

**PHYSICAL HYDROGEOLOGY, 51-365/565 (3 credits)
FALL 2007**

Class Hours: 12:40 - 2:50 p.m WF

Location: Harrington 217

Instructor: Dr. Maureen Muldoon
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Office Hours:
Tu, Wed, Fri 9:10-10:10
Tu, Wed 3:00-5:00
Fri 3:00-4:00
Or by appointment

Required Texts:

Applied Hydrogeology, C.W. Fetter, 4th edition, Prentice Hall, Inc., 2001. There is a web page containing supplemental information for this book <http://www.appliedhydrogeology.info/>

A Civil Action, Jonathan Harr, 1995, Vintage Books (paperback)

Supplemental Texts:

Basic Ground-Water Hydrology, Ralph Heath, 1980, U.S. Geological Survey, Water-Supply Paper 2200

Fundamentals of Ground Water, F.W. Schwartz and H. Zhang, John Wiley & Sons, 2003

Course Web Page:

I have developed a D2L site for this course. You must login to the D2L system. The easiest way to get into D2L is as follows:

- go to UW-Oshkosh's home page (<http://www.uwosh.edu/>),
- click on the "Desire2Learn" icon on the right-hand side and
- follow the instructions on the login page.

Course Description & Goals:

The purpose of this course is to develop a sound understanding of the various aspects of the hydrologic cycle, with the major emphasis on groundwater hydrology. The first third of the course provides an overview of the hydrologic cycle, surface water hydrology, and water budgets. The second two-thirds of the course emphasizes aquifers properties, principles of groundwater flow, flow in the unsaturated zone, well hydraulics and regional groundwater flow systems. In addition to covering the above topics; this course is designed to give you experience in manipulating, analyzing and presenting hydrogeologic data.

Prerequisites:

The study of groundwater differs from some other areas of geology in that we can rarely observe groundwater or the processes that control groundwater flow. Therefore, we must use the principles of physics (and chemistry) to describe and predict the behavior of groundwater. This means that the course will be quantitative in nature. College Algebra and Trigonometry (67-108) are a prerequisite for this course and I will assume that everyone is comfortable with problem-solving involving algebra, unit conversions, graphing, and calculators.

Expectations:*What I expect from you:*

- to take responsibility for your own learning
- to come prepared for class and be an enthusiastic participant in class
- to set high standards for work in group settings and in individual assignments
- to behave in an ethical manner

What you can expect from me:

- to be enthusiastic and knowledgeable about the course material
- to create a challenging course
- to treat you with fairness and respect
- to set high standard for the class

Attendance and Participation:

In order for you to get the most out of this class, it is crucial that you attend each class session and that you have completed the reading assignment *prior* to class. The required reading assignments are listed in the following course schedule. To help focus your reading, I will post “reading review questions” for each topic on the D2L site. You should prepare written answers to these questions *before* coming to class.

Assignments:

The assignments (in-class exercises, problem sets and labs) are critical to helping you gain an understanding of the material covered. The labs are designed to reinforce the material covered in lecture as well as give you "hands-on" experience in manipulating and interpreting hydrologic data. The problem sets will provide you with practice in solving quantitative problems. All problem sets and labs are due on the specified due date. Late assignments will not be accepted unless there are extenuating circumstance and prior arrangements have been made.

Evaluation:

Exams: There will be three hour exams. If you need to miss a scheduled exam (for some valid reason such as illness), you must inform me prior to the exam (by phone or email). A make-up exam must be taken as soon as possible at a time convenient for us both.

Laboratory: A report will be due for each lab exercise. The level of report will vary from exercises turned in at the end of class, short written reports, and some lab exercises will require that you work in groups and present your results to the rest of the class in a brief presentation. The due date for each lab will be announced when the lab is given out.

Problems: Several problem sets will be assigned during the semester on an approximately weekly basis. Solutions (including all work and assumptions) must be written neatly. Problem sets can be turned in during class or placed in my mailbox by 5:00 pm on the due date. Any assignment submitted after that time will be considered late, unless arrangements have been made for an excused late submittal. Late work will be penalized 10% for each day that it is late.

Outside Reading:

Over the course of the semester, you are expected to read Jonathan Harr's *A Civil Action*, a well-written account of an actual groundwater contamination case in Woburn, MA. Many of your lab exercises will be based on data from the Woburn area. You should keep a "journal" while reading the book. As you read, note the pages where you come across information that you feel will be pertinent in the groundwater contamination case. This will serve to focus your reading and help you develop an index to the places in the book that contain pertinent hydrogeologic data.

It is acceptable to work together on lab write-ups and problem assignments, however, it is not acceptable to copy a fellow student's work. Each student will be responsible for the material covered in these exercises and must be able to present his/her work.

Grades:		Scale	
15%	Exam 1	92 - 100% = A	72 - 76.9% = C
15%	Exam 2	87 - 91.9%= AB	67 - 71.9% = CD
15%	Exam 3	82 - 86.9%= B	62 - 66.9% = D
25%	Labs	77 - 81.9%= BC	<62% = F
20%	Problem sets		
10%	Class Participation		

The final letter grade will be assigned based on the above scale, unless the class average deviates significantly from 75%. In the latter case, a "curve" will be applied.

TENTATIVE SCHEDULE

Week		Topic	Reading	Assignments
Part 1: Hydrologic Cycle and Water Budgets				
1	9/5	Intro/What is Hydrogeology Lab: Quantitative Problems	1.1-1.2, 1.6-1.8 (skim)	bring an example of a budget to class on Friday
	9/7	Water/Water Budgets Lab: Measurements	1.3 - 1.5 1.11-1.12	PS1 Assigned
2	9/12	Evaporation/Transpiration Lab: Woburn Introduction	2.1-2.3	
	9/14	Precipitation/Infiltration/Soil Moisture Lab: Climatic Data	2.4 - 2.8 1.9-1.10	PS1 due PS2 assigned
3	9/19	Stream flow Stream/GW interaction Lab: ET Calculation	2.9 - 2.10, 2.13	
	9/21	Analysis of Streamflow Data Lab: Basin Delineation/Water Resources Report	2.11-2.12, 2.14	PS2 due Report 1 assigned
4	9/26	Lab: Stream Data Analysis		
	Part 2: Porosity & Permeability			
	9/28	Porosity/Specific Yield Lab: Porosity/Grain-size	3.1-3.3	

5	10/3	Geologic Controls on Porosity/ Permeability Lab: Work on Woburn Report 1	S&Z pg 13-32	<i>Civil Action</i> Journal to “Discovery” due
	10/5	EXAM 1 – chapters 1, 2, & part 3		
Part 3: Groundwater Flow				
6	10/10	Darcy’s law & Hydraulic Head Lab: Sank Tank Model	3.4.1, 4.1-4.4	Woburn Report 1 due
	10/12	Force Potential & Darcy’s Law Lab: Permeability/Field Measure of Head	4.5-4.6	PS3 Assigned
7	10/17	Hydraulic Conductivity/Heterogeneity Lab: Woburn Geologic Setting	3.4-3.5, 3.11 8.2 to pg 291	
	10/19	Aquifers/Aquifer Characteristics (T, S) Lab: Woburn Geologic Setting	3.7, 3.9-3.10	
8	10/24	Mapping Hydraulic Head/Gradients Lab: Woburn Water Table	3.6, 3.8, 3.12	
	10/26	Regional GW Flow -topographic driving force Lab: TopoFlow exercise1	7.1-7.3	PS3 due
9	10/31	<i>No Class</i>		
	11/2	Granular vs. Fractured Media Lab: TopoFlow exercise2	D&S pg 48-51	<i>Civil Action</i> Journal to “Facher’s Plea” due
10	11/7	GW/SW Interaction Lab: Woburn Water Table	7.7	
	11/9	Exam 2	4.7	
11	11/14	Solutions to GW Flow Equations Lab: Flow Nets (by hand)	4.9 - 4.12	Woburn WT & Report 2 due
	11/16	Solutions to GW Flow Equations Lab: Flow Nets (by computer)	4.8, 4.13-4.14	
12	11/21 & 23	Thanksgiving Break – No Class		
13	11/28	Aquifer Tests— response of an ideal well to pumping Lab: Civil Action Discussion	5.1-5.5	PS4 Assigned <i>Civil Action</i> Journal to end due
	11/30	Single-well tests Aquifer Tests --non-ideal wells Lab: Aquifer Test Analysis	5.6-5.7 5.8-5.9	
14	12/5	Unsaturated Zone Flow Lab: Aquifer Test Analysis	6.1-6.7	PS4 due
	12/7	Managing GW Resources Lab: WI – Water Rich, Water Poor	11.1-11.5	
15	12/12	Catch up/Review		
	12/14	Exam 3		