

**Florida International University**  
Department of Earth and Environment

GLY 4450 Spring 11  
**Environmental and Exploration Geophysics**

Lec: MWF 1:00-1:50, PC311

*Note:* This syllabus supercedes all previous versions (11/9/10)

Dr. Dean Whitman  
Office Hours: MW: 2:30-4:00PM  
after class, or by appointment

PC 325A, Tel: 348-3089  
E-mail: whitmand@fiu.edu

**Required Text:** Burger, H. R, A. F. Sheehan, and C. H. Jones *Introduction to Applied Geophysics, Exploring the Shallow Subsurface*, 2005. ISBN 0-393-92637

**Grading:** Homework exercises 50%; Midterm 20%; Final Exam 30%

**Description:**

Geophysics is the application of physical principles to the study of the Earth's structure and physical properties. Exploration or applied geophysical techniques are used to determine the physical properties of the subsurface from measurements made by instrumentation placed on the surface or in boreholes in the ground. These techniques were first developed as an aid in the exploration for mineral and petroleum deposits but in recent years, they have been increasingly applied to environmental problems such as hydrogeology and site remediation. Applications of geophysical methods include the determination of subsurface stratigraphy and soil properties, characterization of groundwater flow and storage, the identification and tracing of hazardous substances and contaminants in the subsurface, the detection of buried objects and unexploded ordinance, the characterization of soil and bedrock properties for stability, and the exploration of the subsurface for valuable mineral and energy resources.

**Learning Objectives/Outcomes**

This course will provide an introduction to the basic field and interpretation methods used in exploration and environmental geophysics. Topics include introductory surveying and GPS, seismic methods, potential fields, electrical methods, ground penetrating radar (GPR), borehole methods,. The course includes 3-4 field trips to sites in Miami-Dade County and will also include exercises on data reduction, modeling, interpretation, and computerized map production. The field exercises are an essential part of this course and are **required** for all students. The final grade will be based on exercises, homework, and exams.

**Prerequisites:** GLY1010 or 3030, MAC 2311, PHY 2048 & 2049 or PHY 2053 & 2054

**Note:** PHY 2049 or PHY 2054 may be taken concurrently with this course

### Tentative Schedule

Week	Topic	Reading
1	Introduction Seismic Waves <i>Ex1:</i> Field surveying; GPS	Ch 1, Ch 2
2	Seismic wave propagation <i>Ex2:</i> Data reduction/ Intro to GIS Ex	Ch 2, Ch 3
3	Seismic refraction method <i>Ex 3:</i> Seismic Refraction Method	Ch 3
4	Seismic reflection method <i>Ex 4:</i> Seismic Reflection Method	Ch 4
5	Seismic Surveying <i>Ex 5:</i> Seismic Field Survey	Ch 4
6	<b>Midterm (Seismic Methods, Chs. 1 - 4)</b> Gravity on the Earth <i>Ex 6</i> Vertical Gravity Gradient, Field survey	Ch 6
7	Gravity surveying and reduction Regional gravity studies and anomalies <i>Ex 7:</i> Gravity Mapping and Interpretation	Ch 6
8	Gravity Anomalies Due to Simple Shapes 2-D Gravity Anomalies <i>Ex 8:</i> Gravity Modeling	Ch 6
9	Earth Magnetism Magnetic surveying <i>Ex 9:</i> Magnetic & EM Field survey	Ch 7
10	<b>Spring Break</b>	
11	Magnetic Anomalies <i>Ex 10:</i> Magnetic modeling	Ch 7
12	Electrical resistivity <i>Lab 11:</i> DC Resistivity Field Survey	Ch 5
13	Electromagnetic methods <i>Lab 12:</i> Resistivity Modeling and Interpretation	Ch 8
14	Ground Penetration Radar <i>Lab 13:</i> GPR interpretation	Ch 8
15	Borehole Methods <b>Review and Questions</b>	

Applied Geophysics References ( in reverse chronological order)

- Burger, H. R, A. F. Sheehan, and C. H. Jones, 2005, Introduction to Applied Geophysics, Exploring the Shallow Subsurface, Norton,
- Kearey, P., M. Brooks, and I. Hill, 2002, An introduction to geophysical exploration Blackwell Scientific Publications, 3<sup>rd</sup> E., 259 p.
- Mussett, A. E., and M. A. Khan, 2000, Looking into the Earth: An Introduction to Geological Geophysics, Cambridge Univ. Press
- Reynolds, J.M., 1997, An Introduction to Applied and Environmental Geophysics, Wiley, 796 pp.
- Parasnis, D.S., 1997, Principles of applied geophysics, 5<sup>th</sup> ed., Chapman and Hall, 429 p.
- Burger, H.R., 1992, Exploration Geophysics of the Shallow Subsurface , Prentice Hall, 489 p.
- Telford, W.M., L.P. Geldart, and R.E. Sheriff, 1990, Applied Geophysics, 2nd ed., Cambridge University Press.
- Ward, S.H., ed., 1990, Geotechnical and Environmental Geophysics, Society of Exploration Geophysics investigations in Geophysics,
- Milsom, J., 1989, Field geophysics , Open University Press, 182 p
- Carmichael, R.S., 1989, Practical Handbook of Physical Properties of Rocks and Minerals, CRC Press, 741 pp.
- Robinson, E.S., and C. Coruh, 1988, Basic Exploration Geophysics, John Wiley, 562 p.
- Dobrin, M.B., and C.H. Savit, 1988, Introduction to Geophysical Prospecting, 4th ed., McGraw-Hill, 867 pp.
- Hinze, W.J. ed. 1985, The Utility of regional gravity and magnetic anomaly maps , Society of Exploration Geophysicists, 454 p
- Sheriff, Robert E., 1984, Encyclopedic dictionary of exploration geophysics 2nd ed., Society of Exploration Geophysicists, 323 p.
- Beck, A. E., 1981, Physical principles of exploration methods : an introductory text for geology and geophysics students, John Wiley, 234 p.
- Society of Exploration Geophysicists, 1967, Mining geophysics. vols I and II, Society of Exploration Geophysicists
- Keller, G.V. and F. C. Frischknecht., 1966, Electrical methods in geophysical prospecting, Pergamon Press, 519 p.