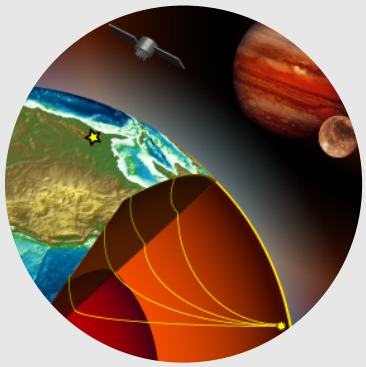

Introduction to Geophysics

EAS 3610/8803

Instructor Info

Winnie Chu

Office hrs: After class or by appointment

ES&T 3250 or online

http://canvas.gatech.edu

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Course Info

Prereq: PHY 2212 & EAS 2600

Mon & Wed

9:30 - 10:45 am

ES&T L1125

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:*

- The common jargon and terminology used in Geophysics
- The instrumentation used in each of the geophysical methods
- The fundamental physical laws and concepts that describe the Earth's surface processes and internal structure
- The interpretation of geophysical data using analytical and numerical methods with an understanding of their uncertainty and non-uniqueness

Reading Material

Required Text:

Lillie, Robert. *Whole Earth Geophysics: An Introductory Textbook for Geologists and Geophysicists*, 1st Ed., Pearson, May, 1998, ISBN-10: 0134905172.

Recommended Text:

1. Lowrie, William. *Fundamentals of Geophysics*. 3rd Ed., Cambridge University Press, Jan. 2020, ISBN-10: 1108716970.
   - *An excellent, more advanced textbook that offers detail overview of the topics covered in this class*

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

3. Fowler, C.M.R, *The Solid Earth: An Introduction to Global Geophysics*, 2nd Ed., Cambridge University Press, Dec. 2004, ISBN-10: 0521893070.
   - *A "classic" reference textbook, but it is more advance than the first two texts*

Grading Scheme

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

Homework **30%**

Quizzes **50%**

Final exam **20%**

Letter Grade: A: $\geq$ 90%, B: 80 - 89%, C: 70 - 79%, D: 60 - 69%, F: $<$ 60%
Satisfactory/Unsatisfactory: S:$\geq$ 70%, U $<$ 70%

Evaluation

Homework:
Homework will be assigned every month and due two weeks from assignment. Late homework will not be accepted without prior consent of the instructor. See the academic honesty section (below), for information on working together.

Quizzes:
There will be bi-monthly quizzes administered during class time. There are five quizzes in total, each takes approximately 20 minutes. They will cover the material of the previous module and they will be equally weighted. Missed quizzes will receive zero credit. Consult the course outline throughout the semester for planned quiz dates.

Exam:
There will be a 1.5 hours long final exam during finals week. The exam will the material covered from modules 1 to 6. It will consist of five questions but you are required to answer two of them. If you answer more than two questions, I will take your highest two scores. Consult the course outline for planned exam date and venue.

Diversity, Inclusivity, and Student-Faculty Expectations

As a member of the Georgia Tech community, I am committed to creating a learning environment in which all of my students feel safe and included. I welcome and encourage your constructive feedback and/or suggestions for improvement. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. Please see http://catalog.gatech.edu/rules/22/ for some basic expectations that we should have of each other.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, please contact the Office of Disability Services http://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.

Academic Integrity

Plagiarism is strictly forbidden. Plagiarism is the submission of material that is wholly or substantially identical to that created or published by another person or persons, without adequate credit notations indicating authorship. It is expected that all students are aware of their individual responsibilities under the GT Academic Honor Code, which will be strictly adhered to and is central to the ideals of this course.

Homework:
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 aid in answering.

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

Course Schedule

The schedule below serves as a reference point and will likely change as the semester progresses.

** Lillie, Whole Earth Geophysics, 1st Ed.
† Lowrie, Fundamentals of Geophysics, 3rd Ed.

MODULE 1: Plate Tectonics		RECOMMENDED READING
Aug 25	Division of the Earth	**Ch. 2, p.14-18
	Type of plate boundaries	**Ch. 2, p.21-29
Aug 30	Euler's theorem & Polar wander	†Ch.2.9, p.41-43
	Modern measurements of plate tectonic	**Ch. 2, p.37-39
Sep 1	**Review of Module 1**	
MODULE 2: Seismic Waves		
Sep 6	**Quiz on Module 1**	
	Elastic waves	**Ch. 3, p.45-51
Sep 8	Travel-time curves	**Ch. 3, p.52-57
	Seismic ray theory	**Ch. 3, p.57-68
Sep 13	Seismic refraction method	**Ch. 4, p.73-87
	Reflection imaging	†Ch.6.3.5, p.164-169
Sep 15	**Review of Module 2**	
Sep 20	**Quiz on Module 2**	
	Exercise: Travel-time curves	
MODULE 3: Earthquake Seismology		
Sep 22	Elastic rebound theory	**Ch. 7, p.185-193
	Seismogram	**Ch. 7, p.194-197
Sep 27	Focal mechanism	**Ch. 7, p.197-205
Sep 29	Deep earth structure from seismology	**Ch. 7, p.205-218
Oct 4	**Review of Module 3**	
Oct 6	Exercise: Focal Mechanism	
Oct 11	FALL BREAK	

MODULE 4: Heat Flow		
Oct 13	**Quiz on Module 3**	
	Sources of Earth's heat	**Ch. 10, p.311-314
	Mechanisms of heat transport	**Ch. 7, p.315-317
Oct 18	Global heat flow	†Ch.9.7 & 9.8, p.267-275
Oct 20	Mantle convection	†Ch.9.9 & 9.8, p.280-285
Oct 25	**Review of Module 4**	
MODULE 5: Magnetism		
Oct 27	Magnetic ordering	**Ch. 9, p.284-293
	Earth's magnetic field	†Ch. 11.2, p.328-332
Nov 1	**Quiz on Module 4**	
	Paleomagnetism	**Ch. 9, p.297-308
Nov 3	Origin of magnetic field	†Ch. 11.2, p.332-334
Nov 8	**Review of Module 5**	
MODULE 6: Gravity		
Nov 10	Gravity field	**Ch. 8, p.224-225
	Shape of the Earth & Geoid	†Ch. 3.4, p.68-76
Nov 15	**Quiz on Module 5**	
	Gravity anomalies & corrections	**Ch. 8, p.225-237
Nov 17	Isotasy	**Ch. 8, p.237-243
Nov 22	**Review of Module 6**	
Nov 24	STUDENT RECESS	
Course Wrap-up		
Nov 29	**Review of Modules 1-6**	
Dec 1	No Class/Study Time	
Dec 6	No Class/Study Time	
Dec 8-16	**Final exam (TBD)**	