

Geotechnical Engineering (9ECTS)

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academic year 2020-2021

Programme

Genesis and classification of soils

- Formation and composition of soils
- Soil classification: grain size distribution, Atterberg limits and plasticity chart
- Phase relationships
- State of a soil
- Exercise on soil classification

Water flow through soils

- Basics of hydraulics
- Darcy's law and one-dimensional seepage
- Governing equation under three-dimensional conditions
- Solution of one- and bi-dimensional seepage
- Exercise: one-dimensional seepage for different schemes, bi-dimensional problem

Elements of stress analysis

- Stress and strain state
- Mohr's circle
- Invariants of the stress-strain state
- The Principle of effective stress
- Relevant stress paths for geotechnical problems
- Exercise: lithostatic stress state in a layered soil deposit, case of an indefinite sloping ground, construction of Mohr's circles

Mechanical behaviour of soil: modelling and experimental evidences

- Modelling aspects: elasticity, plasticity and volumetric behaviour
- Strength criteria and Rankine's formulas
- Exercise: analysis of the stress-strain response of simple elastic-plastic materials
- Drainage conditions
- Compressibility
- Oedometer test
- Consolidation: one-dimensional theory, solution for different boundary conditions
- Exercise: oedometer test, compressibility properties, coefficient of consolidation
- Strength of soils: drained and undrained behaviour, Critical State, effect of dilatancy
- Exercise: limit contact pressures on a retaining structure
- Triaxial test
- Choice of the strength parameters

- Exercise: drained and undrained triaxial tests, evaluation of the strength parameters, evolution of the stiffness with the strain level
- Direct shear test
- Exercise: direct shear test, stress paths and strength parameters

Computational aspects

- Bearing capacity of shallow foundations
- Effective and total stress analysis
- Exercise: bearing capacity of a shallow foundation under undrained and drained conditions, effect of the foundation shape
- Elastic solutions for the induced stresses in the soil
- Settlements of shallow foundations
- Time evolution of settlements
- Exercise: settlements for a shallow foundation

Teaching method

This course aims at providing a basic knowledge on the mechanical behaviour of soils. The constitutive models adopted in practical applications are studied together with the laboratory tests used to characterise the soil response. The main methods of analysis for the evaluation of the lateral earth pressure on retaining structures, of the safety and settlements of shallow foundations are studied.

The course consists of lessons concerning theoretical aspects and exercises for each topic of the programme.

The exercises are mandatory, are evaluated by the lecturer and are considered in the final judgement.

The final examination consists of an oral test aimed at evaluating the exercises and the candidate's ability to solve practical problems using the concepts studied during the course.

Class schedule and weekly meeting

The class schedule is as follows:

Monday	14.00-16.00
Wednesday	11.30-13.30
Thursday	9.00-11.00
Friday	11.30-13.30

The permanent link for the online lessons is:

<https://zoom.us/j/96613843620?pwd=VmZ4azJxU2hpSDN2azRHc0czWVJzZz09>

The weekly meeting (via Zoon) for explanations is on Thursday at 14.00-15.15. Use the following link to join the meeting:

<https://zoom.us/j/92211570987?pwd=ZWZBWUdGTGVzN3c4bUpNSnFpblF4QT09>

All communications are uploaded on the Google Classroom of the course, whose link is:

<https://classroom.google.com/c/Mjc1MTUzNTAzNzA5?cjc=onq25fj>

Contact the lecturer via email (davideno.gorini@uniroma1.it) for any further information concerning the course.

Study material

The recorded lessons, exercises and lecture notes will be uploaded on the Google Classroom of the course.

Suggested books:

- Lancellotta, R. (2008). *Geotechnical Engineering*, 2nd edition, Taylor & Francis, London and New York.
- Budhu, M. (2010). *Soil mechanics and foundations*, 3rd edition, John Willey & Sons, New York.