UCLouvain

lgciv2073

2024

Hydrogeology and Geoenvironment

5.00 credits	30.0 h + 15.0 h	Q1

Teacher(s)	Rattez Hadrien ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	Good knowledge of geomaterials and soil mechanics as taught in courses LGCIV1031 and LGCIV1072
Main themes	The objective of this course is to learn how to manage the different scientific and technical aspects related to geoenvironmental and geoenergy hydrogeology, with links to geomechanics. It contributes to the management of environmental risk, which is an integral part of the geotechnical engineer's job, but also to current challenges related to new sources of energy and storage underground (geothermal, hydrogen, …), and the waste disposals (nuclear, CO2,…). The course has two parts: • The first part deals with theoretical concepts: Fundamental principles of fluid flow and heat transport in porous media, behavior of unsaturated soils and rocks, poromechanics. • The second part deals with applications: geothermal energy, aquifer thermal energy storage, underground compressed air storage, industrial soil pollution, Nuclear and CO2 underground storage, unconventional oil and gas extraction.
Learning outcomes	**At the end of this learning unit, the student is able to :** Regarding the AA reference system of the 'Master of Civil Engineering Construction" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes: AA1.1, AA1.2, AA1.3, AA2 .1, AA2.2, AA5.1, AA5.3, AA5.5, AA6.2, AA6.3, AA6.4. At the end of this course, the student must be able to: 1 • Understand transport and balance between the different soil phases (solid, liquid, gas) • Characterize advection, diffusion, dispersion and attenuation processes in saturated soil and unsaturated soil, through laboratory and in situ tests • Evaluate the mobility of non-aqueous fluids (light and heavy) in a given geoenvironmental context • Determine hydrogeological parameters (transmissivity, storage, etc.) using in situ tests and transient pumping tests • Calculate flow velocities and drawdown induced by pumping under transient conditions • Pre-design a geothermal or hydrothermal installation • Know the challenges and technologies currenty developed for underground storage (Nuclear waste disposal, CO2, Hydrogen).
Evaluation methods	• Oral exam for the practical exercises and the theory • Group project with a presentation on one of the given themes
Teaching methods	Teaching in english, with supports in English.
Content	Theoretical part: • • Unsaturated soils (transport and mechanical models) • Multiphase fluid flows in porous media • Diffusion and advection of heat and chemical species in porous media • Poromechanics Applications part: • • Soil pollution • Geothermal energy (deep and heating) • CO2 storage • Storage of radioactive waste • Extraction and storage of hydrocarbons • Hydrogen storage
Inline resources	PowerPoint slides and exercises are available on Moodle

Bibliography	Available on Moodle
Other infos	Depending on the availabilities, a visit may be organized on-site (quarry, excavation, pumping station, ...)
Faculty or entity in charge	GC

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Environmental Science and Management	ENVI2M	5		
Master [120] in Civil Engineering	GCE2M	5		
Master [120] in Environmental Bioengineering	BIRE2M	5		
Interdisciplinary Advanced Master in Science and Management of the Environment and Sustainable Development	ENVI2MC	5		
Master [120] in Chemistry and Bioindustries	BIRC2M	5		
Master [120] in Agriculture and Bio-industries	SAIV2M	5		