

SYLLABUS
GROUNDWATER HYDROLOGY (476K)
AQUIFER TESTING (191W) (27980)
PHYSICAL HYDROGEOLOGY (391C) (27975)
Fall 2012

Instructor: Jack Sharp, EPS 3.150, JGB (GEO) 6.110 (jmsharp@jsg.utexas.edu)
Office hours: M & W 11-12 or by appointment

Meeting times:

The lecture is from 10:00-11:00 AM MWF in JGB/(GEO) 3.222.

Time for the weekly literature/research discussion meeting for the graduate students will be arranged.

Laboratory: 476K labs and 191W will meet in EPS 2.104.

27670 T - 0800-1000 (27670)
27675 W - 0800-1000 (27675)
27680 W - 1300-1500 (27680)
27685 T - 1400-1600 (27685)
27690 M - 1700-1900 (27690)
27695 T - 1700-1900 (27695)

Objectives: This course:

1. reviews/introduces the basic principles of groundwater hydrology/physical hydrogeology from geological, physical, mathematical, and geotechnical points of view;
2. (in 191W or the 476K lab) reviews/introduces students to basic computational and interpretative methods used in analyzing groundwater systems; scientific paper writing and presentation, and
3. examines promising new areas of hydrogeologic research through lectures, assigned readings, grant proposal writing, and project/term papers.

Meeting times:

The lecture is from 10:00-11:00 AM MWF in JGB/(GEO) 3.222.

A weekly literature/research discussion meeting for the graduate students in 391C will be arranged.

Laboratory: 476K labs and 191W will meet in EPS 2.104.

Texts: Two required texts:

1. Sharp, John M., Jr., 2012, A Glossary of Hydrogeological Terms: Department of Geological Sciences, The University of Texas, Austin, Texas, 82p.
2. Sharp, J. M., Jr., 2012, Hydrogeology Notes: Department of Geological Sciences, The University of Texas, Austin, Texas, 434p.

Inquiring students will supplement the above materials with pertinent portions of the texts listed in the references cited. Additional papers may be assigned during the semester.

Other talks/opportunities. Hydrogeology talks are given in a number of other venues - technical sessions and other seminars within the Department (including periodic hydrogeology brown bag seminars), at the BEG or UTIG, in other UT Departments (especially EER, PGE, CE, and Geography), at other agencies (e.g., USGS), and still other venues (e.g., Austin Geological Society, SIPES, etc.).

I will inform you via email and in class about these other opportunities that help make UT hydrogeology truly unique. Classroom instruction and assignments should not be the only source of your (scientific) education. If you know of other pertinent seminars/talks, please bring them to the attention of the class.

Field trips: Optional field trips will be offered. These may include some of the following ½ or 1-day field trips:

1. Carbonate aquifers and karst: the local Edwards aquifer
2. Sediments and sedimentary rocks
3. Igneous rocks and fractured media
4. A longer 4+ day trip to Trans-Pecos Texas may also be offered.

Because of student schedules and the size of this class, the field trips are not required, but extra credit is given for attendance. The exams will have optional questions that those who participate in the field trips may choose to answer.

Laboratory: All 476K students must attend a laboratory sessions. Graduate students who have not had previous classes in physical hydrogeology should take Geology 191. Graduate students who take 191W generally do better in the exams, have higher class rankings, and are more satisfied with the course. Geology 191W meets concurrently the 476K labs.

391C Graduate discussion: This consists of literature reviews of articles selected by faculty and student, an annotated bibliography, and a short (3-page) research proposal. Undergraduates are welcome to attend. The discussion session times will be arranged

Office hours: Formal office hours are: 11:00-noon - Monday and Wednesday or by appointment or feel free to come in and chat whenever the door to my office is open. *Informal* office hours:

1. when there are hydro speakers at Tech Sessions (typically, we take them out for a few beverages or dinner afterwards).
2. after the Hydrogeology Brown Bag Seminar (1:00PM on Fridays).
3. I will have a few 5:00 PM meeting times to review or discuss tests, etc.

Grading:

	<u>476K</u>	<u>391C</u>	<u>191</u>
2 examinations *	50%	60%	-
Final examination**	(25%)	(30%)	-
Lab problem sets –	25%	-	100%
Term paper – writing ***	25%	-	-
Literature reviews	-	10%	-
Annotated bibliographies	-	10%	-
Research proposal	-	20%	-

Grading policy: A (>90.5%); A- (89.5 -90.4%); B+ (88.0- 89.4%); B (80.5 -87.5%); B- (79.5 – 80.4%); C+ (78.0- 79.4%); C (70.5 -77.5%); C- (69.5 – 70.4%); D (59.50 -69.4%); F (< 59.4%).

* The examinations will be scheduled in the evening so plan your schedule accordingly.

** The optional final is comprehensive and can substitute for your lowest term examination or if you missed one of the term exams.

* **476K is a substantial writing component class. The term paper draft, outline, and final paper are 25%, but there are also writing components in the laboratory.

For each exam, be sure to bring pens & pencils, a ruler, and calculator, if you need one. Most of the test calculation problems will be simple enough to do without a calculator, but...?

NOTE: Information pertinent to the exams, schedule revisions, and announcements of opportunities (talks, job interviews, etc.) will be presented in class lectures. Guest lecturers in hydrogeology will present material in class that will be included on exams. We try to take advantage of the visitors to our program.

NOTE: This syllabus will be revised periodically throughout the fall semester depending primarily upon the pace of the lectures, any University-mandated changes, and special opportunities (e.g., unexpected guest speakers in hydrogeology visiting the Department). Revisions will be distributed via the class email list and will be made available in class and in the lab.

THE 10 COMMANDMENTS OF HYDROGEOLOGY

(courtesy of Mike Campana, slightly modified below)

Thou shall:

1. not assume isotropy, homogeneity, or a uniform hydraulic gradients without field evidence.
2. not assume that wells or streams fully penetrate or that flow systems are 2-dimensional without field evidence.
3. not use regional data to make site-specific judgments.
4. not use color graphics to enhance lousy science.
5. not employ geostatistics to obfuscate poor interpretations or weak conclusions.
6. not rely on stochastic methods to disguise insufficient field data.
7. not place geochemical or isotopic interpretations above hydraulic interpretations.
8. never regard geophysics or a numerical model as the truth.
9. never use a contouring program to make a water-table map (unless you hand contour it first to be sure that the program output is believable).
10. never use more than 3 significant digits.

LECTURE/COURSE SCHEDULE FOR 2012 (subject to revision)

("He listens well who takes notes" - Dante Alighieri)

<i>DATE:</i>	<i>TOPIC:</i>	<i>READINGS:</i>
*date means Prof. Sharp gone		** will be on library reserve or will be handed out in lecture

INTRODUCTION - BASIC CONCEPTS

Aug. 29	The hydrological cycle	1-16
31	Porosity LAB #0: Aquifer short reports, regional flow lab, & annotated bibliography assignments will be given in lecture. The labs will not meet formally until the week of September 10)	17-38
Sep. 3	<i>Labor Day - no class</i>	-
5	Darcy's law	39-56 Darcy, 1856**
7	Permeability	57- 74
10	Permeability and flow nets LAB #1: Porosity	75-90
12	Flow nets & Regional flow systems	91-116
14	Flow nets & Regional flow systems	Wolaver et al.**
*17	Karst LAB #2: Darcy's Law	314-316
*19	Guest Lecture - <u>Case history</u> - Zacatón – Marcus Gary	Gary et al.**
*21	Storativity; Safe yield; sustainability, & groundwater law	Pierce et al.** 293-308
24	Concept of storativity; subsidence LAB #3: Permeability Due: aquifer short reports that were assigned on 31 August.	117-124
26	<u>Case History</u> (tbd) Note: Nico Goldscheider's all day karst lecture for the EAA. I shall be taking a carryall down for this meeting	

GROUNDWATER PHYSICS

28	Tidal and barometric efficiency	125-132 Wilson et al. **
Oct. 1	<i>Water New Years Day</i> Continuity equation LAB #4: Flow nets	133-142

3	Aquifer tests	143-162	
5	Aquifer tests <i>Due:</i> 476K term paper rough first draft and outline by 5:00PM	163-170	
8	Infiltration & piezometer tests LAB #5: Consolidation		
10	Review session <u>First exam</u> (this will be scheduled in the evening., so plan ahead).	--	
12	Vadose (Unsaturated) Zone	171-180	
15	Fractured media LAB #6: Pumping Tests #1	181-192	
17	Fractured media	193-194	
TRANSPORT			
19	Free convection	195-200 Simmons et al. **	
22	Fresh-water / salt-water systems LAB #7: Pump tests #2	201-206	
24	Mass transport	207-222	-
26	Mass Transport	223-226	
29	Diffusion and dispersion <i>Due:</i> 391C annotated bibliographies LAB #8 – regional flow (<i>Due</i> before 10:00 AM; 2 copies. Assigned on 31 August)	223-232	
31	Dispersion	233-242	
Nov. 2	Urbanization –walking field trip (if conditions are miserable outside, this will be switched with the following lecture) <i>Due:</i> 476K term paper (2 copies) final draft by 5:00PM	Wiles & Sharp**	
*5-7	No classes: GSA No LABs	-	
6	<i>Election day – please vote. If going to GSA, vote early.</i>		
9	Urbanization	Sharp**	
11	<i>Veterans Day</i>		
12	Contaminant hydrogeology LAB #9: Fractured media	271-276	

14	NAPLS	277-292
16	Energy transport	243-254
	<i>Due:</i> 476K term paper student edits by 5:00PM	
19	Energy transport LAB#10: Energy transport	255-270
21	Geostatistics	423-434
	<i>Note:</i> Wednesday afternoon lab students should make arrangements to sit in on one of the other 5 labs.	
	<i>Due:</i> 391C GSA grant applications by 1200 noon.	
22-23	<i>Thanksgiving vacation</i>	
SOME EXTENSIONS TO NATURAL RESOURCES		
26	Groundwater geology Lab# 11 (make up – tbd)	309-322
28	Groundwater exploration	331-336
30	Springs <u>or</u> mineral exploration	353-362
	<i>Due:</i> 476K term paper/project final (1 paper copy & one electronic (pdf) <u>before 12:00 noon</u> , attach copy of both student and professor edits)	
Dec, 3	Petroleum migration NO LABS	363-370

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|---------|---|
| 5 | Review
<u>Second exam</u> (this will be scheduled in the evening, so plan ahead). |
| 7 | Return all papers exams, etc., except perhaps the make-up labs. Grades available.
Decide if you want to take the final. Talk to TAs about your lab scores.
Slide show of what we discussed this semester. |
| Dec. 15 | OPTIONAL FINAL (0900-1200 at a site to be designated). |

Note the final is optional.

- If you are satisfied with your tentative grade, you may skip the final.
- If you missed an exam, you must take the final.
- If you are dissatisfied with your grade on one of the other two exams or your class ranking, the final will substitute for your lowest grade.

Final will consist of: 50 multiple choice – 50 points & 5 (out of 8) short answer/discussion/calculation problems – 50 points

Other (I apologize – I know that we all know or can infer these but there are UT directives that you are to be informed of the following):

1) *the honor code* (how it applies to each class, and develop a more thorough description of what constitutes acceptable practices in our classrooms.):

“The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity and responsibility. Each member of The University is expected to hold these values through integrity, honest [*sic*], trust, fairness, and respect toward peers and community.”

No plagiarism or copying of others work for tests, term papers, pop quizzes, or laboratory problem sets is acceptable. Plagiarism or copying is subject to dismissal from the class with a zero grade. An explanation of plagiarism can be found at <http://registrar.utexas.edu/catalogs/gi09-10/index.html>.”

Group learning can be beneficial, so I encourage you to work with each other on occasion, and not always in isolation. However, if it assigned to 3 of your team up to analyze, for example, the data from a Guelph permeameter or the Theis curve matching, you owe it to yourself to do the calculations yourself again from scratch.

2) *students with disabilities*: “The University of ... [Texas] provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, <http://www.utexas.edu/diversity/ddce/ssd/>.” One year, I had a deaf student who was assigned two signers.

3) *classroom etiquette*: (Chana Lee, reported in the Chronicle of Higher Education, 27 March 1998): “Please do not hold conversations with classmates when the professor or another student is speaking. Also refrain from passing notes, reading ...[e.g., The Daily Texan], or participating in disruptive classroom behavior. Your undivided attention is a must. An atmosphere of mutual respect is in order...”

4) *religious holidays*: “By UT Austin policy, you must notify me [your instructor] of your pending absence at least fourteen days prior to the date of observance of a religious holy day. If you must miss a class, an examination, a work assignment, or a project in order to observe a religious holy day, you will be given an opportunity to complete the missed work within a reasonable time after the absence.”

5) *writing component class*: “This course [i.e., 476K] carries the Writing Flag. Writing Flag courses are designed to give students experience with writing in an academic discipline. In this class, you can expect to write regularly during the semester, complete substantial writing projects, and receive feedback from your instructor to help you improve your writing. You will also have the opportunity to revise one or more assignments, and to read and discuss your peers' work. You should therefore expect a substantial portion of your grade to come from your written work.”

There will be a short paper on a selected aquifer and one on regional flow. This is followed by a term paper selected from a list of topics. The term paper is expected to be approximately 20+ pages long and follow a specified format. The final paper will be submitted both electronically and in hard copy. 2 paper copies of the outline and 3 of the draft are required. Each paper will have a student editor (drawn at random) and a professional editor (me and/or a TA) review the draft.

The UT Undergraduate Writing Center (UWC) asks that I provide you this on the syllabus:

“The UWC is a service that can help your students write more effectively--and more independently. Because we share your commitment to improving undergraduate writing, we ask that you: 1) encourage but not require students to come to the UWC. While requiring a visit works in the short term to get students through our door, the actual goals of the writing consultation suffer: students do not engage in the writing process or effectively work toward becoming better writers; ...2) download and refer your students to helpful writing handouts from our main website: <http://uwc.utexas.edu/handouts/>.”

6) *use of lap tops*: I have had complaints from students that the clatter of people typing on their laptops is very distracting or that the person next to or in front of the a student was answering email or playing video games (especially in large, beginning classes), which also caused distractions. Recall Tom Sawyer, Joe Harper, and the tick! Also, it can be distracting to whoever is lecturing. We can discuss this if you wish. If you have a disability that requires you to use a laptop or a recording device, please see me.