Seismology

Fall 2012 Syllabus – GEOL 595 SP/L
Meet at 11:00-11:50 am, Tuesday/Thursday
Lab: Thursdays, 2-5 pm
Live Oak Hall, Room #1221

...if we place a seismograph at some location and watch the way the thing jiggles after there has been an earthquake somewhere else, we might get a jiggling, and a quieting down, and another jiggling...By using a large number of … earthquakes at different places, we know what is inside the earth.

-Richard Feynman
The Feynman Lectures on Physics, 1963

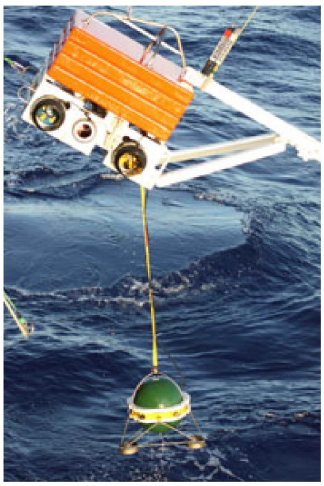
Ancient Chinese seismometer designed by Zhang Heng in 132 AD (Han Dynasty).

Professor: Dr. Dayanthie Weeraratne
Email: dsw@csun.edu
Office hours: Tuesday noon- 2:00 pm or by appointment
Office: Live Oak Hall Rm# 1203
Class webpage: http://www.csun.edu/~dsw/seismo.htm

Required Text: Introduction to Seismology and Earthquakes, and Earth Structure
by Seth Stein and Michael Wysession
Introduction to Seismology
by Peter M. Shearer

Supplementary Texts:
Introduction to the Theory of Seismology by K.E. Bullen and Bruce A. Bolt

Field Trip …..somewhere, TBA



Course Objectives: This course provides an introduction to fundamental concepts in seismology, the study of elastic waves in the solid earth. Seismic wave propagation will be considered using different approaches ranging from body waves to surface waves, ray theory, development of the wave equation, source theory, and array seismic tomography. Techniques will be introduced in single wave propagation, array seismology with large data sets, seismic tomography, seismic anisotropy, introduction to inverse theory, signal processing, and reflection seismology. Applications and seismic image analysis relevant to plate tectonics, earthquakes, and the Earth's interior will be discussed. Designed for upper-level undergraduate and beginning graduate students in geology, geophysics, or related sciences.

Tentative Course Outline:

Week	Date	Topic	Chapter (S&W)	Chapter (Shearer)
1	08/28, 08/30	Intro to Seismology, Earthquakes, and Tectonics	1	1
2	09/04, 09/06	History of Seismology, Basic Instrumentation	Class Notes	1
3	09/11, 09/13	Theory of Seismology: Anatomy of a Wave	Class Notes	Notes
4	09/18, 09/20	Wave on a String - The Wave Equation	2.1, 2.2	Notes
5	09/25, 09/27	Stress and Strain in the Solid Earth *CSUN Seismo-Campus walk (09/27)*	2.3	2
6	10/02, 10/04	Seismic Waves (Plane Waves, Spherical Waves, Body waves)	2.4	3
7	10/09,10/11	Ray Theory: Snell's Law	2.5	4
8	10/16, 10/18	Surface Waves *Shake Out Drill (10/18)*	2.7	8.1, 8.2
9	10/23, 10/25	Surface Wave Dispersion	2.8	8.3, 8.4
10	10/30, 11/01	Signal Processing **Midterm** *(11/01)*	6	Appdx 5
11	11/06, 11/08	Inverse Theory, Generalized 1-D Velocity	7.3	5
12	11/13, 11/15	Inversion Tomography with Arrays/Multipaths	Class Notes	Notes
13	11/20, 11/22	Plane Wave Reflection and Transmission *Class Debate (11/22) :* on Whole vs Layered Mantle Convection (using evidence from seismic studies, tomography, etc.)	2.6	6
14	11/27, 11/29	Earthquake Source Theory, Attenuation *Thanksgiving Holiday (11/29)*	3.7	9
15	12/04, 12/06	Earth Noise, Anisotropy	3.6	11.3
FINAL	12/13, Wednesday	**Final Exam: Dec 11, 2012, Tuesday,** (10:15 am – 12:15) Room: LO #1221 (cumulative)		

Lecture Course Evaluation:

	Points
12 weekly reading reviews (10 pts each)	120
10 homework calculations (10 pts each)	100
1 midterm	100
Final Exam	100
Field trip	20
CSUN Seismo-Campus walk	20
Class Debate	25
Shake Out Drill	15
TOTAL	500

GEOL 595-SP/Laboratory

Lab Evaluation:		Points
● 5 Labs (2 week duration), 30 pts each		150
Individual Project (last 4 weeks)		
● Individual Project **Title**	Due: Nov 6, 2012	10
● Individual Project **Proposal** (paragraph or 1 page)	Due: Nov 13, 2012	15
● Individual Project **Presentation** (10 minutes)	December 13 (3-5pm)	25
● Individual Project **Written Report** (last 4 weeks)	**Due:** Dec 13, 2012	70
TOTAL		270

Lab Project: You will be asked to analyze seismic data for a class project of your choice. Data is available through the IRIS DMC (Data Management Center), or I can provide some data from recent CSUN seismic projects. I will help you design your project as well as assist with computational skills and seismic techniques. A draft and final written report of your project describing the problem, your seismic method, and findings will be due on the last day of class. The report should be 3-4 pages of text, single spaced *(not including pictures or images)* with an additional page for references. (The total length can be over 4 pages with figures and/or images)

Possible Projects:

- Study Chile earthquake tsunami data from the PLATE project (publishable)
- Shear wave splitting (seismic anisotropy)
- Surface wave travel times
- Body wave delay times (P or S)

Academic Dishonesty: I will follow the University's policy on **academic dishonesty** described in the Schedule of Classes**.** Cheating will result in a zero grade for an exam any assignment and notification to the Dean of Students which can result in disciplinary action. It also defeats your ability to learn and grow. Spend the time to figure it out. You might enjoy it!

Absences: Advanced notice of absences is required for make up exams or assignments.

Please be respectful to those around you in class. Inappropriate behavior will not be tolerated. Please **turn off all electronics** before coming to class (it's only an hour!).

Some tips for how to succeed in this class:

1. Ask, ask, ask questions, if you do not understand something or just to participate.
2. "Wherever you go, there you are..." - Be present in the moment. You can minimize study time if you **come to class** and give your **full attention**.
3. **Read** ahead and write down your questions. You'll enjoy it and be more engaged in the class.
4. Keep up with assignments and get them out of the way soon.
5. If you miss a lecture – **read** the material and get a copy of the notes.
6. If you don't do well on the first exam **ask for help** right away, don't put it off.
7. If you have questions or thoughts **come by during office hours**, we're here for **you**.
8. If something interests you, explore it! Life is short!