

EAS 3610/8803: Introduction to Geophysics

THE GEORGIA INSTITUTE OF TECHNOLOGY

August 17 - December 11, 2015

Mon., Wed., Fri., 9:05 - 9:55 am in ES&T L1175

Instructor: Andrew Newman, anewman@gatech.edu, office:404-894-3976, ES&T 2254

<http://geophysics.eas.gatech.edu/classes/Geophysics>

General

This course is an introduction to methods used to visualize and understand the history, shape, mechanical structure, and dynamics of the solid-earth system. We will discuss how geophysical tools, including seismology, gravity, magnetism, heat flow, geochronology, and geodesy, are used to understand the age, whole-earth, and near-surface structure, and to quantify the kinematics and dynamics of plate tectonics.

Prerequisites: Physics 2212: *Introduction to Physics I* and EAS 2600: *Earth Processes*

Instructor Office Hours: ES&T 2254, Wed. 1 pm - 2 pm, and Thurs 1:30 - 2:30 pm, or by appointment.

Required Text: Fowler, C.M.R., *The Solid Earth: An Introduction to Global Geophysics*, 2nd Edition, Cambridge University Press, 685 pp., 2005.

Class Communication: You will occasionally receive class emails via your GT account. Because this information may not be communicated in class, read messages identified as [EAS: Geophysics]. In emailing me for class, please add [EAS: Geophysics] to the subject and identify yourself by name in the message in case your account name is enigmatic.

Evaluation

Undergraduate section: Your grade is based on homework (30%) and 3 exams (70%).

Graduate Section: Your grade is based on homework (30%), 3 exams (60%), and an oral presentation (10%).

The Undergraduate and Graduate sections will be graded and possibly curved independently.

Homework: Homework will be assigned approximately every 2 weeks and will be due one week from assignment. Graduate students will be assigned additional problems in each of the assigned problem sets. Late homework will not be accepted without prior authorization. See the academic honesty section (below), for information on working together.

Exams: There will be three exams, 2 mid-terms administered during class time, and 1 final exam administered during finals. The exams are equally weighted, with the lowest score being dropped. Thus, if you are satisfied with your performance after the second mid-term exam you do not need to take the final. While the first two exams will focus on material covered since the previous exam, the final exam will be comprehensive, and ~50% longer. Missed exams will receive zero credit and the first would be considered your dropped exam.

Academic Honesty

General: It is expected that all students are aware of their individual responsibilities under the Georgia Tech Academic Honor Code, which will be strictly adhered to in this class (<http://www.honor.gatech.edu/>).

Problem Sets: Students are encouraged to work together on developing solutions to problem sets; however, the solutions that are turned in must be the work of each individual. Include the name of individuals consulted for each problem that you sought aid in answering (including me).

Exams: Reference to texts or other documents during exams is strictly forbidden. The use of electronic devices (e.g. cellular phones, computers, etc.) other than non-programmable calculators during exams and quizzes is not allowed.

Course Outline

This is an approximate outline of topics and timing and is subject to change throughout the semester.

Week	Date	Topic	Exam
1	8/17 - 8/21	Introduction: - Why Geophysics? - Math review - Geophysical approximation	
2-3	8/24 - 9/4	Plate tectonics and geodynamics - The geometry and kinematics of plate motions - Survey and characterization of plate motions - Types and importance of plate boundaries - Plate reconstructions and dating - Paleomagnetism and polar wander - Modern measurements of plate motions - Mechanisms and consequences of plate tectonics	
4-5	9/09 - 9/18	Seismology: Earth imaging and earthquake characterization - Seismic waves - Earthquake seismology - Seismic imaging: reflection, refraction, and tomography - The seismometer	
6-7	(no class 9/7) 9/21 - 9/30	(<i>Labor Day</i>) Earth gravity - Mass distribution and relation to gravity - Geopotential and the shape of the earth - Gravity anomalies - The gravimeter - Isostasy	
8-9	10/2 10/5 - 10/16	(<i>Friday</i>) Geochronology: - Geologic time: from relative to absolute - Principles of geochronology - Modern methods - Estimations of the Earth's age	Mid-term 1
10-11	(no class 10/12) 10/19 - 10/30	(<i>Fall break</i>) Internal heat engine: - Sources of Earth's heat - Mechanisms of heat transport - Global heat flow and heat loss - Tapping Earth heat: geothermal energy	
12-13	11/2 - 11/13	Deep Earth structure: - Internal structure from seismology - Planetary inertia and moment - Mantle convection - The geodynamo	
14	11/16 - 11/20	Lithospheric structure: - Oceanic lithospheric formation - Oceanic lithospheric destruction - Growth of continents - Formation of continental basins	
15	11/23 (no class 11/27)	(<i>Monday</i>) (<i>Thanksgiving Break</i>)	Mid-term 2
16	11/30 - 12/04	Course Wrap-up: Emergent geophysics <i>Graduate Student Presentations on Geophysical Research</i>	
17	12/11 - 8-11 a.m.	(<i>Friday</i>)	Final