

PHYSICAL HYDROGEOLOGY, 51-365/565 (3 credits)
FALL 2011

INSTRUCTOR: Dr. Maureen Muldoon
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OFFICE HOURS:
Monday 3:00-5:00
Tuesday 1:50-5:00
Wednesday 10:20-11:20
Or by appointment

CLASS HOURS: Lecture: 1:50 - 2:50 pm M,W
Lab: 11:30 - 1:40 pm Tuesday

LOCATION: Harrington 217

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/>. This site contains information about the text and its author, a review of basic mathematics, and solutions for the problems at the end of each chapter.

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:

There is a D2L site for this course. You must login to the D2L system using the same username and password that you use to access your UW-Oshkosh email account. Within the Physical Hydrogeology course, there is a navigation bar above the announcement area that contains the following tabs: Course Home, Content, Dropbox, Links, Grades, and Calendar. For each chapter, I will post a lecture outline and PowerPoint in the CONTENT area.

ABOUT THIS COURSE:

What do we study?

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.

Course Goals

At the end of this course you should be able to

- use real-world data to develop a water budget for a basin;
- evaluate the porosity, permeability, and hydraulic characteristics of various geologic materials;
- construct water-table maps and hydrogeologic cross sections from subsurface data;
- predict groundwater flow patterns based on hydraulic head distribution and be able to predict how heterogeneities will affect groundwater flow patterns;
- analyze aquifer test data; and
- answer a new hydrogeologic problem by identifying what data to collect, which analytical method to use, and be able to communicate your results.

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. Reading assignments are outlined in the following course schedule; more detailed assignments will be provided in D2L. To help focus your reading, I will post “reading review questions” for each topic on the D2L site.

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 to short written reports. 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. Several 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.

SPECIAL NEEDS: Any students who needs special accommodations for learning or who have special needs are invited to share these concerns or requests with the instructor as soon as possible.

ACADEMIC HONESTY

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 the assignments and must be able to present his/her work. Violations will result in a score of zero on the assignment and will be reported to the Dean of Students for further disciplinary action. See the *University of Wisconsin Oshkosh Student Discipline Code* <http://www.tts.uwosh.edu/dean/studentdisciplinecode.html> for definitions of academic misconduct and details about procedures, sanctions, and other relevant information.

Grades:		Scale			
15%	Exam 1	93 - 100%	A	73 - 77%	C
15%	Exam 2	90 - 93%	A-	70 - 73%	C-
15%	Exam 3	87 - 90%	B+	67 - 70%	D+
25%	Labs	83 - 87%	B	63 - 67%	D
20%	Problem sets	80 - 83%	B-	60 - 63%	D-
10%	Class Participation	77 - 80%	C+	<60%	F

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 COURSE SCHEDULE:

This schedule may change slightly. The SCHEDULE tab in the D2L site contains detailed reading assignments for each day and will reflect any changes in the course schedule.

TENTATIVE SCHEDULE

Week of	Topic	Reading	Assignments
Part 1: Hydrologic Cycle and Water Budgets			
9/5	Intro/What is Hydrogeology		example of a budget
9/12	Water/Water Budgets Sources of climatic data Lab: Quantitative Problems/ Measurements	Chap 1	PS1 Assigned
9/19	Evaporation/Transpiration Precipitation/Infiltration/Soil Moisture Lab: Woburn Introduction/ET Estimate	Chap 2 (2.1-2.8)	PS2 Assigned
9/26	Stream flow Lab: Analysis of Streamflow Data	Chap 2 (2.9-2.14)	

Part 2: Porosity & Permeability			
10/3	Porosity/Specific Yield Geologic Controls on Porosity/ Permeability Lab: Porosity & Permeability	Chap 3 (3.1-3.3) S&Z pg 13-32	
10/10	Class will not meet – GSA meeting EXAM 1 – chapters 1, 2, & part 3		<i>Civil Action</i> Journal to “Discovery” due
Part 3: Groundwater Flow			
10/17	Darcy’s Law & Hydraulic Head Force Potential & Darcy’s Law Lab: Hydraulic Head	3.4.1 Chap 4 (4.1-4.6)	
10/24	Aquifer Properties Lab: Woburn Geologic Setting	Chap 3 8.2 to pg 291	PS 3 Assigned
10/31	Mapping Hydraulic Head/Gradients Regional GW Flow-topographic driving force Lab: Woburn Water Table	Chap 3 Chap 7	
11/7	GW/SW Interaction Granular vs. Fractured Media Lab: TopoFlow exercise	Chap 7 D&S pg 48-51	<i>Civil Action</i> Journal to “Facher’s Plea” due
11/14	Exam 2 Derivation GW Flow Equations Lab: TopoFlow exercise 2	4.7	
11/21	Solutions to GW Flow Equations Lab: Flow Nets 11/23-11/27 Thanksgiving Break	4.8-4.14	
11/28	Aquifer Tests Lab: Aquifer Tests	Chap 5	PS4 Assigned <i>Civil Action</i> Journal to end due
12/5	Unsaturated Zone Flow Managing GW Resources Lab: Civil Action Discussion	6.1-6.7 11.1-11.5	
12/12	WI – Water Rich, Water Poor Review Exam 3 (12/14)		