Syllabus

GEL 161, Exploration Geophysics **Spring 2007**

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Lectures: Tue & Thu 10:30–11:50 Office: 393 Physics/Geology Building
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Goals

The goals of this course are to apply geophysical methods to determine shallow crustal structure. Exploration geophysics includes two main components: 1) Acquiring and processing data (lots of it) and 2) using models to interpret the data and determine crustal structure. The general approach will be to:

1. introduce a geophysical problem to be solved.
2. cover the theoretical background and methods used to acquire/process relevant data.
3. use models (based on theory) to interpret data.
4. combine data to get a more comprehensive picture of the subsurface.

To do this, we need to understand what the methods are capable of doing (do they measure density, constrast in seismic speed, metallic content,...?) and how best to use a method to achieve a specific goal. I will try to use real data in examples and homework whenever possible.

Because data processing is such a big part of real exploration geophysics analysis, I recommend that you know or are willing to learn MATLAB. I will be giving a special introduction to MATLAB the second week of class (time/date to be determined in class). However, all the homework can be done using Excel.

Textbook

An Introduction to Geophysical Exploration by P. Keary, M. Brooks and I. Hill
This is a very readable textbook, with useful diagrams and example. Please do an *overview* reading before lecture. An *overview* reading, is a reading where you, 1) carefully read the introduction, subsection headings andfigure captions, 2) examine the figures (what are the axis, symbols, etc...), 3) quickly read text noting key words (usually italicised). After the lecture you should reread the entire section carefully, working through equations and making sure you understand how the text and figures are connected.

Schedule

The schedule of lectures, reading and homework assignments is listed on the course web-site: www.geology.ucdavis.edu/∼gel161 and attached (subject to modification).
There is homework due at every lecture (yes, really every lecture)!.

Grading

Homework is due in class, it is late as of 1 pm the day that it is due. I will only accept late homework up until the next class period following the due date, at a cost of 10% deduction from the points possible.

Course Grading:	
Problem Sets (15–20):	**50%**
Midterm:	**25%**
Final:	**25%**

Note, that if you don't do your homework, you can fail the class. If your life falls apart in the middle of the quarter (sometimes this happens) and you are not able to keep up with homework, studying, exams, please talk to me immediately. Do not wait until it is too late to do something about it.

Homework Policy

You are strongly encouraged to work through each of the homework problems by yourself first, before discussing it with anyone else. You can only learn the concepts you need to know by forcing yourself to work though them and figure out what you really understand. However, there is also a clear benefit to discussing a homework problem with classmates once you have attempted the problem on your own in order to get clarification on how to proceed if you get stuck part way through. Therefore, you are allowed to discuss the homework assignments with your classmates. How much you discuss is up to you. Just remember, when it gets to the exam, you will not have any friends there to help you. The homework you turn in must be your own written work, with explanations in your own words.

You are strongly encouraged to use MATLAB to do plots and other solutions for you homework. If you do your work in MATLAB, you must turn in a complete and commented MATLAB script. If you do your work in Excel, you need to turn in the excel spreadsheet and a separate page listing the equations used in each column of the excel spreadsheet with all symbols defined.

For each problem you should (as appropriate to the type of question):
1. Summary of key parameters: knowns, unknowns, equations needed.
2. Draw a picture that illustrates the problem you are solving, use a ruler and protractor if needed, label axis, vectors, etc...
3. If equations need to be solved or combined, this must be done using variables–do not plug in any numbers until you have the unknown one side of the equal sign and all the knowns on the other side.
4. After getting a solution, always ask yourself, "Does the answer make sense? Is it the right size? Does is have the right units? Is it the right sign (+/-)? If the answer to any of these question is no, but you are unable to find your error, write down why you think the answer is incorrect (e.g., units are wrong, magnitude is too big) and I will give you partial credit.

Schedule

Course schedule is subject to change, so check the website regularly. Also, homework will be posted for download on the day it is assigned. Solution sets will be posted the day on which late homework is last accepted.

Lecture	Topic	Reading	Homework
1	Introduction	Overview	HW 1
Seismic Reflection & Refraction Surveys			
2	Earthquakes, Seismic Waves, Focal Mech.	Ch 1 & 2 (all)	HW 2
3	Seismic Waves, Data Systems	Ch 3.1-3.5	HW 3
4	Seismic Reflection Surveying Basics	Ch 3.6-3.8, Ch 4.1-4.2	HW 4
5	Seismic Reflection Advanced Concepts	Ch 4.3-4.6	HW 5
6	Seismic Reflection Survey Interpretation	Ch 4.9-4.16	HW 6
7	Seismic Refraction Surveying Basics	Ch 5.1-5.2.3	HW 7
8	Seismic Refraction: Non-horizontal layers	Ch 5.2.4-5.7	HW 8
9	Seismic Refraction: Applications	Ch 5.8-5.11	HW 9
Gravity Measurements, Processing & Interpretation			
10	The Geoid & Gravity Fields	Ch 6.1-6.4	Study
11	Midterm		
12	Gravity Anomalies	Ch 6.5-6.6	HW 10
13	Processing Gravity Data	Ch 6.7-6.9	HW 11
14	Gravity Data Interpretation	Ch 6.10-6.12	HW 12
Resistivity Surveys			
15	Measuring Resistance in the Earth	Ch 8.1-8.2.3	HW 13
16	Resistivity Surveying	Ch 8.2.4-8.2.7	HW 14
17	Resistivity Data Interpretation	Ch 8.2.8-8.2.10	HW 15
Electrical Methods			
18	Induced Potential	Ch 8.3	HW 16
19	Self Potential	Ch 8.4	Study for Final
20	Final - In Class	-	