

## **26:380:608:01 Ground Penetrating Radar Fall 2009 Syllabus**

**Instructor:** Dr. Lee Slater

**Office:** 135 Smith Hall (Office Hours: T 4:30 - 5:30 pm)

**Meeting Time:** 6.00 to 9:00 p.m. T – Smith 127

### **1. Overview of the Course**

This graduate course will examine the theory and practice of the ground penetrating radar (GPR) geophysical method as used to image the subsurface. The material will focus on environmental applications of the method.

### **2. Course Objectives**

The course will provide a comprehensive background in this popular geophysical technique that is regularly applied in environmental investigations and forensics research. The student will gain competency in the electromagnetic theory behind the technique and obtain a unique ‘hands on learning’ experience using the GPR instruments owned by Rutgers-Newark. This ‘hands on’ experience will allow the student to gain confidence in the data acquisition methods in the field and common processing techniques used to interpret GPR datasets.

### **3. Relationship to the rest of the program**

The course builds upon a developing departmental expertise in near surface/environmental geophysics and complements two other courses in near surface geophysics [1] 26-380-606-S01: Electrical Environmental Geophysics, and [2] 26-380-607-S01: Seismic and potential field environmental geophysics.

### **4. Pre- and co-requisites for the course**

‘Applied Geophysics’ and/or permission of instructor

### **5. Specific Learning Objectives**

- Comprehension of the theory of application of ground penetrating radar (GPR) in environmental studies
- Understanding of the link between geophysical properties controlling GPR signals and subsurface environmental parameters
- Understanding of field survey procedures in ground penetrating radar
- Competency running GPR instrumentation
- Ability to perform basic processing of GPR datasets using current software packages
- Able to provide an informed interpretation of processed GPR datasets

### **6. Reading List**

Recommended (not required) class text:

*Jol, H.J., 2009, Ground Penetrating Radar Theory and Applications, Elsevier Science, 544 pp, ISBN-10: 0444533486*

Abbreviated Suggested Reading List:

*Annan, A.P., 2005, GPR methods for hydrogeological studies: in Hydrogeophysics, edited by. Y. Rubin and S.S. Hubbard, Springer, The Netherlands, pp. 185-213*

*Annan, A. P., 2006, Ground Penetrating Radar: Near Surface Geophysics. D. Butler, Society of Exploration Geophysicists, 357-438*

**26:380:608:01 Ground Penetrating Radar - Fall 2009 Syllabus – updated 8/18/2009**

Davis, J. L. and A. P. Annan, 2002, *Ground penetrating radar to measure soil water content. Methods of soil analysis. Part 4.* J. H. Dane and G. C. Topp: *Soil Science Society of America (SSSA)*, 446-463  
Huisman, J. A., S. S. Hubbard, J. D. Redman and A. P. Annan, 2003, *Measuring soil water content with ground penetrating radar: a review: Vadose Zone Journal* 2, 476-491.  
Knight, R. and A. L. Endres, 2006, *An Introduction to Rock Physics for Near-Surface Applications: Near-Surface Geophysics.* D. Butler, *Society of Exploration Geophysicists. Volume 1: Concepts and Fundamentals*  
Neal, A., 2004, *Ground-penetrating radar and its use in sedimentology: principles, problems and progress: Earth-Science Reviews* 66, 261-330  
Slater, L. and Comas, X., 2009, *The contribution of GPR to water resources research, In, Jol. H., Ed., GPR Radar Theory and Applications, Elsevier, New York, 544 pp*

**7. Evaluation Criteria**

<b>Assignment</b>	<b>Percentage of total grade</b>	<b>Due date</b>
Weekly class assignment/ class participation	30	weekly
Participation in and complete write-up of field project:	30	Last week of class
Mid-Term Exam:	30	Middle of semester
Quizzes:	10	Weekly on demand

**8. Week by Week Topics**

<b>Week</b>	<b>Topic</b>
1	Electromagnetic Principles of GPR
2	Electromagnetic Principles of GPR (cont)
3	Electrical and Magnetic Properties of Rocks, , Soils and Fluids
4	GPR Systems and Design
5	Data Processing, Modeling and Analysis in Environmental Applications (I)
6	Data Processing, Modeling and Analysis in Environmental Applications (II)
7	Data Processing, Modeling and Analysis in Environmental Applications (III)
8	Soils, Peatlands and Biomonitoring
9	GPR in Water Resources Research
10	GPR for Contaminant Mapping
11	GPR for Imaging Shallow Stratigraphy
12	GPR Imaging of Glaciers and Ice Sheets
13	GPR in UXO Detection
14	GPR in Forensic Science
15	GPR n Archeological Science

**9. Catalog Description**

**26:380:608:01 Ground Penetrating Radar - Fall 2009 Syllabus – updated 8/18/2009**

Comprehensive study of theory, methodology, processing and interpretation of the ground penetrating radar geophysical method. Focus on the environmental applications of this technique in site characterization studies, contaminant studies, remediation, groundwater surveys, archeology and forensics. Exploration of field data acquisition and processing techniques at sites on and/or close to campus. This class includes a mandatory field component.