

APPLIED HYDROGEOLOGY

Geology 408/608
Syllabus, Fall 2005

Meeting: MWF 1115-1205, Room 322 Brackett Hall

Instructor: Larry Murdoch, Room 337; 656-2597; lmurdoc@clemson.edu

Office Hours: 2930-1030 T/Th or by appt

Text: *Applied Hydrogeology*, C.W. Fetter, 4th Edition, Prentice Hall, 2001

Grading

Midterm I	0.20	Midterm II	0.20
Homework and Quizzes	0.35	Final	0.25

Objective: This course is intended to provide an overview of hydrogeologic processes and settings. We will also review basic theoretical analyses and field methods used in hydrogeology.

Homework: Homework is an important part of learning new material, and your performance on the homework assignments will make up a significant fraction of your grade. Approximately 18 homework assignments will be given during the course and they will be due two class periods after they are assigned unless I tell you otherwise. Homework assignments from the book are listed in the syllabus, and other assignments will be handed out in class. Homework that is slightly late will suffer a penalty of 10% per day, unless you have a valid excuse. Homework that is very late may not be accepted. Please note that late homework can significantly affect your final grade.

Field exercise: A field exercise will be held on Sunday, 20 Nov. at the Clemson Well Field in the Botanical Garden. The field exercise is required.

Reading: Please complete the assigned reading before each class.

Quizzes: Brief quizzes will be given regularly on the reading and in-class material. There will be no opportunity to make up quizzes if you are absent. Some quizzes will be unannounced.

Attendance: You are expected to attend class. Exam questions will be drawn from class discussions as well as assigned readings. Attendance at the scheduled final exam is mandatory. University policy dictates that you must wait 15 minutes after the scheduled class time if I am late.

Students with Disabilities: It is University policy to provide, on a flexible and individualized basis, reasonable accommodations to students who have disabilities. Students are encouraged to contact Student Disability Services to discuss their individual needs for accommodation.

Academic Integrity: As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.

Electronic: Please give me your e-mail address if it is other than the one issued by DCIT. I will use the CLE site for this course to post handouts and assignments.

Graduate student grades: Students taking the course for graduate credit (GEOL 608) will be required to perform an additional project involving ground water modeling. The projects will be based on a problems approved by the instructor. The projects conducted by graduate students will be included as part of the grade for homework and quizzes. Test scores for students taking the course for graduate credit will be scaled independently from scores by students taking the course for undergraduate credit.

Graphical Syllabus

Hydrologic Cycle The course will start with an overview of the hydrologic cycle, including discussions of precipitation, evapotranspiration, ground water flow, and surface water

Ground Water Most hydrogeology deals with processes related to ground water flow. We will study an overview of ground water flow in aquifers and look at graphical, analytical, and numerical methods to predict flow s. This section will include an intro to the use of a ground water model

Wells are an important tool for both extracting ground water and for studying the characteristics of aquifers. We will study the characteristics of wells and methods used for well testing. This section will include a field exercise where we will test wells at the Clemson Experimental Well Field

Regional Hydrogeology is the study of how geology affects water storage and flow in aquifers. We will review this important field and study the regional hydrogeology of South Carolina.

Water Quality and Remediation. Most hydrogeologists are currently employed in the environmental field, either assessing water quality or conducting remediation. We will review these timely topics and get an overview of important remediation methods.

Topics The following is a preliminary list of topics for the course. The exams will be given on the scheduled dates. Other details of the schedule may be slightly modified.

	Date		Topic	#	Homework	Reading
1	Aug 24	W	Hydrologic Cycle			
2	Aug 26	F	Flux, flow rate	1	1.2, 1.6, 1.13, A1	1, H1
3	Aug 29	M	Application of water balances			2.1-2.3; H2
4	Aug 31	W	Evapotranspiration	2	2.1, 2.3, 2.5, 2.6, 2.7	2.4-2.8; H3
5	Sept 2	F	Precipitation and infiltration			2.8
6	Sept 5	M	Rainfall-runoff, hydrographs, extreme events	3	A5, 2.16	2.9-2.12, H5
7	Sept 7	W	Baseflow recession			2.9, 2.12
8	Sept 9	F	Hydrograph analyses			
9	Sept 12	M	Hydraulic head, piezometers, Darcy's Law	4	4.4, 4.8, 4.10, A2	4.1-4.6
10	Sept 14	W	Gradient, flux, 3-pt problem	5	A3	3.12, H4
11	Sept 17	F	Head contours, Potential maps	6	a, b, pg109, A4	7.1-7.2; 3.6-3.8, H4a
12	Sept 19	M	Head contours, cross-sections		A4a	
13	Sept 21	W	Analyzing flow in aquifers, Basic properties			3.1-3.2, H7
14	Sept 24	F	Permeability and hydraulic conductivity	7	3.4, 3.6, 3.8, 3.10, A7	3.4, 3.5, 3.11 H8
15	Sept 26	M	Storativity, effective stress	8	3.12, 3.14, 3.16	3.10, H9
16	Sept 28	W	The ground water head eqn			4.7
17	Sept 31	F	Analytical solutions, boundary conditions			4.8, 4.13
18	Oct 3	M	EXAM			
19	Oct 5	W	Unconfined aquifer	9	A8	4.14; H10
20	Oct 7	F	Flow nets, principles and methods			4.10-4.11; H11
21	Oct 10	M	Flow nets	10	A9, A10	4.12
22	Oct 12	W	Numerical solution of ground water head eqn.	11	A11	13.2-13.6; H12
23	Oct 14	F	Using GWVistas			H13, 13.7-13.8
	Oct 17	M	<i>Fall Break</i>			
24	Oct 19	W	Using GWVistas for a watershed	12	A14	13.7-13.8
25	Oct 21	F	Hydrogeology of the Piedmont			8.4; H18
26	Oct 24	M	Hydrogeology of the Coastal Plain			8.7
28	Oct 26	W	Flow in the vadose zone, infiltration, recharge			6.1-6.7
29	Oct 28	F	Analyzing flow in the vadose zone	13	A14a	6.1-6.7
30	Oct 31	M	Drilling methods and applications for wells			H17
31	Nov 2	W	Horizontal wells, hydraulic fractures			
32	Nov 4	F	Analysis of flow to a well			5.1-5.3
33	Nov 7	M	EXAM			
34	Nov 9	W	Analysis of constant rate well tests	15	5.2, 5.4, 5.10	5.6 H16
35	Nov 11	F	Analysis of slug tests	16	A12	8.10, 8.1-8.3
36	Nov 14	M	Wells in ground water models		A13	8.7, H19
37	Nov 16	W	Water quality	17	9.14, A15	9.13-9.14; H21
38	Nov 18	F	Contaminant conceptual models			H20
	Nov 20	S	<i>Well Testing Exercise; Clemson Well Field</i>			
39	Nov 28	M	Chemical partitioning and transport			H22, 10.6
40	Nov 30	W	Analyzing transport	18	10.4, 10.6, A17	10.6, 10.10
41	Dec 2	F	Predicting movement of plumes			
42	Dec 5	M	Multi-phase flow and remediation			10.6
43	Dec 7	W	Remediation			10.7-10.8
44	Dec 9	F	Review			