GEOMECHANICS

(Civil – 402, 5 credits)

Course program: 08.09.25 – 19.12.25

Theory session: Monday, 11:15 – 14:00, room GR A3 30

Exercises, project session: Thursday, 17:15 – 19:00 room AAC 0 06

Lecturers: **Alessio Ferrari** (AF, main lecturer), **Lyesse Laloui** (LL)

Assistants: Ziad Sahlab (ZS), Mathilde Métral (MM), Alessandro Parziale (AP)

W	Date	Room	Content
1	08.09.25	GR A3 30	**1. Course introduction** Goal of the course Introduction to geomechanics A general overview of the program **2. Basic concepts, stress paths, and stress-strain behaviour** Effective stress concept Laboratory tests with particular focus on triaxial testing (set-up and stress paths) Stress-strain behaviour of geomaterials in drained and undrained conditions.
	11.09.25	AAC 0 06	**LMS - Lab visit**
2	15.09.25	GR A3 30	**3. Elasticity** Stress-strain constitutive frameworks (stress and strain variables, existing models) Linear and non-linear elasticity
	18.09.25	AAC 0 06	**Exercise 1**: Processing triaxial tests data
3			
	25.09.25	GC B1 10	**Workshop 1: Nikolaos Karavangelas – Terminal Investment Limited (TIL)**
4	29.09.25	GR A3 30	**4. Plasticity** Plasticity principle and yield criteria for geomaterials Elastic-perfectly plastic models Applications of elastic-perfectly plastic models
	02.10.25	AAC 0 06	**Exercise 2 -** Elasticity / **Project** – Part 1: Elastic parameters from triaxial data
5	06.10.25	GR A3 30	**5. Hardening elasto-plasticity** Post-yield behaviour (flow rule, plastic potential, hardening rule) Elasto-plastic stress-strain constitutive frameworks
	09.10.25	AAC 0 06	**Exercise 3 -** Perfect plasticity **/ Project** – Part 2: Elastic-perfectly plastic model parameters

6	13.10.25	GR A3 30	**6. Critical state concept** Definition of "critical state" Experimental evidence on normally and overconsolidated soils Critical state line (CSL) and critical state parameters Shear strength vs critical state
	16.10.25	AAC 0 06	**Exercise 4**: Critical state concept
7	27.10.25	GR A3 30	**7. Modified Cam Clay (MCC): a hardening elasto-plastic constitutive model** Equations Prediction of the mechanical behaviour according to the MCC model Example of application
	30.10.25	AAC 0 06	**Exercise 5**: Modified Cam-Clay Model / **Project** – Part 3: MCC parameters
8	03.11.25	GR A3 30	**Mid-term written EXAM (weeks 1 to 7)**
	06.11.25	AAC 0 06	**Hands-on session** – Implementation of constitutive models / **Hands-on session** – Introduction to FEM software

ECTS credits allocated to this course: 5

Evaluation:

- Final exam (written): 60% of the final mark
- Mid-term exam (written): 20% of the final mark
- Project report: 20% of the final mark

Additional details:

Communication

- This class is on Moodle forum.

Mid-term and Final exam

- A formulary associated with each lecture will be created; a collection of formularies will be provided during the written exam tests.

Continuous assessment

- The project (groups of 3/4 students), has to be submitted by Friday 19th December 2025 on Moodle.

Exercise sessions

- Students should bring their laptops during the exercise sessions.