Soil mechanics

Lecturer
Alessia Cuccurullo (Coordinator)

Course mnemonic
CNST-H302

ECTS credits
5 credits

Language(s) of instruction
English

Course period
First term

Campus
Solbosch

Course content

This course introduces the basic concepts of soil mechanics and foundation engineering. It covers the following fundamentals :

- Soil constituents (three-phase material, soil structure and fabric, volumetric and mass ratios, soil-water interaction);
- Soil classification (size of soil fraction, grain size distribution, clay fraction/minerals and properties, soil classification, clay activity and liquidity index);
- Principles of water flow in soil (soil permeability, rate of water flow and velocity, darcy's law, steady state flow);
- Soil compaction (compaction process, Proctor compaction test, compaction curves of different soils, characteristics of compacted soils);
- Stresses in soil (effective stress and pore water pressure, Mohr circle and stresses);
- Process of consolidation (types of settlement during consolidation, soil consolidation in practice, one-dimensional consolidation, oedometer test, Terzaghi's theory of consolidation);
- Shear strength of soil (direct shear tests, triaxial compression tests, stress path concept);
- Soil constitutive model (elastoplasticity and hardening);
- In-situ testing (CPT and pressuremeter tests);
- Shallow and pile foundation (general concepts, bearing capacity and settlement);
- Dewatering and drainage (Dupuit's theory) ;
- Embankment dam.

Objectives (and/or specific learning outcomes)

Provide the basic theoretical and experimental notions of Soil Mechanics focusing on the elaboration, the choice and the interpretation of classical experimental tests in the laboratory and the field.

On completion of this course, the student will be able to:

1. Master soil mechanics notions which are useful for the design of geotechnical elements in a construction project;
2. Develop an appreciation of soil as construction material, with soil mechanics being essential in the engineering of civil infrastructure;
3. Dvelop an understanding of the relationships between physical characteristics and mechanical properties of soils;
4. Experience experimental measurement of the physical and mechanical soil properties commonly used in engineering practice;
5. Demonstrate ability to explain theoretical and experimental notions of soil mechanics;
6. Apply Darcy's Law; consolidation models for load-time-deformation responses of soils; Mohr-Coulomb models for shear strength behaviour of soils, etc;
7. Demonstrate ability to apply the effective stress concept to solve elementary geotechnical problems;
8. Design shallow and pile foundations;
9. Develop good technical reporting and data presentation skills;
10. Understand both the applications and limits of engineering methods commonly used to solve soil mechanics problems in civil engineering.

Pre-requisits and co-requisits

Pre-requisites courses

CNST-H2001 | Mécanique des solides et des structures | 5 crédits

Course having this one as co-requisit

PROJ-H305 | Projet de conception des structures | 5 crédits

Teaching method and learning activities

Theoretical lectures (24h)

Exercises (24h):

Tutorial exercises are given with supervised tutorial classes. The aim is to give the students opportunities to develop skills in applying the theories and methods learned to solve elementary geotechnical engineering problems. The exercises cover a great variety of elementary geotechnical problems with varying degrees of difficulty.

Laboratory sessions:

Laboratory experiences are designed to clarify lecture material. Laboratory classes are undertaken in the Soil Mechanics Laboratories. The students work in groups under the supervision

of a laboratory demonstrator. The aim is to train the student in proper laboratory test techniques, including the analysis of results and the evaluation of relevant properties. 3 laboratory sessions will be organised by a group of around 6 students. Attendance of those sessions is mandatory and a report will be requested after each session. Those 3 reports will be evaluated and will count for 10% of the final mark.

References, bibliography and recommended reading

B. François "Soil Mechanics". Course Syllabus

Other information

Place(s) of teaching

Solbosch

Contact(s)

Alessia CUCCURULLO Av. A. Buyl, 87 - 1050 Bruxelles Bât. C, niveau 4, local 301

Evaluation method(s)

written examination, Oral presentation and Other

Determination of the mark (including the weighting of partial marks)

3 reports from laboratory sessions will count for 10% of the final mark.

In case of failure during the first session, only the mark corresponding to the laboratory sessions can be kept for the second exam session. Marks assigned to written exams (exercises) and oral exams (theory) will not be kept for further exam sessions.

Main language(s) of evaluation

English

Programmes

Programmes proposing this course at the Brussels School of Engineering

BA-IRAR | Bachelor in Engineering : Architecture | unit 3 and BA-IRCI | Bachelor in Engineering Sciences | option Bruxelles/unit 3