EAS 4200/6320: Structural Geology and Continuum Mechanics

The Georgia Institute of Technology

August 19 - December 9, 2014

Lectures: Tues. and Thurs. 9:35 - 10:55 am in ES&T L1175
Lab: Fri. 12:05 - 2:55 pm in ES&T L1116

	Instructor	*Instructor*	*Teaching Assistant*
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`http://geophysics.eas.gatech.edu/classes/Structure`

General

Designed for Earth Science and Engineering majors and graduate students interested in applying field and theoretical methods to understand the dynamic history and state of Earth's crust. Useful for a wide range of natural and anthropogenic topics, including: plate tectonics; earthquake occurrence; landscape evolution; groundwater and petroleum reservoirs; and mineral resources.

Prerequisite Requirements:

- *Undergraduates:* Completion of EAS 2600 (*Earth Processes*).
- *Graduate Students:* Completion of an introductory Geologic Processes course.

Office Hours: Office hours will be held in our respective offices.

- Newman: Mondays from 2-3 pm, and Thursdays from 2 - 3:30 pm, or by appointment.
- Ferrier: Mondays from 2-3 pm, and Thursdays from 2 - 3:30 pm, or by appointment.
- Karakas: Tuesdays from 11 am -12 pm, and Thurdays from 1 - 2 pm, or by appointment.

Required Text:

- Fossen, Haakon, *Structural Geology*, Cambridge University Press, 463 pp., 2010.
- Allmendinger, R. W., N. Cardozo, & D. M. Fisher, *Structural Geology Algorithms: Vectors and Tensors*, Cambridge University Press, 289 pp., 2012.

Referenced Text; no need to purchase:

- Kearey, P., K. Klepeis & F. J. Vine, *Global Tectonics, 3^{rd} Ed.*, Wiley-Blackwell Publishing, 482 pp., 2009.
- Marshak, S., & G. Mitra, *Basic Methods of Structural Geology*, Prentice Hall Publishing, 446 pp., 1988.

Lab Materials: For each lab bring writing utensils (including a mechanical pencil), a notebook, *your fully charged laptop computer*, and the Allmendinger textbook.

Class Communication: You will occasionally receive class information via email to your Georgia Tech account of record through T-square. Because this information may not be communicated in class, it is your responsibility to read all such emails.

Lecture Outline

This is an approximate outline of topics and timing and is subject to change throughout the semester. Below, **F** represents the Fosson text, and **A** represents the Allmendinger et al. text.

Date	Chapter	Topic	Instructor
Aug 19 (Tu)	F: Ch 1	Introduction	Ferrier
Aug 21 (Th)	F: Ch 2	Deformation	Newman
Aug 22 (Fr)	A: Ch 2	*Lab 1: Math Review*	
Aug 26 (Tu)	F: Ch 2	Deformation	Newman
Aug 28 (Th)	F: Ch 3	Strain in Rocks	Newman
Aug 29 (Fr)	A: Ch 1	Lab 2: Illustrating Structure	
Sep 2 (Tu)	F: Ch 4,5	Stress	Newman
Sep 4 (Th)	F: Ch 4,5	Stress	Newman
Sep 5 (Fr)	A: Ch 3	Lab 3: Coordinate Transformations	
Sep 9 (Tu)	F: Ch 6,10	Rheology	Newman
Sep 11 (Th)	F: Ch 6,10	Rheology	Newman
Sep 12 (Fr)	A: Ch 4	Lab 4: Matrix Operations	
Sep 16 (Tu)	F: Ch 11	Folding	Newman
Sep 18 (Th)	F: Ch 12	Foliations	Newman
Sep 19 (Fr)	A: Ch 5	Lab 5: Tensors	
Sep 23 (Tu)	F: Ch 13	Lineations	Newman
Sep 25 (Th)	F: Ch 14	Ductile Thinning	Newman
Sep 26 (Fr)	A: Ch 6	Lab 6: Stress	
Sep 30 (Tu)	F: Ch 15	Shear Zones	Newman
Oct 2 (Th)		**Mid-term 1**	
Oct 3 (Fr)		*no lab*	
Oct 4 (Sa)		**Field Trip 1: Structural Field Mapping**	
Oct 7 (Tu)	F: Ch 7	Brittle Behavior	Ferrier
Oct 9 (Th)	F: Ch 7	Brittle Behavior	Ferrier
Oct 10 (Fr)	A: Ch 7	Lab 7: Introduction to Deformation	
Oct 14 (Tu)		*no class: Fall Break*	
Oct 16 (Th)	F: Ch 8	Faults	Ferrier
Oct 17 (Fr)	A: Ch 8	Lab 8: Small Strains	
Oct 21 (Tu)	F: Ch 8	Faults	Karakas
Oct 23 (Th)	F: Ch 9	Kinematics & Paleostress	Ferrier*
Oct 24 (Fr)	A: Ch 9	Lab 9: Large Strains	
Oct 28 (Tu)		*no class*	Ferrier
Oct 30 (Th)	F: Ch 16	Compressional regimes	Ferrier
Oct 31 (Fr)	A: Ch 10	Lab 10: Recovering Strain Histories	
Nov 4 (Tu)	F: Ch 16	Compressional regimes	Ferrier
Nov 6 (Th)	(handouts)	Geology of the Southern Appalachians	Newman
Nov 7-9(Fr-Sun)		**Field Trip 2: Southern Appalachian Tectonics**	
Nov 11 (Tu)		Field Recap.	Newman
Nov 13 (Th)	F: Ch 17	Tensile regimes	Ferrier
Nov 14 (Fr)	A: Ch 11	Lab 11: Velocity Fields	
Nov 18 (Tu)	F: Ch 18	Strike-Slip regimes	Ferrier
Nov 20 (Th)	F: Ch 21	The "Big Picture"	
Nov 21 (Fr)	A: Ch 12	Lab 12: Error Analysis	
Nov 25 (Tu)	F: Ch 21	The "Big Picture"	Ferrier
Nov 27-28 (Th-Fr)		*gobble, gobble.*	
Dec 2 (Tu)		TBD	
Dec 4 (Th)		TBD	
Dec 5 (Fr)		*no lab*	
Dec 9 (Tu 8:05 am)		**Mid-term 2**	

** TBD. Topics and timing are subject to change during the semester.*

Evaluation

Students enrolled in EAS-4200 will be evaluated independently of those enrolled in EAS-6320. Those enrolled in EAS-6320 will be required to perform all homework assignments and exams as students in EAS-4200, as well as additional laboratory exercises, field assignments, and exam questions.
For both the undergraduate and graduate sections, the grade is based on lab and field exercises (60%), and exams (40%).

Labs/Homework: Homework will be primarily assigned as a portion of the labs and field exercises. All due dates will be identified when homework is assigned, and will not be accepted if late. Unless otherwise written, all lab assignments will be due at the beginning of the following lab period. You are expected to attend all laboratory classes. If you cannot attend an individual lab for whatever reason, you will receive a zero for that assignment. Your total lab score will be based on your 10 best lab scores, and all field excercises. See the academic honesty section (below) for information on working together.

Exams: There will be two equally weighted exams. The first will be administered during normal class hours, while the second will be administered during your final exam period for this course. 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-6320 may be responsible for additional in-depth questions during exams.

Field trips: Two field trips are associated with the class. The first is a one day (Saturday) trip to NW Georgia. The latter is a weekend trip (Friday through Sunday) traveling from Atlanta, traveling through north Georgia, eastern Tennessee, the Smoky Mountains, and then through western North Carolina before returning to Atlanta. **Both trips are mandatory!**

Disabilities:

If you are a student with a documented short-term or permanent disability seeking reasonable accommodations in this course, please contact The Office of Disability Services (www.adapts.gatech.edu). For most accomodations, notification of instructors is expected within the first week of school.

Academic Honesty

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.

Problem Sets and Projects: 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 instructors). Any write-up of laboratory or field reports, should however be the work of the individual student, thus for this work there should be no copying from others in class. Finally, at any point in which you are using material you've referenced from another source, it is your obligation to appropriately reference that source. 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 [1].

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. cellular phones, computers etc.) other than non-programmable calculators during exams and quizzes is not allowed.

[1] as defined by the Georgia Tech Academic Honor Code (`http://www.honor.gatech.edu/`)