Course: Engineering Seismology and Seismic Hazard Assessment
Lecturer: Prof. Dario Slejko
Date: 04/09/2017-22/09/2017
Classroom: 1-15@IUSS

Course schedule

Week	Date	Lecture hours	Tutorial hours	Subject	Tot h
1	Sept. 4	9:00 -12:30	14:00 -16:00	Introduction to the course + Plate tectonics	5
	Sept. 5	9:00 -12:30	14:00 -16:00	Earthquakes and faults	5
	Sept. 6	9:00 -12:30	14:00 -16:00	World seismicity + major earthquakes	5
	Sept. 7	9:00 -12:30	14:00 -16:00	Historical seismology	5
	Sept. 8	9:00 -12:30	14:00 -16:00	Instrumental seismology	5
2	Sept. 11	9:00 -12:30	14:00 -17:00	Earthquake location procedures + Ground motion	6
	Sept. 12	9:00 -12:30	14:00 -17:00	Statistics for Seismic Hazard + Basics of PSHA	6
	Sept. 13	9:00 -12:30	14:00 -17:00	Milestones of PSHA	6
	Sept. 14	9:00 -12:30	14:00 -17:00	Seismic Hazard + Seismic Hazard Maps	6
	Sept. 15	9:00 -12:30	14:00 -17:00	Uncertainties in PSHA + Earthquake Prediction	6
3	Sept. 18	9:00 -12:30	14:00 -16:00	Seismic Risk and Seismic Codes	5
	Sept. 21			PROJECT PRESENTATION	
	Sept. 22			FINAL EXAM	

Brief Contents Description and Course Syllabus: The course will give a general overview of the earthquake geology before entering in the basics of seismology and engineering seismology. Concepts of risk and hazard will be explained and all details for seismic hazard computation will be presented with several examples of seismic hazard map construction. Particular attention will be paid to the seismogenic source characterization and to the ground motion modelling.

1. EARTH AND EARTHQUAKES
   1.1. The structure of the Earth
   1.2. The moving Earth (Continental drift, Sea-floor spreading, Subduction, Hot spots, Plate tectonics, Mapping the ocean floor)
   1.3. Faults (Fault types, Dip-slip faults, Strike-slip faults, Oblique-slip faults , Fault characterization)
   1.4. Earthquakes (Earthquake myths, Tectonic earthquakes, Induced earthquakes)
   1.5. Effects of earthquakes (Landslides and liquefaction, Tsunamis)
   1.6. Stress and strain
   1.7. Elastic-rebound theory
   1.8. Theoretical models for earthquake occurrence
   1.9. Coulomb stress failure
   1.10. Faults generating earthquakes

2. NON-INSTRUMENTAL SEISMOLOGY
   2.1. Macroseismic intensity

- 2.2. The macroseismic scales (The Rossi – Forel scale (1873), The Mercalli-Cancani-Sieberg scale (1930), The Modified Mercalli scale (1956), The Medvedev–Sponheuer-Karnik scale (1964), The European Macroseismic Scale)
- 2.3. Isoseismals
- 2.4. Macroseismic parameters
- 2.5. Historical seismology
- 2.6. Palaeoseismology and Archaeoseismology
- 2.7. ShakeMap
- 2.8. The Community Internet Intensity Map

3. INSTRUMENTAL SEISMOLOGY
- 3.1. Elementary seismic waves
- 3.2. Dependent seismic waves
- 3.3. Travel-time tables
- 3.4. Seismic instruments (Theory of the seismograph, Characteristics of the seismographs)
- 3.5. Interpretation of seismograms and locating earthquakes
- 3.6. Magnitude
- 3.7. Seismic moment
- 3.8. Energy
- 3.9. Focal mechanisms and stress tensor inversion)
- 3.10. Foreshocks and aftershocks
- 3.11. Earthquake statistics and the Gutenberg – Richter law

4. STRONG GROUND MOTION
- 4.1. Ground motion parameters (Amplitude parameters, Frequency content parameters, Duration, Other ground motion parameters)
- 4.2. Development of predictive relationships

5. SEISMIC HAZARD
- 5.1. Deterministic approach
- 5.2. Probabilistic approach (historical probabilism, seismotectonic probabilism, general probabilistic hazard model, The smoothed seismicity approach, Earthquake prediction)
- 5.3. Software for PSHA
- 5.4. Seismic hazard maps
- 5.5. Site effects in seismic hazard maps
- 5.6. The SSHAC methodology in PSHA for strategic facilities

6. SEISMIC RISK
- 6.1. Risk and hazard
- 6.2. Examples of studies on seismic risk assessment
- 6.3. Global urbanization and increased seismic risk
- 6.4. Earthquake preparedness

7. BUILDING CODES
- 7.1. The Eurocode 8
- 7.2. The U.S. building code