen is **DUE ON Feb 22** and will be submitted for peer review. The introduction and proposed plan of each paper will be reviewed by 3 of your peers, and each person in the class will be responsible for completing 3 reviews. The review process will be double-blind (that is, the reviewers will not know who wrote the paper and the author will not know who the reviewers were). Peer reviews are **DUE ON Mar 3**. You will then have UNTIL **Mar 10** to make any necessary changes to your midterm before turning it in for the instructor to grade. Each person will post their completed and revised introduction on the class Wiki.

Schedule:

Basics of water and defining our study

Jan 13	syllabus, discussion of class organization
Jan 18	MLK holiday
LAB 1	water cycle(**reading: ch.1 Manning on water cycle; ch. 2 Manning on properties of water**)
Jan 20	lecture: water cycle/properties of water
Jan 25	**review** of journal article, discuss survey design, IRB request **(reading: journal article #1 TBA)**
LAB 2	map local watersheds, defining problem with base map, create poster for survey
Jan 27	DISCUSSION: discussion of environmental justice reading **(reading: article TBA)**

Surface processes and data handling

Feb 1	GO TO DOUGLASS: tour of school and short project on properties of water **(reading: ch 4 Manning on precipitation)** **newsletter: 1st post completed**

MIDTERM HYPOTHESIS AND STRATEGY DUE

LAB 3	lab exercise: mapping and interpolating data
Feb 3	DISCUSSION: reflection on Douglass, **quiz 1**

*****Feb 3 class will be from 9:00 – 9:50*****

Feb 8	survey day on Rhodes campus (no class: sign up for time slot in pairs) **review** of journal article **(reading: journal article #2 TBA)**

LAB CANCELED THIS WEEK

Feb 10	GO TO DOUGLASS: present the survey plan, survey students, activity related to precipitation **(reading: ch. 5 Manning on infiltration and soil water)**
Feb 15	lecture: precipitation/infiltration/soil water **(reading: excerpt from Silent Spring)**
LAB 4	in lab: carbon cycle, atmosphere/hydrosphere, interactions with rock cycle
Feb 17	mini-lecture and DISCUSSION: POPs, pesticide usage, history, how to analyze **(review on article #3 TBA)**
Feb 22	GO TO DOUGLASS: get reports on survey and plot by hand on the poster, Google Earth, collect their soil samples, and risk assessment activity

MIDTERM SUBMITTED FOR PEER REVIEW

LAB 5	size fraction analysis of Douglass students' field samples, make pamphlet for Douglass students

Feb 24 DISCUSSION: reflection on Douglass and Iceland McPhee reading **(reading: part 3 McPhee on Mississippi River)**

Hydrosphere/atmosphere interactions

Mar 1 GO TO DOUGLASS: report results of their samples and short group project on evaporation/condensation and carbon cycle **(reading: ch 3 Manning on evaporation/condensation)**

LAB 6 in field in Douglass neighborhood: GPS measurements of surface cover and test infiltration rates

Mar 3 DISCUSSION: reflection on Douglass **quiz 2**

MIDTERM PEER REVIEWS DUE

Mar 8 lecture: evapotranspiration and environmental change **(reading: ch 6 Manning on evapotranspiration)**

LAB 7 GIS: map our own data – surface materials, soil moistures

Mar 10 no class: survey day off campus

MIDTERM REVISIONS DUE

SPRING BREAK

Groundwater processes and data interpretations

Mar 22 lecture: groundwater and how this affects our interpretations **(reading: ch 7 Manning on groundwater)**

LAB 8 in field: sampling water quality – possible testing point source emitters upstream and downstream **(reading: article TBA)**

Mar 24 DISCUSSION **quiz 3**

Mar 29 GO TO DOUGLASS – groundwater activity **(reading: part 2 of McPhee on landslides in CA)**

LAB 9 in lab: mapping our data - sightings of fishing, identify locations that should be sampled, art contest for signs about contaminated waters

Mar 31 DISCUSSION on Douglass (**review on article #4 TBA)**

EASTER BREAK BEGINS AT 10PM **newsletter 2nd post due**

Water quality and contaminant transport

April 5 runoff **(reading: ch 8 Manning on runoff)**

LAB 10 in lab: groundwater and GIS: Local data and recent lawsuit of MS vs Memphis over groundwater removal rights

April 7 **oral presentations of URCAS projects**

April 12 GO TO DOUGLASS playing with chemical sensors **(ch 9 Manning on quality of natural waters**

LAB 11 in field: groundwater input to rivers vs runoff input and suspended load vs bedload transport

April 14 DISCUSSION on Douglass and reading **(reading: part 3 McPhee), Quiz 4**

OPTIONAL SHORT FIELD TRIP Sat-Sun April 17-18 as far as Vicksurg

April 19 GO TO DOUGLASS – water quality in field near school?

LAB 12 in lab – Mock Memphis debate: what do we do about the pollution problem?

April 21 DISCUSSION on Douglass visit **(reading: excerpt from the Rising Tide book)**

April 26 finalizing and printing for URCAS

LAB 13 sandbox experiments making levees and trying to prove or disprove theories from Rising Tide

April 28 wrap party! **Newsletter 3rd post due**

Friday April 30 URCAS (final exam grade)