
COURSE: SEISMOLOGY & SEISMOTECTONICS

ACADEMIC YEAR: 2019-2020

TYPE OF EDUCATIONAL ACTIVITY:

TEACHER: FILIPPOS VALLIANATOS

e-mail: fvallian@geol.uoa.gr

website:

phone:

mobile (optional):

Language:

ECTS: (lessons e
tutorials/practice) 6n. of hours: (lessons e
tutorials/practice) 56Campus: **Potenza**
Dept./School: **Dipartimento di
Scienze**
Program: Laurea Magistrale
Internazionale in Geoscienze e
GeorisorseSemester: 3rd
(date)

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES**Knowledge**

The course aims to provide an understanding of the dynamics of the solid Earth from theoretical and observational seismology and seismotectonics in relation to earthquake hazard and mitigation. It provides an in-depth study of earthquake seismology and earthquake hazard covering 6 topics: the Propagation of Seismic Waves; Earthquake Source Mechanics; Crustal Tectonics; Statistics of Earthquake. This is a geophysics based course, which covers the breadth of traditional seismology, developed from the seismic wave equation, and the physics of the earthquake source. The course covers fault mechanics, seismotectonics and earthquake statistics

Skills and Abilities

The aim of the course is for students to gain knowledge and understanding seismotectonics based on fundamental geophysics of the seismic wave propagation and earthquake mechanics, in relation to earthquake hazard and mitigation. The course provides students with the mathematical and physical underpinning of the subject.

The students will acquire the following practical skills:

- Interpretation of earthquake seismograms
- Determining earthquake focal mechanisms and quantitative seismotectonics
- Practical approaches to earthquake hazard assessment
- Calculations based on statistical seismology laws

The students will acquire the following transferable skills:

- ✓ Processing, interpreting and presenting seismological data using the Matlab computer program
- ✓ Solving geophysical problems using computational and analytical techniques
- Using the Internet as a source of seismological information
- ✓ Application of statistics to hazard

PRE-REQUIREMENTS**Knowledge on the Principles of Geophysics and Tectonics**

SYLLABUS**Part 1- Topic** Observational Seismology

- 1 Introduction
- 2 Earthquake Waves

Tutorials : Tu. 1 Earthquake Seismicity Tutorial, Tu. 2 Seismic Waves Tutorial

Self-study Tu. 3 Maths Tutorial

Practical : Earthquake Location Practical

Part-2 . Topic Observational Seismology

3 Earthquake Rays and Earth Structure

Handouts Derivation of ray parameter; Crustal Phases

4 Surface Waves

Practical : Earthquake Location Practical - Handout Earthquake location

Part- 3 . Topic Earthquake Source Mechanics

5 Earthquake Focal Mechanism

6 Earthquake magnitude & intensity

Practical : Earthquake Location Practical - Handout Finding Earthquake Seismograms on IRIS

Tutorial : Fault Plane Solution & Seismotectonics

Part-4 . Topic Earthquake Source Mechanics

7 Seismic Moment

8 Global Seismotectonics

Practical : Fault Plane Solution

Handouts. Source parameters - Magnitude determinations - Magnitude calibration

Part- 5 . Topic Tectonics

9 State of Stress in the Crust- Strain Kinematics

10 Faulting

11 Earthquake cycle deformation

Practical : Coulomb Stress Practical

Tutorial : Stress-Strain Tutorial

Part- 6 . Topic Statistical Seismology

12 Earthquake Statistics

13 Earthquake Recurrence

Tutorial : Earthquake Hazard Exercise

Self-study Tu. Maths Tutorial (Poisson statistics)

TEACHING METHODS

The course is taught through:

- lectures supported by directed reading
- practical sessions on the interpretation of seismograms, seismotectonics (fault plane solution), stresses on faults, statistical seismology
- self-guided tutorials involving both numerical and analytical solutions of seismological and seismotectonics problems
- Use of the web for accessing seismological and geohazard data

Matlab programming language and use of tensors will be supported by self-guided tutorials. Additional tutorial support will be arranged as required

EVALUATION METHODS

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1. Project work and presentation
 2. Practical weekly homework
 3. Final written test
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TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

- *Global tectonics*. Edited by P. Kearey - Keith A. Klepeis - Frederick J. Vine. Oxford: Wiley-Blackwell, 2009.
 - STEIN, Seth and Michael WYSESSION. *An introduction to seismology, earthquakes, and earth structure*. Malden, Mass.: Blackwell Publishing, 2003.
 - LAY, Thorne and Terry C. WALLACE. *Modern Global Seismology*. Academic Press, 1995.
 - Shearer P M (1999) *Introduction to Seismology*, C.U.P.
 - Bolt B A (2003) *Earthquake* 5th edition, W H Freeman & Co., New York
 - Fowler C M R (2005) *The Solid Earth* 2nd edition, Cambridge University Press
 - Gubbins D (1990) *Seismology and Plate Tectonics*, C.U.P.
 - Bullen K E & Bolt B A (1987) *An Introduction to the Theory of Seismology*, C.U.P.
 - Lomnitz C (1994) *Fundamental of Earthquake Prediction*, John Wiley & Sons
 - Scholz C H (1990) *The Mechanics of Earthquakes and Faulting*, C.U.P.
 - *Reference . IASPEI New Manual of Seismological Observatory Practice (2002) ed P Bormann, GeoForschungs Zentrum Potsdam*
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INTERACTION WITH STUDENTS

EXAMINATION SESSIONS (FORECAST)¹

SEMINARS BY EXTERNAL EXPERTS YES NO

FURTHER INFORMATION

¹Subject to possible changes: check the web site of the Teacher or the Department/School for updates.