

FRANKLIN & MARSHALL COLLEGE
Department of Geosciences
ENE / PHY 237 - Physics of the Earth Fall, 2006

Instructor: Prof. Sternberg
Office: K12
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Class: MWF 10:00-10:50, W 1:30-4:20, HAC 131
Office hours: T Th, 9-11; by appt.
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Text: *Looking Into the Earth: An Introduction to Geological Geophysics*
Alan E. Mussett and M. Aftab Khan
Cambridge University Press, Cambridge, 470 p., 1997

Course objective

To gain a basic understanding of physics applied to the solid earth. (For this course, the "solid earth" will exclude the atmosphere, ionosphere, and hydrosphere, although these could be included in a broader definition of geophysics.) The emphasis will be on applications to problems of global and regional geophysics and geology, but applications to environmental geophysics will also be included. We should bear in mind that what geologists observe on the surface of the earth must be related to what we can "see" on and below the surface using geophysical techniques. I hope you will come to understand that math and physics do indeed help us to understand the nature of the earth. In the words of the great geophysicist Sir Harold Jeffreys, "If geophysics requires mathematics for its treatment, it is the Earth that is responsible, not the geophysicist."

Grading

Homework	25 %
Labs	10 %
Lab writeup	10 %
Exam 1	15 %
Exam 2	15 %
Case study	5 %
<u>Final exam</u>	<u>25 %</u>
SUBTOTAL	105%
Lowest	-5%
TOTAL	100%

Problems

Problems from the text or my personal collection are assigned for nearly every class. These will be collected and graded. If you have had significant help/advice on an assignment, you must acknowledge it on the assignment. Solutions will be provided.

Exams

There will be two hourly exams covering lecture, text and lab material, but the emphasis will be on solution of problems. The questions will be similar to the homework problems and the proofs covered in class. There are generally three problems and one derivation on my exams. There will be a cumulative open-book final exam.

Lab Assignments

Lab exercises will emphasize the *doing* of geophysics. Lab work will sometimes be done in groups. The paper on the vertical gradient of gravity lab will be a formal lab report. . Guidelines for scientific writing will be made available. Shorter write-ups may be done for other labs. The grading assigned to the lab projects is roughly proportional to their difficulty and the effort required to complete them

Case Study

Students will make oral reports using PowerPoint on the case studies given at the end of the text.

Extensions

Homework is due in my mailbox by 4:30 the day of class. This allows for you to ask questions in class the day homework is due. Late penalties will be assessed. Once a graded assignment is returned, it will no longer be accepted for late credit.

Extensions of due dates for the lab assignments may be granted if you talk to me before the due date. This is to allow for emergencies, or the possibility that you will have multiple major assignments from different courses due on the same day. Extensions will normally be for only one or two days.

Class attendance

Lecture attendance is expected. After three unexcused absences, your course grade will drop by one percentage point for each missed class. You are required to attend lab. Unexcused absences from lab will subtract 1/3 of a letter grade per absence off your final course grade. Excused absences must be verified by the infirmary, the Dean of Students office, or athletics department.

CLASS	DATE	TOPIC	READING	TOPIC	
1	W	8/30	Course introduction	ch. 1, ch. 19	
2	F	9/1	Gravity	8.1-8.3	
3	M	9/4	Free-air anomaly	8.6	
4	W	9/6	Bouguer anomaly	8.6	Vertical gradient of gravity
5	F	9/8	Anomaly modeling - spheres	8.4	8.5
6	M	9/11	Anomaly modeling - slabs	8.4	
7	W	9/13	Isostasy	9.1.1-9.1.4	Vertical gradient interpretation
8	F	9/15	Isostasy	9.1.5-9.4	
9	M	9/18	Shape of the Earth	9.5	
10	W	9/20	Gravity applications		Gravity modeling
11	F	9/22	Magnetism	10.1.1	ch 2, 8.7-8.10
12	M	9/25	EXAM 1		
13	W	9/27	Magnetic elements	10.1.2	Magnetic elements
14	F	9/29	Magnetic field	10.1.2-10.1.3	11.1.1-11.1.2
15	M	10/2	No class (YK)		
16	W	10/4	Magnetization	10.3,10.6,11.4 11.2-11.3,11.5-	Magnetic survey (weekend?)
17	F	10/6	Magnetic anomalies	11.8	11.1.3-11.1.4
18	M	10/9	Paleomagnetism	10.2.1,10.4	
19	W	10/11	Secular variation		Data reduction
20	F	10/13	Reversals	10.5	
			FALL BREAK		
21	W	10/18	Paleomagnetic poles	10.2.2-10.2.3	Paleomagnetism 1
22	F	10/20	No class (GSA)		
23	M	10/23	EXAM 2		
24	W	10/25	Elasticity	Box 4.1	Paleomagnetism 2
25	F	10/27	Seismic waves	4.1,6.5	
26	M	10/30	Seismic waves	4.5.2,5.7	
27	W	11/1	Refraction	4.4.1 4.3,4.4.2-	Field geophysics (weekend)
28	F	11/3	Earth structure	4.4.3,4.5.1	
29	M	11/6	Earth structure	4.5.3-4.6	
30	W	11/8	Earthquake location	5.1-5.2	F&M seismograms
31	F	11/10	Fault plane solutions	5.3-5.4	4.2
32	M	11/13	Earthquake size	5.5,5.8,5.9,Box5.2	
33	W	11/15	Seismotectonics	5.6	Travel time curves
34	F	11/17	Earthquake damage	5.10	
35	M	11/20	Refraction seismology	6.1	
			THANKSGIVING		
36	M	11/27	Refraction seismology	6.6-6.7	
37	W	11/29	Reflection seismology	7.1-7.2	Earthquake magnitudes
38	F	12/1	Reflection seismology	7.3-7.6	
39	M	12/4	Reflection seismology	7.7-7.12	
40	W	12/6	Plate tectonics	20.1-20.4	Case studies
41	F	12/8	Plate tectonics	20.5.1,20.6-20.9	
		TBA	EXAM		

