COURSE SYLLABUS

GEO 5640/6640 Seismology

Spring 2017 Lecture: MWF 1:30-2:20 pm rm 217A

Professor: Tony Lowry (Department of Geology)

- Geology Bldg Room 106 (Phone: 797-7096)
- Email: Tony.Lowry@usu.edu
- Office Hours: MWF 2:30-3:30 (or by appt)
- Website: http://aconcagua.geol.usu.edu/~arlowry/Seismo/index.html

COURSE DESCRIPTION

Seismology is a geophysical toolbox that uses the elastic wave equation to address a wide variety of different basic and applied problems.

Seismologists conceptualize seismic waves as a convolution (an "integral combination" through time) of information about strain energy released at a source and the physical properties of the medium through which the seismic wave propagates. Hence seismology can be used both for 3D imaging of the Earth's interior and for characterization of sources, which include obvious things like earthquakes and explosions, but also more interesting creatures like slow fault slip, glacial calving events, drilling activity and storm waves in distant oceans. This will be an introductory course in which we learn some of the fundamentals of seismology and discuss applications to current events and important problems of all types. We will place significant emphasis also on the implications of seismology for Earth material properties and for internal dynamical processes. (This course will also briefly cover near-surface imaging applications commonly used in industry, but note that these are treated in much greater detail in GEO 5660/6660, Introduction to Applied Geophysics).

Not surprisingly, the tools we will discuss (and use) in this course are fundamentally mathematical. We'll try to stick to basic concepts of calculus, linear algebra and probability & statistics that in some cases will be familiar territory (and when they're not, we'll introduce the unfamiliar concepts slowly).

Ultimately, this course is meant to provide you (the student) with a set of tools and skills that will be helpful in your later career and (in the case of graduate students) your current thesis research.

About the professor:
I am a geophysicist ("Physics of the Earth") who focuses on measuring and understanding how and why planets deform. On Earth, this relates most directly to processes of fault slip, deep ductile flow, earthquakes and volcanoes, but also has implications for mass transfer in the atmosphere, hydrosphere and cryosphere.

Course Text
(Required): **An Introduction to Seismology, Earthquakes and Earth Structure** (Stein & Wysession). Reading assignments to be announced.
(Recommended): **Quantitative Seismology: Theory and Methods**, (Aki & Richards), particularly if you intend to pursue further studies in seismology.

TENTATIVE SCHEDULE

9–13 Jan:	Introduction; The Seismogram	S&W 1-38
18–20 Jan:	Vectors, Derivatives, & Complex Variables (Jan 16 is MLK Day; no class)	
23-27 Jan:	Tensors, Stress and Strain	S&W 39-74
30 J–3 Feb:	Equations of Motion; the Wave Equation	
6–10 Feb:	Spherical Coordinates; Ray Theory; the Seismic Source	
13–17 Feb:	Plane Wave Reflection/Transmission; Evanescent Waves	
21–24 Feb:	Surface Waves: Rayleigh & Love Waves (Feb 20 is President's Day; 21st is Monday schedule)	
27 F–3 Mar:	Normal Modes; Take-home exam 1.	
6–10 Mar:	Spring Break	
13–17 Mar:	Reflection/Refraction Seismology	
20–24 Mar:	Reflection Methods	
27–31 Mar:	Body waves; Imaging Earth's Deep Interior	
3–7 Apr:	Anisotropy	
10–14 Apr:	Amplitudes & Attenuation	
17–21 Apr:	Earthquakes and Focal Mechanisms	
24–28 Apr:	Moment Tensors; Source Theory	

Final Course Project: (Grad students only) This will require both an oral presentation and a written report, both due on the final exam date.

Finals Week: Take-home Exam 2 due at the end of the final exam period (3:30 PM, Wednesday May 3).

Web materials (incl. lecture ppt's), updated scheduling and announcements will be available at http://aconcagua.geol.usu.edu/~arlowry/Seismo/index.html

Grading:		**5640**	**6640**
Short exercises	~6	50%	33.3%
Take-home exams	2	50%	33.3%
(Grads) Semester Project		---	33.3%

Late Assignment Policy:

All assignments are due at the date & time specified; no late assignments will be accepted. If you're not finished, just hand in what you have. Note that, because all assignments are to be submitted to me by email, I will not accept illness as an excuse for late assignments (unless the illness induces a coma).

Differences between the 5000 and 6000 level course:

In addition to doing a semester project, as noted above, taking the course at the graduate level entails doing a few additional (more challenging) problems for the assignments and exams.

Notice to veterans and students with disabilities: **Students with ADA-documented physical, sensory, emotional or medical impairments are eligible for reasonable accommodations. Veterans may also be eligible for services. All accommodations are coordinated through the Disability Resource Center (DRC) in Room 101 of the University Inn, (435) 797-2444 voice, (435) 797-0740 TTY, or toll free at 1-800-259-2966. Please contact the DRC as early in the semester as possible. Alternate format materials (Braille, large print or digital) can be made available.**