



# UNIVERSITÀ DI PISA

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## EARTHQUAKE SEISMOLOGY

**FRANCESCO GRIGOLI**

Anno accademico

2023/24

CdS

EXPLORATION AND APPLIED  
GEOPHYSICS

Codice

288DD

CFU

6

Moduli	Settore/i	Tipo	Ore	Docente/i
EARTHQUAKE SEISMOLOGY	GEO/10	LEZIONI	54	FRANCESCO GRIGOLI

### Obiettivi di apprendimento

#### *Conoscenze*

The course focuses on theoretical, computational and observational aspects of earthquake seismology. The objective of course is to teach the fundamentals of seismic waves generation and propagation in seismology, the physics of earthquake sources as well as the routine analysis of seismological data.

#### *Modalità di verifica delle conoscenze*

Through the practical sessions each student shall show to be able to apply, with critical awareness, what explained by the lecturer during the course.

#### *Capacità*

The student will learn the physics on seismic wave propagation and generation and he will be able to use it to solve basic numerical problems in seismology. He/She can also carry out in-depth analysis on topics related to seismological data processing.

#### *Modalità di verifica delle capacità*

Oral exams on theory and coding practicals (in Python) aimed at solving different seismological problems.

#### *Comportamenti*

Students attending this course will understand both a theoretical and practical point of view the main seismological concepts, furthermore they will learn to solve autonomously a wide range of seismological problems

#### *Modalità di verifica dei comportamenti*

Written and oral test.

#### *Prerequisiti (conoscenze iniziali)*

Signal Theory, Linear Algebra, Calculus of Single and Multiple Variables and Vector Calculus, Structural Geology, Coding Skills in Python.

#### *Corequisiti*

Computational Geophysics

#### *Programma (contenuti dell'insegnamento)*

Introduction and general concepts (2 h)

Theory of Seismic Waves (24 h)

- Fundamentals of Elasticity Theory
- The Seismic Wave Equation
- Body Waves and Ray Theory
- Surface Waves and Dispersion
- Seismic Waves and the Internal Structure of the Earth



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Earthquake seismology (24 h)

- Physics of Seismic Sources
- Seismic Moment Tensors and Source parameters
- Kinematics and Dynamics of Earthquakes
- Seismological Data Analysis
- Earthquake statistics
- Elements of Seismotectonics

Principles of Seismometry (4 h)

- The Seismometer
- Ambient Noise
- Seismic Networks and Arrays
- Seismograms Interpretation

Practicals:

During the course students will write python codes to solve the following computational problems:

- a) Modeling synthetic seismograms in a layered medium with reflectivity (plane SH wave)
- b) Modeling of seismic wave propagation in 2D media using the finite difference method
- c) Modeling the dispersion curve of the fundamental mode of Rayleigh waves
- d) Modeling seismic source spectra using the Brune model
- e) Analysis of seismograms of real earthquakes

### Bibliografia e materiale didattico

Reference Books:

- Aki, Richards: Quantitative Seismology  
Thorne, Lay: Modern Global Seismology  
Pujol : Elastic Wave Propagation and Generation in Seismology  
Udias, Buforn, Madariaga : Source Mechanisms of Earthquakes

### Modalità d'esame

Written and Oral Test

*Ultimo aggiornamento 04/08/2023 09:48*