

USC Geology 440 Syllabus – Spring 2016

Introduction to Geophysics

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Lectures:	Tuesday and Thursday 11– 12:20 pm	ZHS 200	
Discussion:	TBA		
Textbook:	none required, lecture notes. Recommended: Lowrie, <i>Fundamentals of Geophysics</i> , Cambridge U Press, 2 nd edition Fowler, <i>The Solid Earth: An introduction to Global Geophysics</i> , Cambridge U Press, 2 nd edition		

Abstract: Introductory geophysics class that covers plate tectonics, magnetic and gravity fields, earthquakes, seismic waves, reflection and refraction seismics, heat transport, mantle convection, and deep Earth structure.
Prerequisite: MATH 126. *Corequisite:* 1 from (PHYS 135B or PHYS 152), or permission of instructors.

Lecture Topics

	Date	Instructor
I. Earth as a Gravitational Object in Space (4 lectures)		
1 – Introduction, origin and age of the Earth, 1D structure Reading: Lowrie, chap. 1	01/19	TWB/TJ
2 – Gravitational potential of a sphere, spherical harmonics Reading: Lowrie, 2.4.1-2.4.5	01/21	TWB
3 – MacCullagh's formula, geoid, precession, Chandler wobble Reading: Lowrie, 2.4.1-2.4.5	01/26	TWB
4 – Gravity anomalies Reading: Lowrie, 2.5.1-2.5.5.3	01/28	TWB
Examination #1	02/02	(TWB)
II. Seismic Waves (6 lectures)		
5 - Elasticity	02/04	TJ
6 - The 1D Elastic Wave Equation	02/09	TJ
7 - Body Waves, Surface Waves	02/11	TJ
8 - Reflection, Refraction, Mode Conversion of Seismic Waves	02/16	TJ
9 - Structure of the Earth's Interior from Seismic Waves.	02/18	TJ
10 - Inferring Composition of the Earth's Interior	02/23	TJ
Examination #2	02/25	(TJ)
III. Earth's Magnetic Field (3 lectures)		
11 - Basic Equations of Electricity and Magnetism	03/01	TWB

Earth's Dipole Field and Earth's Non-Dipole Field		
12 - Reversals of Earth's Dipole Field	03/03	TWB
Generation of Earth's Magnetic Field		
13 - Paleomagnetism and its Application to Plate Tectonics.	03/08	TWB

Examination #3 **03/10** (TJ)

Spring Break (no lectures on 03/15, 03/17, and 03/22)

IV. **Heat Flow** (3 lectures)

14 - Basic Heat Flow Equations	03/24	TJ
15 - Radiogenic Heat Sources in Rock	03/29	TJ
Measuring Heat Flow at Earth's Surface		
Reduced Heat Flow – Accounting for Near-Surface Heat Sources		
16 - Temperatures in the Earth's Lithosphere and Interior	03/31	TJ

Examination #4 **04/05** (TJ)

V. **Convection in the Earth's Interior** (4 lectures)

17 – Isostasy, basic fluid dynamics, and post-glacial rebound	04/07	TWB
18 - Linear stability analysis for Rayleigh Benard	04/12	TWB
19 - Boundary layers analysis	04/14	TWB
20 - Style of mantle convection – plumes and plates	04/19	TWB

Examination #5 **04/21** (TWB)

Grading:

Five Examinations @ 100 points each	500 pts.
Homework Assignments	200 pts
TOTAL POSSIBLE POINTS	700 pts

Grading will be on a curve, however, the following grades are guaranteed:

90 – 100% = A; 80 – 90% = B; 70 – 80% = C

Improvement during the term, a pleasant attitude and small acts of kindness toward the TA will be taken into account in assigning a final grade.