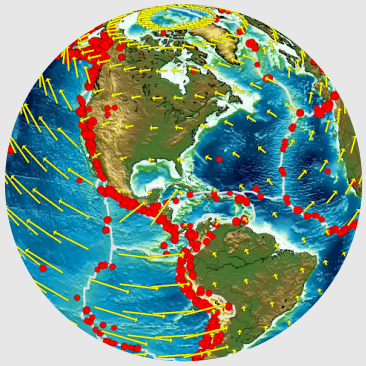

Geodynamics

EAS 4312/6312

Instructor Info

- Samer Naif
- Office hrs by appointment
- Online
- http://canvas.gatech.edu
- snaif@eas.gatech.edu

Course Info

- Prereq: EAS 3610
- Mon & Wed
- 3.30–4.50p
- Online lectures

Overview

This course is a quantitative discussion of the physical properties of materials and dynamic processes driving the solid Earth. We will closely follow *Geodynamics* by Turcotte & Schubert, in covering topics in stress and strain, elasticity and flexure, heat transfer, fluid mechanics, rock rheology, and crustal faulting as mechanisms and consequences of plate tectonics.

Learning Objectives

- Develop a quantitative understanding of plate tectonics and its driving forces
- Define the physical properties and internal structure of the solid Earth
- Describe the observations underpinning our knowledge of the solid Earth
- Solve deformation, heat transfer, and fluid flow problems in the solid Earth

Reading Material and Software

Required Text

Turcotte, D.L. & G. Schubert. *Geodynamics, 3rd Edition*. Cambridge University Press, 623 pp., 2014.

Reference Texts (no need to purchase)

Stacey, F.D. & P.M. Davis. *Physics of the Earth*. Cambridge University Press.

Recommended Software

GeoMapApp (http://www.geomapapp.org)

Google Earth Pro (https://www.google.com/earth/versions/)

GMT (https://www.generic-mapping-tools.org)

Matlab and/or *Python*

Other

Any required journal articles and book chapters will be provided on Canvas.

Grading

Students enrolled in EAS-4312 will be evaluated independently of those enrolled in EAS-6312. Grades will be based on:

Homework	30%
Quizzes	20%
Midterm Project	20%
Final Project	30%

Letter grade: A $\geq$ 90%; B = 80–89%; C = 70–79%; D = 60–69%; F $<$60%.

Satisfactory/Unsatisfactory: S $\geq$ 70%.

Evaluation

Homework

Homework will be assigned every 2–3 weeks and due the following week. Late homework will not be accepted without prior consent of the instructor. Students enrolled in EAS-6312 can expect extended problem sets that require more advanced mathematics and/or numerical solutions.

Quizzes

There will be a few brief "quizzes" on the reading material during the course. Quizzes will be administered through Canvas.

Midterm and Final Projects

Each project will require you to solve a problem on a topic covered during the first & second half of the course, write up your results in journal form (e.g., *GRL*), and give an AGU style presentation summarizing your findings to the class. For the midterm project, in lieu of solving a problem, students enrolled in EAS-4312 will have the option to write up and present a scientific literature review on a comparable topic approved by the instructor. Grading will be based on the quality of your submitted work (60%) and oral presentation (30%), and your participation during others' presentations (10%).

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 this link 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, contact the Office of Disability Services at 404-894-2563 or online at `http://disabilityservices.gatech.edu`, as soon as possible, to make an appointment to discuss your special needs and to obtain an accommodation letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Academic Integrity

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 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 and Projects

All other assignments must be entirely your own work, thus there should be no copying from others in class.

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 (as defined by the Georgia Tech Academic Honor Code).

Course Schedule

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

* assigned reading in course textbook
† assigned reading in *Advanced Geodynamics* by D.T. Sandwell (will be made available on Canvas)

MODULE 1: Plate Tectonics, Plate Kinematics, and Heat Transfer

Jan 18	NO CLASS	
Jan 20	Course Overview & Plate Tectonics I	Read: *Ch 1.1–1.14
Jan 25	Plate Tectonics II	
Jan 27	Plate Kinematics	Read: †Ch 3
Feb 1	Heat Conduction	Read: *Ch 4.1–4.8
Feb 3	Fourier Transforms	Read: †Ch 2
Feb 8	Cooling of Oceanic Lithosphere	Read: *Ch 4.12–4.16 and †Ch 5.1
Feb 10	Plate Cooling Models I	Read: *Ch 4.17, 4.22–4.23 and †Ch 5.2–5.6
Feb 15	Plate Cooling Models II	
Feb 17	Review	

MODULE 2: Stress, Strain, and Elastic Deformation

Feb 22	MIDTERM PRESENTATIONS	
Feb 24	Stress & Strain in Solids I	Read: *Ch 2
Mar 1	Stress & Strain in Solids II	
Mar 3	Elastic Deformation I	Read: *Ch 3.1–3.8
Mar 8	Elastic Deformation II	Read: †Ch 6
Mar 10	Elastic Deformation III	Read: *Ch 3.9–3.18
Mar 15	Flexure w/ Fourier Transforms	Read: †Ch 8
Mar 17	Review	

MODULE 3: Fluid Mechanics, Rheology, and Faulting

Mar 22	Pipe Flow & Stream Functions	Read: *Ch 6.1–6.4, 6.7–6.9
Mar 24	NO CLASS	
Mar 29	Postglacial Rebound	Read: *Ch 6.10
Mar 31	Mantle Convection	Read: *Ch 4.28, 6.18–6.19
Apr 5	Mantle Rheology I	Read: *Ch 7.1–7.4
Apr 7	Mantle Rheology II	Read: *Ch 7.5–7.6
Apr 12	Crustal Rheology	Read: *Ch 7.9–7.10
Apr 14	Viscoelasticity	
Apr 19	Faulting I	Read: *Ch 8.1–8.9
Apr 21	Faulting II	
Apr 26	Overview: Driving Forces of Plate Tectonics	
May 5	FINAL PROJECT PRESENTATIONS	2.40–5.30pm