

## **GLG 471: Introduction to Applied Geophysics - SS 2010**

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| Instructor: Dr. Remke Van Dam<br>Office: 310 Natural Sciences Building<br>Phone: 432-9177<br>Email: rvd@msu.edu<br>Office Hours: Mo, We, Fr: 1:30-3:30 pm |
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Lecture      M,W,F      11:30-12:20      Location: 205 NS

Lab            W            16:10-18:00      Location: 26 SSB / 213 NS / Outside

*Before spring break:*      Computer labs in 026 SSB

*After spring break:*      Location depends on activity

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| Location of lab or class can occasionally differ from what is listed in the syllabus. I will send out a note through email the evening before at the latest. |
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Text: **Introduction to Applied Geophysics - Exploring the Shallow Subsurface**, by Burger, Sheehan, and Jones - ISBN: 9780393926378

**Course Objectives:** After this course you should be able to:

- 1) explain theory behind different geophysical methods,
- 2) use Excel and simple forward modeling programs to predict equipment performance and expected results,
- 3) make informed choices of which method to use for specific problems, and
- 4) have experience operating geophysical equipment and interpreting data.

**Course Organization:** The course is divided into two more or less equal parts.

- The first 8 weeks are composed of **lectures** and **computer labs**.
  - Computer labs are done on a personal basis, but discussions and working in small groups is encouraged. After each lab (or set of labs) a report has to be turned in.
  - Homework problems will be given for you to help understand the material; however, these will not be turned in or graded.
  - The material covered in the book readings, lectures, and labs will be tested in a **mid-term exam**.
- During the second 8 weeks you will get your hands on geophysical equipment to solve specific problems. The **projects** will involve survey design, data collection, data interpretation, and presentations. There will be one *class project*, and one *group project*.

**Homework:** Seismics, GPR, electrical resistivity, and gravity problems will be posted on Angel.

**Lab reports:** Lab reports are due at 11:30am on Wednesdays of the scheduled week, unless otherwise noted. They can be submitted through email or in the form of printouts at the beginning of class. All reports must be typed.

**Exams & Tests:** There will be one midterm test and a final assessment; both will be on all material (readings, lectures, projects) that has been covered up till that point.

**Projects:** There will be two projects. The survey design, data collection, analysis, and associated presentations will be performed in groups; writing of reports is done individually. To accommodate your schedules the fieldwork timing is flexible.

**Grades:**

scale: 4.0 (90-100), 3.5 (85-90), 3.0 (80-85), 2.5 (75-80), 2.0 (70-75), 1.5 (65-70), 1.0 (55-65), 0.0 (0-55)

I use Angle and email for announcements and grades

|  |     |
|--|-----|
| Lab reports.....   | 20% |
| Midterm .....  | 25% |
| Final .....  | 5%  |
| Project 1 (fieldwork, field report) .....  | 10% |
| Project 2 (2 presentations, proposal, peer reviews, fieldwork, final report) ... |     |
| 40%  |     |

**Relevant additional textbooks available in the library:**

|                                     |                    |
|-------------------------------------|--------------------|
| Telford's Applied Geophysics        | TN 269 .A663 1990  |
| Reynold's Intro to Appl & Env Geoph | QC 808.5 .R49 1997 |
| Kearey's 3rd ed Intro Geoph Expl.   | TN269 .K37 2002    |
| Sharma's Env & Eng Geophysics       | TA705 .S515 1997   |

## COURSE OUTLINE:

| Week (Dates)                  | Lecture Topic  | Book Chapter, Appendix | Lab <sup>#</sup> |  | Assignment          | Reading                  |
|-------------------------------|--|------------------------|------------------|--|---------------------|--------------------------|
| 1 (1/11-1/15)                 | Introduction<br>Seismic Fundamentals                       | 1<br>2                 | -                |  | -                   | 1-6<br>7-41              |
| 2 (1/18-1/22)                 | Seismic Refraction   | 3, A                   | L1               |  | -                   | 65-80, 90-96,<br>106-119 |
| 3 (1/25-1/29)                 | Ground-penetrating radar                                   | 8, E                   | L2               | 1/28 GLG seminar*  | L1                  | 501, 524-539             |
| 4 (2/1-2/5)                   | Electrical resistivity                                     | 5, C                   | L3               | 2/4 GLG seminar*   | L2                  | 265-289, 298-308         |
| 5 (2/8-2/12)                  | Electrical resistivity                                     | 5                      | L4               |  | -                   | 317-324                  |
| 6 (2/15-2/19)                 | Gravity methods  | 6, D                   | L5               |  | L3,4                | 349-385, 399-414         |
| 7 (2/22-2/28)                 | <i>Equipment demos (L6)</i>                                |                        | L6               |  | L5                  |                          |
| 8 3/1-3/3<br>3/3 (lab)<br>3/5 | Review + Questions<br>Mid-term Exam<br>No class            |                        | Exam             |  | Exam<br>L6 (Friday) |                          |
| 9                             | <i>Spring Break</i>  |                        |                  |  |                     |                          |
| 10 (3/15-3/17)<br>3/19        | Project design   |                        | L7               | L7 - Presentations   |                     |                          |
| 11 3/22-3/26<br>3/26          | <i>No lectures – P1</i>                                    |                        | Field (4)        | Data collection  | L7                  |                          |
| 12 (3/29-4/2)<br><br>3/31     | <i>No lectures – P2 prep</i><br><br><i>P2 planning lab</i> |                        | L                | Group planning meetings<br>Lab will be used for planning of P2 | P1 field notes      |                          |
| 13 (4/5-4/9)                  | Magnetic methods ^   | 7                      | -                | P2 progress report   |                     | 429-464                  |
| 14 (4/12-4/16)                | Electromagnetic meth. ^                                    | 8                      | L8               |  |                     | 509-523                  |
| 15 (4/19-4/23)                | <i>No lectures this week</i>                               |                        | -                | P2 progress report   | L8                  |                          |
| 16 (4/26-4/30)                | <i>No lectures this week</i>                               |                        | -                |  |                     |                          |
| 17 (5/4)                      | Final Exam   |                        |                  | 7:45-9:45 a.m.   | 205 NS              |                          |

\* You are required to attend one of the two Department seminars listed in the course outline. If you are not available due to class scheduling then let me know, so we can find an alternative

^ Depending on how projects are progressing, one lecture each of these two weeks may be used for project related tasks.

# Lab 1: Seismic refraction

# Lab 2: ground-penetrating radar

# Lab 3: Electrical Resistivity 1D

# Lab 4: Electrical Resistivity 2D

# Lab 5: Gravity

# Lab 6: Equipment demos

(during all 4 class and lab times this week – the lab will be in room 213 NS)

The lab report for L6 is due on Friday 3/5

# Lab 7: Project 1 - Tunnel modeling

# Lab 8: Magnetic and EM methods

Week 11: We will be in the field during all 4 class periods. Typed out field notes are due the following week on the standard day and time (Wednesday 11:30)