Geodynamics
GEOS 620: Fall 2008

Instructor: Erin Pettit
Tel: 474-5389
pettit@gi.alaska.edu (email is better for contacting me)
Offices: 338 Reichardt and ? in the GI (4th floor)
Office Hours: by appointment

Days and Time: Tuesday and Thursday 3pm-4:30pm.

Classroom: 319 IARC except on Nov 18 (room TBA)

Course Description: In this course we will study the fundamentals of continuum mechanics and rheology of materials as they apply to geodynamic problems in the Earth sciences.

Website: http://gi.alaska.edu/~pettit/geodynamics
This site will contain the most up dated schedule – due dates for all assignments will be posted here. I will also post links, readings, assignments, problems set solutions, etc.

Books: I will assign readings and problems from Turcotte and Schubert, "Geodynamics" 2nd Edition; however the course will not follow the book. I will also assign journals articles and other readings. There will be one copy of this book and supplementary books on reserve in the GI library.

Electronic Reserves: Journal Articles that are restricted to library use will be posted on the electronic reserves for you to download. Click here to go to Electronic Reserves. I did not put a password on the system.

Homework: I will assign a weekly problem set or related assignment, which will be due at the beginning of class on Wednesdays/Thursdays. Late assignments, 5 points off per day.

Term Project: You will prepare a proposal for research based on geodynamic principles applied to a current issue in geology and geophysics. The proposal must be no more than 5 pages, using the guidelines for writing and NSF proposal. The first complete draft is due by **12pm (noon) on Friday, November 21**. I will return the draft to you the following week. The final version will be due the **week of Dec 8**.

Final Presentation/Oral Exam: During the week of Dec 8 there will be no classes. You will prepare a short (no more than 5 slides, 5-8 minutes) presentation of your proposal. You will individually present this to me, followed by an oral exam of roughly 30 minutes in length. You will also turn in your final version of your proposal. We will discuss the details of this presentation/exam later in the semester.

Assessment:

Problem Sets: 25%
Proposal First Draft: 10%
Proposal Final Draft: 30%
Presentation/Oral Exam: 30%
Contributions during class discussions: 5%

Extra Credit:

You can get up to one full homework set worth of extra credit by giving a 10 minute explaination to the class of the geodynamic concepts in the paper you are writing your proposal on. These will most likley be towards the end of the semester.

Schedule:

Week	Concepts covered	Readings, assignments due
Week 0 Sept 4	Introduction meeting	
Week 1 Sept 8	Continuum concepts in one dimension: stress/strain, material behaviors, visco-elastic model, energy. Thursday we will discuss your term project.	Read Selby (2006) by Tuesday, T&S Chapter 1 as background information. Read Raymond Ch2 (E Reserves) and T&S Sections 7-1, 7-6, 7-9, 7-10.
Week 2 Sept 15	Introduction to tensors: mathematical tools of indicial notations, transformations.	Problem Set #1 due Friday Reading Raymond Ch 3, T&S 9-1 and 9-2.
Week 3 Sept 22	Stress and strain, principal directions. Examples: stresses on floating plates, others	Problem Set #2 due Friday Reading T&S Chapter 2, MIT Lecture notes. Sangre de Cristo example.
Week 4 Sept 29	More Stress examples, Introduction to strain. Mohr's circle. Field Equations (Newton's Laws, Conservations Laws)	Problem Set #3 due Monday (noon) Reading T&S Chapter 2 (still), and MIT Lecture notes.
Week 5 Oct 6	Strain. Field Equations (Newton's Laws, Conservations Laws)	Problem Set #4 due Friday (noon).
Week 6 Oct 13	General Elastic and Visco-elastic Problems (Beam loading, isostasy).	Tuesday discussion of paper from homework. Read Chapter 3 in T&S. Proposal Plan Due Friday at noon
Week 7 Oct 20	Elastic and visco-elastic problems in Earth Science.	Problem Set #5 due Friday (noon).

Week 8 Oct 27	Faulting and Fracture	Problem Set #6 due Friday (noon).
Week 9 Nov 3	Faulting and Fracture	Problem Set #7 due Friday (noon).
Week 10 Nov 10	Flow of linear and non-linear viscous fluids, creep, flow in channels and pipes, post glacial rebound	Problem Set #8 due Friday (noon).
Week 11 Nov 17	More viscous flow, glaciers, Rayleigh-Taylor instability	First draft of proposal due Friday at noon.
Week 12 Nov 24	More viscous fluid flow, convection	Thanksgiving
Week 13 Dec 1	No Class December 2. December 4th extended class synthesis of the material.	Problem Set #9 and 10 due Thursday in class (part of discussion).
Week 14 Dec 8	Final presentation/oral exams	Final proposal due during your exam time.

List of Additional Readings:

Selby, C.C. 2006. "What makes it science?" ***Journal of College Science Teaching.*** **July/August 2006. 8-11.**