COURSE SYLLABUS

GEO 5690/6690 Geodynamics

Fall 2016 MWF 8:30–9:20 rm 217A

Professor: Tony Lowry (Department of Geology)
- Geology Bldg Room 106 (Phone: 797-7096)
- Email: Tony.Lowry@usu.edu
- Office Hours: MWF 9:30–10:30 am (or by appt)
- Website: http://aconcagua.geol.usu.edu/%7Earlowry/Geodyn/index.html

COURSE DESCRIPTION

This course will introduce (and survey current literature on) the field of geodynamics, the study of dynamical processes of the solid Earth. By its nature, geodynamics is rooted in fundamental physics and highly interdisciplinary. The important elements of geodynamics are the same line-up of "Usual Suspects" that you find everywhere in environmental physics: Namely, energy, fluxes of energy and material, and material properties. Energy in the Earth's interior is dominantly thermal, gravitational potential, and strain potential (but others can be important)! Consequently much of this course will deal with inter-relationships of heat transfer, gravity, mass density and deformation.

The course incorporates both introductory materials and current papers relating to geodynamics of the lithosphere and asthenosphere. Much of your effort in the class will involve solving problem sets and doing some relatively simple modeling exercises using standard codes (which we will learn together as a group). The rest will involve reading and discussing critically the physics, measurements and observations underlying some current papers on relevant topics, and presenting discussion materials on the paper on at least one occasion. Graduate students taking the course for 6000-level credit also are required to develop a semester research project on a topic of your choosing (presumably, something related to your thesis topic). I will attempt to skew the course materials a bit toward the thesis topics and/or interests of students taking the course.

The course has three main goals: (1) To introduce some fundamentals of geodynamics (from Turcotte & Schubert); (2) To familiarize ourselves with some basic modeling tools; and (3) To survey the recent literature on exciting new developments in understanding dynamical behavior of the solid Earth.

About the professor:
I am a geophysicist. My research focuses on measuring and understanding how and why planets deform, and particularly the rheological relationships that modulate processes of ductile flow, fault slip, earthquakes and volcanism. Elements of my research also have implications for mass transfer in the atmosphere, hydrosphere and cryosphere.

Course Text:
Geodynamics: Second Edition. D.L. Turcotte and G. Schubert, Cambridge (NY).

Selected journal articles.

(Very Approximate) Schedule of Topics:

Dates	Topic	Reading
28 Aug– 2 Sep	Introduction to the course; Intro Lithosphere; Lithosphere as thermal boundary layer: Conductive heat transfer; radiogenic heating	 T&S 132-149
5 Sep	Labor day (no classes)	
7 Sep– 9 Sep	Time-dependence (cooling & heating); Temperature and density	T&S 149-162 T&S 171-177 Furlong & Chapman (2013)
12 Sep– 16 Sep	Advective heat transfer processes	T&S 162-171; 179-183 Roy & al. (2009)
19 Sep– 23 Sep	Intro Asthenosphere: The adiabat; fluid flow Convection; plumes Asthenosphere = Convection?	T&S 185-190; 226-238 254-261; 266-280 Kellogg & al. (1999)
26 Sep– 28 Sep 29 Sep	Subduction as downwelling Prof out of town (Kanda subs?)	T&S 244-249; Schmandt & Humphreys (2011)
3 Oct– 7 Oct	Delamination and drips as downwelling Rheology	T&S 292-323 Becker & al. (2015)
10 Oct– 14 Oct	 Frictional rheology: seismogenic layer = lithosphere?	Bürgmann & Dresen (2009) T&S 339-355
17 Oct– 20 Oct 21 Oct	Flexural Isostasy (Lithosphere as strong layer) (No class: Fall Break)	T&S 105-130 Pérez-Gussinyé & al. (2009)
24 Oct 28 Oct	Flexural strength as lithosphere	Watts & Burov (2003)
31 Oct– 4 Nov	Rheology; Rheological implications of flexural rigidity	Lowry & P-G (2011)
7 Nov– 11 Nov	Lithosphere = Tectonic Plate? Viscoelasticity: Asthenosphere from rebound?	Mierdel & al. (2007) T&S 238-241
14 Nov– 18 Nov	Postseismic deformation: Asthenosphere from rebound?	Willett & al. (1985)
21 Nov 23-25 Nov	Major element chemistry: Lithosphere as tectosphere Happy Thanksgiving!	Schutt & Lesher (2006)
28 Nov– 2 Dec	Geochemistry: Asthenosphere as mixed reservoir Equations of State and lithology	T&S 410-427 Guerri & al. (2015)

5 Dec– 9 Dec	Special topics…	
12 Dec	Final Semester Projects Presentations	7:30-9:30

Write-up of Semester Projects Due 14 Dec at class-time

Updated course schedule and powerpoint lectures will be at
http://aconcagua.geol.usu.edu/%7Earlowry/Geodyn/index.html

Grading:	**UG**	**Grad**
Exercises	50%	30%
Class discussions/discussion leads	50%	30%
Semester Project and Presentation		40%

Notice to students with disabilities: Students with physical, sensory, emotional or medical impairments may be eligible for reasonable accommodations in accordance with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973. If you have a disability that will likely require some accommodation by the instructor, you must contact the instructor and document the disability through the Disability Resource Center (DRC) in Room 101 of the University Inn, 797-2444 voice, 797-0740 TTY, or toll free at 1-800-259-2966, preferably during the first week of the course. Any requests for special considerations relating to attendance, pedagogy, taking of examinations, etc. must be discussed with and approved by the instructor. In cooperation with the Disability Resource Center, course materials can be provided in alternative formats--large print, audio, diskette or Braille.