

EAS 4312/6312: Geodynamics

THE GEORGIA INSTITUTE OF TECHNOLOGY

January 9 - April 19, 2018

Tues., Thurs. 3:00 - 4:15 pm in Cherry Emerson 322

Instructor: Andrew Newman (anewman@gatech.edu)

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

General

This course is a quantitative discussion of the physical properties of earth 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.

Office Hours: Hours will be held in my office, ES&T room 2254, Wednesdays from 1:30-3:30 pm, or by appointment. I will make every effort to be accessible by appointment, as I understand schedules are tight/variable.

Required Text:

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

Referenced Text; no need to purchase:

- Kearey, P. & F.J. Vine, Global Tectonics, Blackwell Publishing, 333 pp., 1996.
- Stein, S.A., & M. Wysession, An Introduction to Seismology, Blackwell Publishing, 498 pp., 2003.

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 <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.

Student-Faculty Expectations: At Georgia Tech we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty and students. 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. Please see <http://catalog.gatech.edu/rules/22/> for some basic expectations that we should have of each other.

Class Communication: You will occasionally receive class information via email to your prism account. Because this information may not be communicated in class, you should be sure to read messages identified as [EAS: Geodynamics]. In emailing me for class, please add [EAS: Geodynamics] to the subject line and identify yourself by name in the message since not all prism accounts clearly identify the email's author.

Evaluation

Students enrolled in EAS-4312 will be evaluated independently of those enrolled in EAS-6312. Those enrolled in EAS-6312 will be required to perform all homework assignments and exams as students in EAS-4312, as well as additional homework assignments, exam questions and project requirements.

Course Grade: For students enrolled in:

EAS-4312: Grade is based on homework (30%), exams (60%), and project (10%).

EAS-6312: Grade is based on homework (20%), exams (60%), and project (20%).

- Letter Grade: $A \geq 90\% > B \geq 80\% > C \geq 70\% > D \geq 60\% > F$
- Satisfactory/Unsatisfactory: $S \geq 70\% > U$

Homework: Homework will be assigned approximately every 3rd week and will be due one week from assignment. I will not accept late homework without authorizing such beforehand. See the academic honesty section (below), for information on working together. Students enrolled in EAS-6312 can expect extended homework requirements that include reporting on results from scientific literature.

Exams: There will be two equally weighted exams that will be administered during normal class hours. Each exam will focus on material covered since the previous exam, however knowledge of previously covered material will be expected to fully complete any exam. Missed exams will receive a score of zero unless approved and rescheduled beforehand. Students enrolled in EAS-6312 will be responsible for additional in-depth questions during exams.

Project: All students will review and present on a topic of your choosing in Geodynamics using relevant research and review articles from peer-reviewed scientific literature (not *National Geographic* or *Scientific American*, but journals like *Science*, *Nature*, *Journal of Geophysical Research*, *Earth and Planetary Science Letters*, etc. . .). In order to receive full credit for the project you must read and synthesize no less than three papers on the subject. You will, however have the opportunity to receive 10% extra credit on the project if you 1) outline a new approach to addressing an unresolved problem; 2) uniquely solve a problem; 3) perform unique numerical calculations to determine parameter sensitivities and/or feasibility of measurement; or 4) perform a physical analog or unique computational experiment to test hypothesis.

All students will present a 15 min. AGU-style talk (12 min. talk + 3 min. questions). Students enrolled in *EAS-4312* will be graded on the presentation (80%), and participation during others' presentations (20%). Students enrolled in *EAS-6312* will additionally be responsible for a manuscript written up in journal form suitable for *Geophysical Research Letters* (GRL). For guidelines on document preparations for GRL submissions go to:

<https://publications.agu.org/author-resource-center/text-requirements>.

Grading of your project will be on the quality of the manuscript (40%), presentation (40%) and participation during others' presentations (20%).

Course Outline

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

| Week | Date | Topic | Chapter | Exam |
|-------|--------------------|---|---------|---------------|
| 1 | Jan 9 - 11 | Introduction to Plate Tectonics, Geodynamics and mathematical approximation | 1 | |
| 2-3 | Jan 16 - 25 | Stress and Strain in Solids | 2 | |
| 4-6 | Jan 30 - Feb 15 | Elastic Deformation | 3 | |
| 7-9 | Feb 20 - Mar 8 | Heat Transfer | 4 | |
| 8 | Mar 1 | | | Exam 1 |
| 10,12 | Mar 13 - 29 | Fluid Mechanics | 6 | |
| 11 | <i>Mar 19 - 23</i> | <i>Spring break</i> | | |
| 13-14 | Apr 3 - 10 | Rock Rheology and Faulting | 7,8 | |
| 14-15 | Apr 12 - 17 | Project Presentations | | |
| 15 | Apr 19 | | | Exam 2 |

Academic Honesty

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

Problem Sets: 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 (including me).

Project: Each student is expected to develop her/his unique project, thus there should be no copying from others in class. Plagiarism is strictly forbidden.

Plagiarism Submission of material that is wholly or substantially identical to that created or published by another person or persons, without adequate credit notations indicating the authorship (<http://honor.gatech.edu>).

Exams: All information required for exams will be supplied. Reference to texts or other documents during exams is strictly forbidden. The use of electronic devices (e.g. cell phones, smart watches, etc.) other than non-programmable calculators during exams and quizzes is not allowed.