



COURSE: Soil and Foundation Dynamics			
ACADEMIC YEAR: 2019/20			
TYPE OF EDUCATIONAL ACTIVITY: Characteristic			
TEACHER: Roberto Vassallo			
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phone: +39 0971 205390		mobile (optional):	
Language: Italian/English if foreign students will attend			
ECTS: (lessons and tutorials/practice) 6	n. of hours: (lessons and tutorials/practice) 54	Campus: Potenza Dept./School: School of Engineering Program: Master in Civil Engineering	Semester: I

#### EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

The course teaches the fundamentals of soil response in cyclic and dynamic conditions and provides the principles and the methods for their application to the problem of evaluating the free-field Local Site Effects. Fundamentals of foundation design under seismic loading are also taught within the general framework of structural design. The main recommendations of the Italian technical code in the field of geotechnical engineering are analyzed.

**Knowledge and understanding:** students have to prove themselves able to know and understand: the peculiarities of soil response when subjected to dynamic actions, either seismic or not; the fundamentals of wave propagation and seismology, necessary to characterize the dynamic load; in situ and laboratory tests for soil dynamic characterization; the phenomenon of dynamic soil-foundation interaction.

**Applying knowledge and understanding:** students have to prove themselves able to: evaluate the effect of the seismic action on a real subsoil; carry out an appropriate design of foundations under seismic loading within the framework of seismic technical codes, including the planning of geotechnical investigations required for an adequate modelling of soil-structure interaction.

**Making judgements:** students have to be able to deepen what they learn, in order to use the acquired knowledge as a good basis to obtain further results, with ever-growing maturity and independent judgement.

**Communication:** students have to be able to communicate the acquired knowledge, also to non-expert people, by using the scientific language.

**Lifelong learning skills:** students have to be able to continuously update their knowledge by consulting books, documents and publications and by attending specific seminars.

#### PRE-REQUIREMENTS

Good knowledge of soil mechanics, in particular for:

- constitutive laws;
- planning in-situ and laboratory investigations;
- laboratory test to estimate soil mechanical properties.

Basics of Structural Engineering, in particular for:

- behaviour of frame structures under horizontal loads.



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#### SYLLABUS

Introduction to the role of Soil Dynamics in engineering practice (2 hours);  
Fundamentals of Single-Degree-of-Freedom oscillating systems (4 hours);  
Fundamentals of Wave Propagation in homogeneous and heterogeneous subsoil (3 hours);  
Soil response under cyclic and dynamic conditions: equivalent shear modulus and damping – shear strength and liquefaction – simple constitutive models (3 hours);  
Geotechnical characterization of dynamic soil properties: laboratory and in situ tests – main factors affecting constitutive parameters (17 hours);  
Seismic load: earthquakes – ground motion parameters – seismic hazard (6 hours);  
Analysis of seismic vulnerability: Local Site Effects for an ideal and a real subsoil. Tutorials: Analysis of a case-history: free-field Local Site Effects; Foundation design under seismic loading (11 hours).  
Basics of structural dynamics; Modal analysis using response spectra; Pseudostatic approach; Italian seismic technical code (D.M. 14.01.2008 and D.M. 17.01.2018); Planning geotechnical investigations and design of foundations according to the Italian Code; Dynamic Soil-Structure Interaction (8 hours).

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#### TEACHING METHODS

Theoretical lessons (42 hours), Project works (12 hours).

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#### EVALUATION METHODS

Oral examination, Discussion of a project work.

The objective of the exam is to verify which level the student has reached relatively to the educational goals specified above.

The exam consists in an oral test in which the teacher will evaluate the student's ability to make links and compare the different aspects dealt with in the course. The final grade is determined by the outcome of the oral test.

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#### TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

G. Lanzo, F. Silvestri – Risposta Sismica Locale – Hevelius

F. Vinale, C. Mancuso, F. Silvestri – Dinamica dei terreni (in 'Manuale di Ingegneria Civile', Vol. 1) – Zanichelli

S.L. Kramer – Geotechnical Earthquake Engineering – Prentice-Hall

Course handouts available at: <http://oldwww.unibas.it/utenti/vassallo/home.shtml>

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#### INTERACTION WITH STUDENTS

At the beginning of the course, after describing objectives, syllabus and evaluation methods, the teacher makes some educational material available to the students by the website mentioned above. At the same time, the list of the students is gathered, with name, surname, matriculation number, phone number and e-mail address.

Office hours: in Potenza: Monday from 15 to 18, Macchia Romana Campus, Soil Mechanics Laboratory (Laboratorio di Geotecnica), room 4.

Besides, the professor is always available for assisting the students by e-mail or by video-calling.

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#### EXAMINATION SESSIONS (PLANNED)<sup>1</sup>

13/01/20, 03/02/20, 03/03/20, 06/04/20, 04/05/20, 08/06/20, 06/07/20, 27/7/20, 07/09/20, 05/10/20, 9/11/20, 14/12/20

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SEMINARS BY EXTERNAL EXPERTS      YES

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#### FURTHER INFORMATION