CIVIL-402	Geomechanics				
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Cursus		Sem.	Туре	Language of	English
Civil Engineering		MA1, MA3	Obl.	teaching	Linglish
Mechanics			Opt.	Credits Session Semester Exam Workload	4 Winter Fall Written 120h
				Weeks Hours Lecture	14 4 weekly 2 weekly 2 weekly
				Number of positions	2 WEEKIY

Summary

The course aims at providing future civil engineers with the knowledge of geomechanics for professional practice. It addresses, among others, the main stress-strain constitutive models within the context of elasticity and elasto-plasticity and the estimation methods of the lateral earth pressure.

Content

- Engineering applications and challenges
- Basic concepts of continuum mechanics and geomechanics

Stress-strain behaviour of geomaterials in drained and undrained conditions Laboratory tests with special focus on triaxial testing

- In-situ stress state
- Stress-strain constitutive frameworks

Elasticity
Linear and non-linear elasticity
Applications of elastic models
Plasticity
Plasticity principle and yield criteria for geomaterials
Critical state concept
Elasto-plastic stress-strain constitutive frameworks (among other Modified Cam Clay model)

• Time dependent behaviour of geomaterials

Real cases and time-dependent phenomena Viscous deformations: basic concepts and experimental evidences Visco-elasto plastic models

• Behaviour of unsaturated geomaterials

Basic concepts Hydraulic and mechanical behaviour Effective stress definition for unsaturated geomaterials

• Retaining structures in saturated and unsaturated geomaterials

Lateral earth pressure for saturated and unsaturated soils (Rankine¿s theory) Shear strength of unsaturated geomaterials Darcy¿s law for saturated and unsaturated geomaterials



• Thermo-mechanics and soil dynamics

Mechanical behaviour of soils in non-isothermal conditions Mechanical behaviour of soils under dynamic loads

· Advanced topics in geomechanics

Energy related applications

Bio-improved soils

• Series of workshop with professionals in geomechanics and geotechnical engineering

Keywords

Mechanical behaviour of geomaterial, Constitutive models, elasto-plasticity, numerical modelling in geomechanics, laboratory and in-situ testing

Learning Prerequisites

Required courses Soil mechanics and groundwater seepage

Learning Outcomes

By the end of the course, the student must be able to:

- Recognize the stress path(s) to which the soil is subjected in the context of the engineering application of interest
- Use methods for evaluating the in-situ stress state
- Recognize the most suitable constitutive model for the problem of interest in relation to the soil and the problem itself
- Judge capabilities and limitations of constitutive models
- Assess / Evaluate Evaluate the geotechnical parameters governing the geomechanical problem
- · Choose the correct laboratory or in-situ tests for the determination of the needed parameters
- Interpret the experimental data resulting from a laboratory campaign in order to obtain the parameters of interest
- Assess / Evaluate the lateral earth pressure under different hydraulic conditions
- Use consciously a finite element software for creating a geomechanical model appropriate for the problem of interest

Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Use a work methodology appropriate to the task.
- Communicate effectively with professionals from other disciplines.
- Demonstrate the capacity for critical thinking
- Use both general and domain specific IT resources and tools
- Access and evaluate appropriate sources of information.

Teaching methods

• Ex cathedra and exercices

Assessment methods

Final exam (written): 60% of the final mark

Mid-term exam (written): 20% of the final mark Continuous assessment (workshops and projects): 20% of the final mark

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Bibliography Lectures notes and handouts given during the course

Moodle Link

• https://go.epfl.ch/CIVIL-402