

**51-366/566 CHEMICAL HYDROGEOLOGY (3 CREDITS)
SPRING 2010 SYLLABUS**

INSTRUCTOR: Dr. Maureen Muldoon
Office: 104 Harrington Hall
Phone: 424-4461
email: muldoon@uwosh.edu
web: http://www.uwosh.edu/faculty_staff/muldoon/

OFFICE HOURS:
Tues: 9:10 - 12:30
Wed: 1:50 - 5:00
Thurs: 9:10 - 12:30
Or by appointment

CLASS TIME: Tuesday & Thursday 1:50-4:00, Harrington 217

REQUIRED TEXT:

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

SUPPLEMENTAL TEXTS:

Applied Hydrogeology, C.W. Fetter, Fourth edition, Prentice Hall, Inc., 2001

Physical and Chemical Hydrogeology, P.A. Domenico and F.W. Schwartz, 2nd Ed., John Wiley & Sons, 1998

COURSE WEB PAGE:

I have developed 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 Schedule. For each chapter, I will post a lecture outline and PowerPoint in the CONTENT area.

COURSE DESCRIPTION & GOALS:

What do we study?

This is a survey course with the overall goal of providing the theoretical and practical background necessary to address groundwater contamination problems. The first portion of the course will emphasize the chemistry of natural waters and the important reactions affecting groundwater chemistry. The second portion of the course will provide an overview of basics of site characterization procedures and cover the physical and chemical processes affecting solute transport. The final portion of the course will provide an introduction to the characteristics of common contaminants and methods of remediating soil and groundwater contaminants.

Course Goals:

Many folks pursuing the "Hydrogeology Professional Emphasis" do so in the hope of obtaining employment in the environmental consulting field. To be successful in either the job market or graduate school you will need both a strong theoretical background in hydrogeology as well as many specific skills. My goals for this course are that you 1) gain a good understanding of basic principles of groundwater chemistry and contaminant transport; 2) develop adequate quantitative skills; 3) be able to manipulate and analyze both hydrogeologic and geochemical data; and 4) develop adequate communication skills so that you can prepare technical reports and presentations.

Prerequisites:

The study of contaminant hydrogeology requires not only a background in geology, but also a familiarity with the fields of physics and chemistry. The prerequisites for this course include Physical Hydrogeology (51-365) and General Chemistry II (32-106). Many portions of this course will be

quantitative in their emphasis; it is only by applying mathematics, physics, and chemistry that we can provide answers to questions such as How fast does groundwater flow? How far will a certain contaminant travel? How will contaminant concentrations change over time?

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 standards 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 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 hydrogeologic and geochemical 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 (see schedule below). Late assignments will not be accepted unless there are extenuating circumstance and prior arrangements have been made.

EVALUATION:

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

Laboratory: Laboratory sessions will be a mix of case studies, demonstrations, and laboratory & field exercises that will require a written report. 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 assigned.

Problems: Three problem sets (approximately 30 to 40 points each) will be assigned during the semester; the due date for each problem set is included in the following course schedule. Solutions (including all work and assumptions) must be written neatly.

SPECIAL NEEDS:

Any students who need 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
25%	Problem sets	80 - 83%	B-	60 - 63%	D-
5%	Class Participation & Quizzes	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.

****Readings:** S&Z = Schwartz & Zhang, F=Fetter, D&S=Domenico & Schwartz; reading in [brackets] is not required but is recommended if you feel that you need further clarification on some topic.

Week		Topic	Reading**	Assignments
1	2/2	Course Overview /Review Hydro I <i>Lab: Site Characterization I– Hydrostratigraphy</i>		Bring syllabus to class
	I. Groundwater Chemistry			
2	2/4	Dissolved Constituents in GW <i>Lab: Writing Exercise</i>	S&Z 16.1-16.3 [F 9.1-9.3, 9.13]	
	2/9	Water Sampling <i>Lab: Sampling Equipment</i>	S&Z 16.6-16.8 [F 10.3-10.4]	Seymour 1 due
3	2/11	Kinetic & Equilibrium Reactions <i>Lab: Plotting Chemical Data</i>	S&Z 17.1-17.3, [F 9.4-9.6] S&Z 16.4-16.5 [F 9.14]	
	2/16	Chemical Reactions 1 <i>Lab: Problem Set 1 Water Chemistry</i>	S&Z 18.1-18.2, [F 9.7-9.8]	
4	2/18	Chemical Reactions 2 <i>Demo: Chemical Speciation</i>	S&Z 18.3-18.4 [F 9.11]	Plotting Lab due
	2/23	Chemical Reactions 3 <i>Lab: Water Analysis</i>	S&Z 18.5-18.6 [F 9.9-9.10, 10.6.7]	
5	2/25	Isotopes <i>Lab: Water Analysis</i>	S&Z 20.1-20.6 [F 9.12]	PS 1 due
	3/2	Chemical Evolution <i>Lab: Review</i>	S&Z 21.1-21.4	
	3/4-5	<i>WI AWRA Meeting, Middleton</i>		
	3/4	EXAM 1 – Groundwater Chemistry		

II. Site Investigations & Transport Processes				
6	3/9	Geologic & Hydrogeologic Investigations I <i>Lab: Review of Heads & Gradients (PS 2)</i>	S&Z 7.1 - 7.4	Water Analysis due
	3/11	Geologic & Hydrogeologic Investigations II <i>Lab: Site Characterization II - GW Flow</i>	S&Z 7.5- 7.6 [F 12.3-12.7]	
7	3/16	Overview of Transport/Advection & Diffusion <i>Lab: Site Characterization II - GW Flow</i>	S&Z 19.1-19.2 [F 10.6.1-10.6.3]	PS 2 due
	3/18	Dispersion <i>Lab: Seymour Writing Exercise</i>	S&Z 19.3-19.5 [F 10.6.4-10.6.5]	Seymour 2 due
	3/20-28	Spring Break	Have Fun!	
8	3/30	Role of Heterogeneities in Transport <i>Lab: Problem Set 3</i>	S&Z 19.6	
	4/1	Measuring Transport Parameters <i>Lab: Simulation of Transport</i>	S&Z 19.8	Seymour Report due
III. Contaminant Hydrogeology				
9	4/6	Intro to Contaminant Hydrogeology <i>Lab: Intro to Characterization Case Study</i>	S&Z 22.1-22.2 [F 10.7]	
	4/8	Plume characteristics & Reactive Transport <i>Lab: Characterization Case Study</i>	S&Z 22.3 [F 10.6.6-10.6.7]	PS 3 due
10	4/13	NAPL Behavior <i>Lab: Review</i>	S&Z 22.4	
	4/15	EXAM 2		
11	4/20	Contaminant Site Investigation Well Capture Zones <i>Lab: Characterization Case Study</i>	S&Z 22.5-22.6	
	4/22	Remediation: Source Containment & Removal <i>Lab: Visit campus LUST site</i>	Read D&S 20.1-20.4 (thru p. 423), 20.7 Skim D&S 20.5-20.6 [F 10.8.2-10.8.3]	
12	4/27	Remediation: Bioremediation & Abiotic Chemical Destruction <i>Lab: Field Trip Preparation</i>	D&S 21.1-21.3 [F 10.6.7]	
	4/29	Remediation Field Trip		
13	5/4	<i>Lab: Characterization Case Study</i>		
	5/6	<i>Characterization Presentation</i>		
14	5/11	<i>Lab: Plume Busters</i>		
	5/13	Final Exam		