

## **HYDROGEOPHYSICS**

Course unique number: GEO 391 – 27175  
GEO 371C – 26950

Interim meeting time – 1:00 -3:00 PM Mondays in JGB(GEO) 3.104

Instructors: Jack Holt & Jeff Paine & Jack Sharp

This Fall 2010 graduate/upper level undergraduate course surveys the major geophysical methods that are applied in hydrogeological investigations. The class is intended for hydrogeology, geophysics, or engineering students with an interest in practical interpretations. The class will consist of 6 modules that will include:

- Use of the Total Station and GPS for precise location of the test site(s)
- Electrical resistivity (ER)
- Ground penetrating radar (GPR)
- Geophysical well logging
- Electromagnetic surveying (EM)
- Gravity methods
- Seismic refraction/reflection

Each module includes: 1) lecture method theory and its hydrogeological applications (1-3 lecture hours), 2) using the instruments in the field, and 3) analysis of the data, interpretation, and hydrogeological insights. Grades will be based on participation in classes and field exercises, written field exercise summaries, literature reviews, a report on the application of a geophysical method or methods to a hydrogeologic study, and a final report/presentation on the hydrogeology of the site(s). Hopefully, the last will be publishable. Several sites are now under consideration – one a shallow alluvial aquifer, a fractured carbonate unit, and 2 sites on the Edwards aquifer recharge zone.

Prerequisites: Graduate standing, undergraduates need permission from one of the faculty. A background in hydrogeology or geophysics is necessary. A background in both fields is ideal.

Text: No text is required, but the students should refer to one of the following texts for general background information. Please note the reading dates in the syllabus

### References:

- Burger, H.R., 1992, Exploration Geophysics of the Shallow Subsurface: Prentice-Hall, Englewood Cliffs, NJ, 489p.
- Butler, (Jeff - Citation and where to insert the readings please)
- Dobrin, M.B., 1960, introduction to geophysical prospecting (2<sup>nd</sup> ed.): McGraw-Hill Book Co., New York, 446p. [*an old "classic"*]
- Kirsch, R. (ed.), 2009, Groundwater Geophysics – A Tool for Hydrogeology (2<sup>nd</sup> ed.): Springer-Verlag, Berlin, 548p.
- Rubin, Y., and Hubbard, S.S., (eds.), 2005, Hydrogeophysics: Water Science and Technology Library, Springer, Berlin, v. 50, 523p.
- Sharma, P.V., 1997, Environmental and Engineering Geophysics: Cambridge University Press, Cambridge, UK, 475p.

### Grading:

Filed participation and field reports	40%
Literature reviews	25%
Individual report	25%
Final report	10%

For more information, contact:

Jack Holt at [jack@ig.utexas.edu](mailto:jack@ig.utexas.edu),  
Jeff Paine at [jeff.paine@beg.utexas.edu](mailto:jeff.paine@beg.utexas.edu), or  
Jack Sharp at [jmsharp@jsg.utexas.edu](mailto:jmsharp@jsg.utexas.edu) .

DATE	MODULE	READINGS
Aug, 30	Introduction, requirements Set field trip dates	Kirsch, Ch. 1 Rubin & Hubbard, Ch. 1
Sep. 6	<i>No class</i> – Labor Day	
13	EM Literature review paper	Kirsch, Ch. 4, 5, & 6 Rubin & Hubbard, Ch. 1 Sharma, Ch. 7& 12

20	TOTAL station – GPS Planning field investigations	Kirsch, Ch. 14 Rubin & Hubbard, Ch. 2, 12, 13, & 14 Burger, Ch. 1 Sharma, Ch. 1
27	Gravity Literature review paper	Kirsch, Ch. 11 Burger, Ch. 6 Sharma, Ch. 2
Oct. 4	Seismic refraction Literature review paper	Kirsch, Ch.2 Rubin & Hubbard, Ch. 8 Burger, Ch. 2 & 3 Sharma, Ch. 4
11	Seismic reflection Literature review paper	Rubin & Hubbard, Ch. 9 Burger, Ch.4
18	ER Literature review paper	Kirsch, Ch. 3 Rubin & Hubbard, Ch. 4 & 5 Burger, Ch. 5 Sharma, Ch. 6 & 12
25	GPR Literature review paper	Kirsch, Ch. 7 Rubin & Hubbard, Ch. 7 Sharma, Ch. 8
Nov.1	<i>No class - GSA</i>	
8	Airborne geophysics Literature review paper	Kirsch, Ch. 5& 6 (again) Rubin & Hubbard, Ch. 11
15	Other methods Literature review paper Individual class report on method (depending upon class size)	Kirsch, Ch. 8. 9. 10 Rubin & Hubbard, Ch. 16 & 17 Burger, Ch. 7
22	Individual class report on method	Rubin & Hubbard, Ch. 3
29	Class final report Arrange for preparation of paper for scientific journal.	

FIELD TRIP DATES (one will be 2 days to the Brazos River area, the others will be ½ to one day local trips): September 18/19, 26; October 3, 9/10, 16/17, 24; November 6/7, 14, 21.

Other: (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 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/>.”

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 ...[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 your instructor(s) 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.”