UCL Université catholique de Louvain

LAUCE2176

2015-2016

Geotechnical risks

5.0 credits	40.0 h + 10.0 h	1q

Teacher(s) :	Vanden Berghe Jean-François ; Holeyman Alain ;
Language :	Anglais
Place of the course	Louvain-la-Neuve
Inline resources:	Transparencies of the course and project data
Prerequisites :	- Soil mechanics; - Geotechnics, which can be followed simultaneously ; *The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
Main themes :	The course goal is learning how to manage the various facets of geotechnical risks. This risk management is an integral part of the professional life of the geotechnical engineer. It implies to be able to identify the risks, to quantify them and to mitigate their impact. The proposed learning is acquired by illustrating the "risk" aspects of different geotechnical problems already solved within the mandatory geotechnical curriculum, as well as by introducing new problems where the risk pertains to the project demands and to particular behaviors of soils. The course is divided into two parts: -- The first part starts with the definition of risk and the concept of acceptable risk. Then, it moves on to the methods used to represent the risks and guide the decision-making process. The risks relating to the different phases of a geotechnical engineering project are discussed. These are intrinsically linked to the uncertainties belonging to soil mechanics, namely the uncertainty of characterization resulting from the natural variability of the soil and of the limits of the means of investigation, the uncertainty of calculation resulting from the limitations of the calculation available models, the uncertainty of loading, particularly important in the case of natural loading (for example, earthquakes) and finally the uncertainty of achievement due to the difficulty of underground construction processes. -- The second part deals with a series of practical cases that will help implement the concepts acquired in the first part. For example, the risks related to the slope stability, seismic risks, the risks relating to offshore constructions and environmental risks will be treated according to the preferences of the students.
Aims :	With regards to the learning outcomes (LO) repository of the program "Master in Civil Engineering", this course contributes to the development, acquisition and the evaluation of the achievements of the following LOs: Demonstrate the mastery of a body of knowledge in the basic, disciplinary, and polytechnical sciences, allowing one to solve arising problems (LO1.1, LO1.2, LO1.3) Organize, fulfill, and validate an approach of engineering aimed at responding to a need or a specific problem (LO2.1, LO2.2) Document and summarize the state of knowledge in a limited area (LO3.1) Communicate the results of one's work in the form of reports, plans, presentations, or other documents tailored to one's audience (LO5.3, LO5.5) Act with professionalism and rigor, while integrating the issues and ethical choices in the exercise of one's responsibilities (LO6.1, LO6.3) More specifically, at the end of this course, the student should be able to: Technical skills and engineering: Understand and quantify the uncertainties of characterization of the soil and integrate its uncertainties in a design process of a geotechnical project based on risk management Assess the importance of the consequences arising from imperfections in the actual construction of elements of civil engineering works with regards to their stability Understand the importance of the responsibility of the Geotechnical Engineer in a legal context and contractual. Imagine and put in place a monitoring plan for a project to adapt the design for further safety and/or economy Characterize the seismic hazard to which a project is exposed, taking into account its geological environment Characterize the behavior of soils under cyclic stresses and assess their risk of liquefaction Sizing a slope, a retaining wall, and a foundation subject to seismic loading Measure the geotechnical challenges facing the offshore industry. Skills project management / managerial and relational competencies: Manage risk, make decisions, and defend the positions taken Design the conceptual resolution of a problem by integrating skills acquired in other courses (mainly of geotechnical engineering) Communicate effectively with teachers. Submit an idea/analysis and defend it *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*

Evaluation methods :	The evaluation will be made in 2 parts: Part 1: exercises (50% of the final score) For each exercise session, the students will have to present the resolution of exercises in a short report/calculation note highlighting the approach used, the assumptions and the choices made. This work will be carried out by group of 2 The reports will be graded and the students will be individually interviewed on an exercise. This poll will be open book. Part 2: overview and critique of an article (50% of the final score) Presentation of an articlelinked with the course subject, from a list proposed towards Week 9. The students discuss the conclusions of the article by linking them to the material of the course and/or to the control of risks in geotechnical engineering. The presentation will take place during the exams session and will last 20 ', followed by a 10' discussion This work can be accomplished by group of 2, no report being necessary beyond the presentation file.
Teaching methods :	Ex-cathedra teaching on the basis of transparencies for Volume 1. Problem solving workshops (directed exercises, case studies, etc.) for Volume 2.
Content :	Part I: Framework and basic elements Ch 1: concepts of risk (Course + 1 exercise): Introduction, Definition of risk, acceptable risk, risk assessment, Risk in a legal and contractual context Ch 2: uncertainties of characterization (Course + 1 exercise) : Introduction, steps in the geotechnical investigation, Sources of characterization uncertainties, quantification of characterization uncertainties Ch 3: Uncertainty of realization (Course + 1 exercise) Geometry, materials, elements: example of piles, Civil Engineering projects Ch 4: Design, sizing and verification (Course + 3 exercises) Introduction, Formulations of reliability, Integration of the function of performance, design Methodologies Part II: Areas of application illustrating Ch 5: seismic hazard (course + 1 exercise) Introduction, Internal Structure of the earth, seismic Movement (intensity), earthquakes (Magnitude), Response spectrum, Seismic Hazard Assessment Ch 6: cyclic behavior of soils (Course + 1 exercise) Elastodynamics (geometric attenuation), dynamic properties of soils, Liquefaction of soils, assessment of the risk of soil liquefaction Ch 7: Earthquake Engineering (Courses + 1 exercise) Foundations subjected to dynamic loads, stability and seismic deformation of embankments, seismic stability of retaining structures, Eurocode 8 Ch 8:Offshore Risks (courses) Offshore Activities, major offshore structures, risks associated with platforms jack ups, risks related to offshore pipelines, offshore geological uncertainties
Bibliography :	-- Transparencies of the course ; -- Articles to be read ;
Other infos :	The course pre-requisite LAUCE2171 can be taken simultaneously with this course
Faculty or entity in charge:	GC

Programmes / formations proposant cette unité d'enseignement (UE)

Intitulé du programme	Sigle	Credits	Prerequis	Acquis d'apprentissage
Master [120] in Civil Engineering	GCE2M	5	LAUCE2171	