

# SIO 161 SEISMOLOGY

Winter Quater 2024

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<b>Class Hours:</b>	TuTh 2:00am-3:20am	<b>Class Location:</b>	Munk 303
<b>Discussion Hours:</b>	Th 12:30am-13:20am	<b>Discussion Location:</b>	Munk 303

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**Instructor:** Dr. Wenyuan Fan, [wenyuanfan@ucsd.edu](mailto:wenyuanfan@ucsd.edu), Munk 328

## Course Description:

This course covers the fundamentals of earthquake physics and seismic wave propagation. The class instruction will center around the learners and deliver the content through hands-on practicals. The course will discuss five topics sequentially, including earthquakes, seismic waves, Earth's internal structures, exploration seismology, and environmental seismology.

## Learning Outcomes:

1. Classify earthquakes and faults, quantitatively describe earthquakes characteristics, and compare and calculate earthquake physical properties
2. Explain seismic waves and the associated ground motions, illustrate seismic wave propagation using ray theory, and calculate body wave travel times for simple layered velocity structures
3. Explain Earth seismic structure, and describe how to use seismic travel times to infer subsurface structures
4. Describe principles of active source seismology, and explain how to apply active source seismology for industry explorations, hazard assessment, and scientific investigations
5. Identify environmental seismic sources, and explain how the near-surface physical processes can generate seismic waves
6. Summarize general seismology principles and interpret example data
7. Solve quantitative problems related to the general seismology principles
8. Synthesize scientific findings in peer-reviewed publications

## Textbook:

Introduction to Seismology by Shearer (3rd Edition). Not required.

### **Course Notes:**

Course notes are the most important class materials. We will go through most of the quantitative concepts step by step, and you should take your own notes for later reference. Some lecture notes will be distributed. Such notes are supplementary to your notes, and they may not cover everything.

### **Attendance:**

Attendance of the class is not required. However, it is highly recommended. See **Grading Policy** below for details.

### **Tentative Course topics (flexible!):**

- Syllabus and Overview
- Crash Course on Latex and Scientific Computing
- Crash Course on Linear Algebra and Statistics
- Earthquakes and Seismic Source Theory
- Earthquake Triggering and Prediction
- Seismic Waves: Body Waves and Surface Waves
- Seismic Wave Propagation: Travel Time, Amplitude, and Phase
- Inversion of Seismic Data: Earth's Internal Structures
- Exploration Seismology: Reflection and Refraction Seismology
- Environmental Seismology

### **Syllabus Change Policy:**

Except for changes that substantially affect implementation of the evaluation (grading) statement, this syllabus is a guide for the course and is subject to change with advance notice.

### **Class Presentations:**

During the lectures, there will be student led presentations. The presentations will discuss a recent natural hazard event or seismology papers.

### **Homework:**

There will be one homework assignment per week on average. They will always be due one week after assignment. Working with classmates is fine, but you should be able to solve the problems at the end individually. Homework should be turned in on time, and a late submission will lead to a 20% grade reduction per day. You are allowed to miss the due date twice during the quarter without compromising your grades.

### **Grading Policy:**

Homework assignments (30%). Presentation (10%). Participation (10%). One midterm exam (20%) and one final exam (30%).

**No make up exams** will be offered. If you miss the midterm, your final exam grades will be given 50% weight.

Grading standards are set by each instructor and should be explained in each course's syllabus. UCSD has no "official" grading standards. This allows each instructor to adopt grading procedures consistent with the design of the course and with the instructor's professional standards for grades. If you remain in the course after the drop-add period is over, you are agreeing to be bound by the instructor's announced grading standards, which will be found in the course syllabus. Therefore, if you have any questions about an instructor's grading procedures and standards, talk to the instructor before the drop-add period is over. If a student believes that nonacademic criteria have been used in determining the student's grade in a course, the student may follow San Diego Academic Senate Regulation 502 for grade appeals.

### **Grading Scale:**

A  $\geq$  93, A- 89–92, B+ 85–88, B 80–84, B- 77–79, C+ 74–76, C 70–73, C- 67–69, D 57–66, F <57. Final grades in the class will be determined based on the distribution of the final scores, rather than a fixed grading scale.

### **UCSD Policy on Integrity of Scholarship:**

The UCSD Policy on Integrity of Scholarship outlines the University's expectations for the integrity of students' academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process. Students are responsible for reading the UCSD Policy on Integrity of Scholarship and for living up to their pledge to "...no student shall engage in an activity that undermines academic integrity or facilitates academic integrity violations by others..." (more details in UCSD Academic Senate Manuals.)

### **Free Tutoring from UCSD:**

UC San Diego offers numerous tutoring and study assistance programs, most of them free of charge. Use these links to find a tutoring or support program that's right for you.

### **Academic Support:**

Made up of six unique, but integrated hubs, The Teaching + Learning Commons provides comprehensive academic support for students. Services provided by the Academic Achievement, Experiential Learning, and Writing Hubs empower students to take control of their education, helping them to develop essential skills for learning across disciplines and enabling them to achieve their full potential.

### **UCSD CAPS:**

Counseling and Psychological Services (CAPS) has been an integral member of the UCSD community since the late 1960's. We are accredited by the International Association of Counseling Services (IACS). Our integrative and student-centered services are designed to support students towards their academic success and personal development and well-being while at UC San Diego.