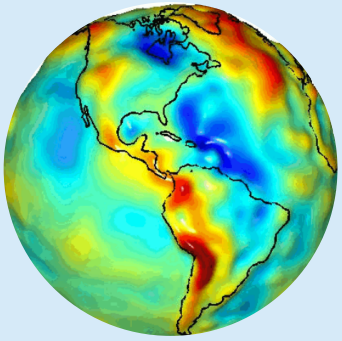

Introduction to Geophysics

EAS 3610/8803

Instructor Info

Winnie Chu

Office hrs: Email appointment

Office: Ford ES&T 3240

Canvas link

winnie.chu@eas.gatech.edu

Course Info

Prereq: PHY 2211

Mon & Weds

9:30 - 10:45 a.m.

Class Loc: Ford ES&T L1117

Overview

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.

Learning Objectives: Students completing this course will have a strong understanding of the following:

- Become familiar with the common jargon and terminology used in Geophysics.
- Improve your understanding fundamental physical laws and concepts that describe the Earth's surface processes and internal structure
- Gain knowledge on the inner-working of common geophysical methodology.
- Practice skills regarding geophysical data analysis and data interpretations through lab exercises.

Material

Required Text:

Lowrie, William. *Fundamentals of Geophysics*. 2^{nd} Ed., Cambridge Univer- sity Press, Oct. 2007, ISBN-10: 0521675960. GT library ♢ Amazon

Recommended Text

1. Lowrie, William. *A Student's Guide to Geophysical Equation*, 1st Ed., Cambridge University Press, May. 2011, ISBN-10: 1107005841.
   - A complementary, handy textbook to our course textbook. It contains information on the essential mathematical background and derivations of geophysical equations.

2. Lillie, Robert. *Whole Earth Geophysics: An Introductory Textbook for Geologists and Geophysicists*, 1^{st} Ed., Pearson, May, 1998, ISBN-10: 0134905172.
   - A more basic introductory to geophysics textbook. The material is slightly out-of-date compared to our textbook, but nonetheless it provides a good, alternative entry-level background to our lectures.

3. Fowler, C.M.R, *The Solid Earth: An Introduction to Global Geophysics*, 2^{nd} Ed., Cambridge University Press, Dec. 2004, ISBN-10: 0521893070.
   - A classic reference textbook with more quantitative and advance explanation gear toward graduate student level. If you want to own a geophysics textbook for graduate school, this will be the one to have.

Grading Scheme

The proportion that each evaluation component contributes toward the final grade are as follow:

40%	**Homework**
40%	**Lab Worksheets**
20%	**Final Exam**

Grades will follow the standard scale: Letter Grade: A: 90 - 100%, B: 80 - 89.99%, C: 70 - 79.99%, D: 60 - 69.99%, F: < 60%.

Satisfactory/Unsatisfactory: S: >70%, U < 70%.

Homework: Homework will be assigned about every 3 weeks and will be due one week from the assignment unless otherwise noted. Late homework will not be accepted without the prior consent of the instructor. See the academic honesty section (below), for information on working together.

Lab: There will be approximately 4 in-class labs, which you will be required to turn in a "lab report" in one week following (unless otherwise noted). During the in-class labs, you can either work individual or as a group, but the report will always be graded individually.

Final Exam: There will be a final exam during finals week. Final is scheduled for December 11th, 8 - 10:50am and will take place at our usual classroom.

Note: Do not trust "final grades" as reported automatically by Canvas. Please follow the above guidelines when calculating your own scores. If you're unsure, please check with the grader.

Late Submission Policy

Make-up exams or assignments will only be allowed for students who have a substantiated excuse approved by the instructor *at least 24 hours before the due date*.

Academic Integrity

Homework & Labs: Students are encouraged to work together on developing solutions to problem sets; however, the solutions/answers that are turned in must be the work of each individual. Include the name of individuals consulted for each problem that you sought help in answering.

Final Exam: You are forbidden from sharing answers during, or otherwise while the exam is still open for others to take. If there is substantial evidence of such, you will be reported to the Dean of Students, receive a zero (0%) on the exam and that score will not be dropped in determining your final grade.

Student-Faculty Expectations

At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgment, and responsibility between faculty and students. Please see the Student Handbook Code of Conduct for some basic expectation that we should have of each other. Ultimately, we should respect each others time, hard work, and quest for knowledge. We all should strive to build an environment for cordial and effective interaction.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services at (404)894-2563 or https://disabilityservices.gatech.edu, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Class Schedule

MODULE 0: Introduction

Lecture 1	Course Overview	

MODULE 1: Plate Tectonics

Lecture 2	Introduction to Plate Tectonics Continental drift & Sea-floor spreading Earth structure & Division	Lowrie, Ch. 1
Lecture 3	Types of plate boundaries Hotspot	Lowrie, Ch. 1.1
Lecture 4	Forces driving plate tectonics Triple Junctions	Lowrie, Ch. 1.2

MODULE 2: Seismology

Lecture 5	Introduction to Seismic Theory Elastic properties of Earth's material Stress & strain diagram	Lowrie, Ch. 3.1 - 3.2
Lecture 6	Seismic wave propagation Refraction theory Seismic shadow zones	Lowrie, Ch. 3.3, 3.6
Lecture 7	Near-surface seismic Travel-time curves	Lowrie, Ch. 3.7
Lab 1	IRIS: Imaging Earth with seismic waves	Web resource (link)

MODULE 3: Earthquakes

Lecture 8	Introduction to Earthquakes Earthquakes and human society Internal structure of the Earth	Lowrie, Ch. 3.5
Lecture 9	Body & surface waves Three-component seismograms Earthquake magnitude and intensity	Lowrie, Ch. 3.3 - 3.4
Lecture 10	Fault plane solutions Principle stresses	Lowrie, Ch. 3.5

	Focal mechanisms	
Lab 2	Stereonet: Visualize fault planes on 2-D	Web resource (link)
MODULE 4: Ground Deformation		
Lecture 11	Introduction to Earth Deformation	
	Ground and satellite/airborne tools	
Lecture 12	Plate motions	
	Earthquake faulting	
	Volumetric sources (hydro/petro/volc.)	
Lab 3	Working with GNSS data	
MODULE 5: Magnetism		
Lecture 13	Introduction to Magnetic Field	Lowrie, Ch. 5 and web resource (link)
	Geomagnetism	
	Magnetic fields of the Sun, Moon, and planets	
Lecture 14	Magnetic anomalies	Lowrie, Lowrie, Ch. 5.5
	Magnetic surveying	
MODULE 6: Electromagnetic Methods		
Lecture 15	Basic concepts of EM	Web resource (link)
	Common EM methods	
	Transient EM techniques	
Lecture 16	Electric conductivity and resistivity	Web resource (link)
	Resistivity interpretation	
Lab 4	Working with TDEM data from Malaspina Glacier	Jupyter Notebook link
MODULE 7: Gravity		
Lecture 17	Newton's law of gravity	Lowrie, Ch. 2.1 - 2.3
	Gravity acceleration	
	Gravity correction	
Lecture 18	Geoid and potential	Lowrie, Ch. 2.4 - 2.6
	Factors affect gravity and geoid	
	Examples from Earth, Venus and Mars	