

Phys/Geol/Astr 6610
Earth and Planetary Physics I
Fall, 2006

<http://ciei.colorado.edu/physics6610>

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Office Hours: by appointment.

Class Time: T & TH, 12:30 - 1:45 PM, BESC 355. Note: Duane G1B35 will not be the classroom after the first meeting on Tues Aug 29.

Theoretical Seismology Session: Friday 3:30 - 4:45 PM in Duane C223 beginning September 8. (13 sessions.)

Texts:

For all students: *An Introduction to Seismology, Earthquakes, and Earth Structure*, Seth Stein and Michael Wysession. Available used (like new) via Amazon starting at \$74.00.

For the Theoretical Seismology Session: *Quantitative Seismology*, 2nd ed., K. Aki and P. Richards. This is the same as Vol. 1 of the 1st edition. Can be ordered directly from University Science Books, <http://www.uscibooks.com>, for \$84.60 or from Amazon for \$84.00.

Lectures: T & TH 12:30 - 1:45 PM, Benson Earth Sciences Bldg 355.

Prerequisites:

Undergraduate junior level mechanics, introduction to linear algebra and ordinary and partial differential equations, vector calculus.

Assignments and Grading:

Homeworks. (75%) There will be weekly homeworks, usually due on Tuesday. Because there will be no exams per se, students are asked to treat the homeworks as the equivalent of take-home exams. Students are encouraged to ask each other for help over the rough spots, but should do their own work. Some assignments may require access to a computer for plotting and doing simple analysis. Students are responsible for obtaining access to computers on their own and being able to edit, print, perform simple computations, plot line diagrams, and so on. Late homeworks will not be accepted, but the lowest homework at the end of the semester will be dropped.

Course Project. (25%) There are two options. First, active participation in the Theoretical Seimology Session, including leading discussion at least once. The grade will be based on the quality of that session and participation through the rest of the semester. Second,

completion of a 10 page paper (not including figures) on a subject of the student's interest, chosen and designed in consultation with the professor.

Attendance:

Attendance is not mandatory. Lectures will be designed to complement the text so that not all required material will be covered fully in the reading assignments. Students are responsible for all announcements and material covered in class regardless of their attendance.

Closing Statement:

The University abides by Section 504 of the Rehabilitation Act of 1973 which stipulates that no student shall be denied the benefits of an education "solely by reason of a handicap". Disabilities covered by law include but are not limited to learning disabilities and hearing, sight or mobility impairments. If you have a disability that may have some impact on your work in this class and for which you may require accommodations, please see me or the Coordinator of Services to students with disabilities in the Disability Services Office, Willard 322 (phone 303-492-8671), so that such accommodations may be arranged.

Class Outline

Travel Schedule: T Sept 19 (SRR in Orlando), TH Oct 12 (GSNSN in Albuquerque), T Oct 31 (CIG/EarthScope in St. Louis), TH Nov 2 (CIG/EarthScope in St. Louis), T Dec 12 (AGU in SF), TH Dec 14 (AGU in SF), F Dec 15 (AGU in SF).

1. Oscillations and waves. Aug 28 - Sept 21. (7 class sessions, 4 homeworks.)

Reading: notes, xeroxes from various texts, Ch. 2.2 of Stein & Wysession, Ch. 6.2-6.4 of Stein & Wysession.

Formalisms of classical mechanics

Harmonic oscillator and coupled oscillators.

1D wave equation (string, acoustic waves).

Laplace and Fourier methods.

Green functions.

Scattering.

Approximate methods (Rayleigh-Ritz, WKBJ, perturbation theory).

Waves in fluids (acoustic waves).

Waves in 2D acoustic media: membranes (surface waves, stationary phase).

2. Elasticity theory and seismic waves. Sept 26 - Oct 19. (7 class sessions, 4 homeworks.)

Reading: Ch. 1, Ch. 2, Ch. 6.6 of Stein & Wysession.

Seismology and society.

Stress and strain.

Seismic wave equation.

Wave propagation in layered media.

Reflection and transmission.

Surface waves and dispersion.

Normal modes.

3. Seismology and Earth structure. Oct 24 - Nov 9. (4 class sessions, 2 homeworks.)

Reading: Ch. 3 and Ch. 7.3-7.4 of Stein & Wysession.

Reflections and refractions in plane layered media.

Body waves in a spherical earth.

Travel time tomography.

Anisotropic and anelastic media.

Composition of mantle and core.

4. Source characterization. Nov. 14 - Dec 7. (6 class sessions, 3 homeworks.)

Reading: Ch. 7.2 and Ch. 4 of Stein & Wyssession.

Earthquake location.

Focal mechanisms.

Moment tensors.

Source parameters.