

Course: Foundation Engineering and Earth-Retaining Structures

a.y.: 2023/2024

Lecturer: Dr. Guido Andreotti

Teaching assistant: Dr. Sebastian Aedo-Maluje

Date: 08/04/2024 – 10/05/2024

Classroom: Lectures and tutorials: Classroom Eucentre1 (below the lab)

Written exam: Classroom Eucentre3 (ground floor)

Course schedule

Week	Date	Day	Lecture hours (9:30-12:30)	Lecture/Tutorial hours (14:30-16:30)	Topic	Tot hours	Classroom
1	8-Apr	Monday	x	x	0) Presentation of real case studies - 1) Review of soil mechanics : review of fundamentals of soil mechanics & exercises	5	Eucentre 1 (below lab)
	9-Apr	Tuesday					
	10-Apr	Wednesday	x	x	1) Review of soil mechanics : review of fundamentals of soil mechanics & exercises - Homework assignment n. 1	5	Eucentre 1 (below lab)
	11-Apr	Thursday	x	x	2) Shallow foundations : introduction, bearing capacity, exercises	5	Eucentre 1 (below lab)
	12-Apr	Friday					
2	15-Apr	Monday	x	x	2) Shallow foundations : bearing capacity, settlements, exercises	5	Eucentre 1 (below lab)
	16-Apr	Tuesday					
	17-Apr	Wednesday	x	x	2) Shallow foundations : settlements, seismic condition, introduction to soil-structure interaction - Homework assignment n. 2	5	Eucentre 1 (below lab)
	18-Apr	Thursday	x	x	3) Deep foundations : introduction, vertical bearing capacity (single pile), piled foundations (pile group), exercises	5	Eucentre 1 (below lab)
	19-Apr	Friday					
3	22-Apr	Monday	x	x	3) Deep foundations : lateral bearing capacity, settlements, displacements and introduction to soil-structure interaction, exercises	5	Eucentre 1 (below lab)
	23-Apr	Tuesday	x	x	3) Deep foundations : settlements, displacements and introduction to soil-structure interaction - Homework assignment n. 3	5	Eucentre 1 (below lab)
	24-Apr	Wednesday	Graduation day (UNIPV)				
	25-Apr	Thursday	holiday/vacation				
	26-Apr	Friday	holiday/vacation				
4	29-Apr	Monday	x	x	4) Earth-retaining structures : introduction, lateral earth pressure	5	Eucentre 1 (below lab)
	30-Apr	Tuesday	x	x	4) Earth-retaining structures : Rigid systems, analysis, design, exercises - Homework assignment n. 4	5	Eucentre 1 (below lab)
	1-May	Wednesday	holiday/vacation				
	2-May	Thursday	x	x	4) Earth-retaining structures : Flexible systems, analysis, design, exercises	5	Eucentre 1 (below lab)
	3-May	Friday					
5	6-May	Monday	x		Written exam	3	Eucentre 3 (ground floor)
	7-May	Tuesday					
	8-May	Wednesday					
	9-May	Thursday					
	10-May	Friday					

Objectives: The course aims to apply the principles of soil mechanics to the analysis and design of foundation systems and earth-retaining structures.

Description: The course opens by presenting two real case studies of assessment and design solved using the principles of soil mechanics, foundation engineering and earth-retaining structures. The discussion about the problems encountered and the adopted solutions will be used to introduce the main topics addressed during the course, showing their roles and collocation within the engineering design process. These case studies will also offer the possibility of highlighting some research aspects. Once the main topics have been introduced, each subject will be addressed in detail during the course.

The first part of the course is focused on *reviewing the main concepts of soil mechanics*, which are fundamental for understanding the principles of foundation engineering and earth-retaining structures.

Then, the course addresses the problem of *shallow foundations*, presenting the general typologies, design criteria, analytical approaches and safety checks for ultimate and serviceability limit states.

Subsequently, *deep foundations* will be covered, with classification and illustration of the different types of piles. Analytical approaches for calculating the bearing capacity of a single pile subjected to axial and lateral loads will be presented, considering the interaction between piles and group effects.

Then, it is the turn of *earth-retaining structures*, with a discussion about the classification of this type of construction, design criteria, failure mechanisms, and analytical approaches to performing safety checks.

The philosophy of current standards (e.g. Eurocode7) and design recommendations for the types of construction presented during the course will also be discussed.

Assignments: Homework will be assigned during the course. Students can help each other with their homework, but each student has to hand in his or her own work.

Exam: The final examination consists of a three-hour written test divided into a first part of theoretical questions (closed-books) and a second part of exercises (open-books).

Grade Breakdown:

- Homework assignments 30%
- Exam 60%
- Class participation 10%

Main Textbooks:

- Geotechnical Engineering, 2nd ed., Renato Lancellotta, Spon Text, 2008
- Foundation Analysis and Design, Joseph E. Bowles, McGraw-Hill, 1997
- Piles and Pile Foundations, Carlo Viggiani, Alessandro Mandolini – Gianpiero Russo, Spon Press, 2011
- Eurocode 7: Geotechnical Design Worked examples, European Commission, Joint Research Centre, Institute for the Protection and Security of the Citizen, ISBN 978-92-79-33759-8, ISSN 1831-9424, doi: 10.2788/3398