CIVIL-203

Soil mechanics and flow through porous media

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Cursus	Sem.	Type
Civil Engineering	BA4	Obl.

Language of teaching	English
Credits	6
Session	Summer
Semester	Spring
Exam	Written
Workload	180h
Weeks	14
Hours	**6 weekly**
Courses	3 weekly
Exercises	2 weekly
TP	1 weekly
Number of positions	

Summary

The course introduces students to the fundamentals of the mechanics of soils and fluid-infiltrated porous media. The first part is devoted to the constitutive behavior of soils in dry conditions, while the second part accounts for the presence of pore water.

Content

- Soil structure and phases, porosity, grain size distribution, soil classification
- Micromechanics, stress and strain within a soil mass
- Linear elasticity, geostatic stresses, stresses induced by loads, elastic halfspace solutions
- Nonlinear elasticity, oedometric compression, general stress-strain behavior
- Behavior under shear (direct shear, triaxial compression tests), dilatancy, shear strength, Mohr-Coulomb failure criterion
- Basic constitutive models of plasticity, introduction to the concept of Critical State
- Pore water pressure, effective stress, saturation, undrained behavior
- One-dimensional flow through soils, seepage forces, laboratory measurement of permeability, Darcy's law
- Two-dimensional flow through soils, flow nets, influence of soil anisotropy
- Pore pressure development during undrained loading
- One-dimensional consolidation and its analytical/numerical solution

Keywords

Soil mechanics, underground flow, effective stress, constitutive relationships, elasticity, failure criteria

Learning Prerequisites

Required courses

Mécanique des milieux continus (pour GC) CIVIL-205
Géologie CIVIL-211

Important concepts to start the course

Mechanics of deformable media, linear elasticity theory

Learning Outcomes

- Formalize a problem linked to the field of soils and underground flows.
- Hypothesize on the behavior of geomaterials.
- Apply analytical and numerical techniques for the solution of underground flow problems.
- Interpret laboratory test results.

Transversal skills

- Access and evaluate appropriate sources of information.
- Demonstrate the capacity for critical thinking

Teaching methods

Ex cathedra course, audio-visual means, in-class exercises, practical laboratory sessions.

Expected student activities

Active participation, home study, solution of provided exercises, preparation of laboratory reports.

Assessment methods

Written exam during the summer session (70%), intermediate test (20%), lab reports (10%).

Supervision

Office hours	Yes
Assistant.e.s	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

No

Bibliography

Lecture notes uploaded on Moodle
Geotechnical engineering by R. Lancellotta - CRC Press (2002)
An Introduction to Soil Mechanics by A. Verruijt - Springer (2018)

Ressources en bibliothèque

- Find the references at the Library

Moodle Link

- https://go.epfl.ch/CIVIL-203

Prerequisite for

Geotechnical Engineering, Rock mechanics