Geophysics 130 "Introduction to Seismology"

Course Syllabus – Fall 2014

Course information

instructor	Nori Nakata
office	ESMB 309
email	nnakata@stanford.edu
office hour	Tuesday and Thursday: 11:00–12:00

Class Meets: Tuesday and Thursday, 2:15–3:30 (ESMB Room 350)
3 units

TA: Clara Yoon (ESMB 453 A), ceyoon@stanford.edu, Wednesday: 3:30–4:30
The course webpage is at http://coursework.stanford.edu (F14-GEOPHYS-130-01).

Course Goal

The goal of this course is to introduce you to the fundamental concepts of elasticity and the wave equation, P, S, and surface waves, dispersion, ray theory, reflection and transmission of seismic waves, seismic imaging, large-scale Earth structure, earthquake location, earthquake statistics and forecasting, magnitude scales, and seismic source theory.

Course Learning Objectives

Upon successful completion of this course, you should be able to

- derive wave equations with appropriate assumptions and distinguish the differences of P, S, and surface waves
- describe basic earth structure that relates to earthquakes
- write Snell's law and Fermat's principle for reflection seismology
- explain physics of fundamental wave phenomena including refraction, reflection, dispersion, anisotropy, and attenuation.
- assess character of earthquakes from given information such as focal mechanisms, moment tensor, magnitude, etc.

Grading Basis

Weekly homeworks	60%
Midterm	20%
Final	20%

Schedule

9/23(T)	What is seismology?	Reading: Chapter 1
9/25(R)	Waves, Waves on a string	Reading: Chapter 2.1–2.2; Appendix A.1–A.4
9/30(T)	Stress and Strain	Reading: Chapter 2.3; Appendix A.6
10/2(R)	Equation of Motion, Wave Equation	Reading: Chapter 2.4
10/7(T)	Body Waves: *P* and *S* Waves	Reading: –
10/9(R)	Snell's Law, Fermat's Principle	Reading: Chapter 2.5
10/14(T)	Reflection and Transmission	Reading: Chapter 2.6
10/16(R)	Surface Waves and Dispersion	Reading: Chapter 2.7–2.8
10/21(T)	Refraction Seismology	Reading: Chapter 3.1–3.2
10/23(R)	Reflection Seismology	Reading: Chapter 3.3
10/28(T)	Midterm	
10/30(R)	Seismograms as Signals	Reading: Chapter 6.1–6.3
11/4(T)	Waves on a Spherical Earth	Reading: Chapter 3.4–3.5; Appendix A.7
11/6(R)	Anisotropy and Anelasticity	Reading: Chapter 3.6–3.7
11/11(T)	Focal Mechanisms	Reading: Chapter 4.1–4.2
11/13(R)	Moment Tensors	Reading: Chapter 4.3–4.4
11/18(T)	Source Parameters, and Statistics	Reading: Chapter 4.6–4.7
11/20(R)	Earthquakes and Tectonics	Reading: Chapter 5.1–5.6
11/25(T)	*no class*	
11/27(R)	*no class*	
12/2(T)	Earthquake Location	Reading: Chapter 7.1–7.2
12/4(R)	Large-Scale Earth Structure	Reading: Chapter 7.3–7.4
12/11(R)	Final Exam (7:00–10:00 pm)	

Books

textbook

- Stein, S. and M. Wysession, 2002, *An Introduction to Seismology, Earthquakes and Earth Structure*, Blackwell Publishing

other introductory books

- Shearer, P., 2009, *Introduction to Seismology*, Cambridge University Press
- Bullen, K. E., 1985, *An Introduction to the Theory of Seismology*, Cambridge University Press
- Richter, C. F., 1958, *Elementary Seismology*, W H Freeman & Co

advanced books

- Aki, K. and P. Richards, 2002, *Quantitative Seismology*, University Science Books
- Dahlen, F. A. and J. Tromp, 1998, *Theoretical Global Seismology*, Princeton University Press
- Ben-Menahem, A. and S. J. Singh, 1981, *Seismic Waves and Sources*, Springer