





Teacher(s)	Bielders Charles (coordinator) ;Javaux Mathieu ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	General knowledge in soil science : texture, structure, composition, etc.
Main themes	<ul style="list-style-type: none"> <li>- Characteristics of a porous medium</li> <li>- Water retention and water potential in soils</li> <li>- Flow of water in saturated and unsaturated media</li> <li>- Techniques for characterizing water content, water potential and hydraulic conductivity</li> <li>- Introduction to solute transfer</li> <li>- Transfer of gas and heat in soils</li> <li>- Soil Mechanics</li> </ul>
Learning outcomes	<p><b>At the end of this learning unit, the student is able to :</b></p> <p>a. Contribution de l'activité au référentiel AA (AA du programme) M1.2 ; M1.4 ; M2.2 ; M2.3 ; M2.4 ; M6.5 ; M6.8</p> <p>b. Formulation spécifique pour cette activité des AA du programme</p> <p>At the end of the course, the student will be able to:</p> <ul style="list-style-type: none"> <li>- Explain the factors that determine the physical properties of soil</li> <li>- Master the basic techniques of characterization of soil physical properties</li> <li>- Explain the impact of soil physical properties on the retention and flow of water, the transfer of gas, heat and dissolved substances, and mechanical properties of soils</li> <li>1 - Establish the profiles of total water potential from baseline data</li> <li>- Establish the basis for modeling the dynamics of soil water in space and time, and applying Darcy's equation to estimate steady water flow</li> <li>- Associated with a given type of soil, depending on texture and structure, the physical properties that correspond to it, and interpret soil physical data</li> <li>- Describe the principle of operation, advantages and disadvantages of conventional methods and instruments used for the characterization of soil physical properties</li> <li>- Extract soil samples in situ and characterize the basic hydraulic properties in the laboratory</li> <li>- Write a report according to scientific standards and critically and consistently analyze results</li> <li>- Contribute effectively to collegial data acquisition, analysis and writing of the results and conclusions.</li> </ul>
Evaluation methods	Report of practicals (40%) Oral exam based on solving of exercises (written preparation) (40%) Oral exam based on 3 theoretical questions (no préparation) (20%)
Teaching methods	<ul style="list-style-type: none"> <li>- Classes, largely illustrated by photos, schematics and exercices</li> <li>- Inverted classrooms, based on Videos from the MOOC 'L'eau et le sol' (in French) (water retention and flow in soils)</li> <li>- Practical in the lab and in the field</li> <li>- Exercise solving sessions</li> <li>- Feedback on practicals report around mid-semester</li> </ul>
Content	Lectures : <ul style="list-style-type: none"> <li>- Reminder regarding the characteristics of a porous medium</li> <li>- Retention of water in soil, capillarity, water retention, hysteresis</li> <li>- Potential of water in soils: gravitational, matrix, hydrostatic, overburden, osmotic, barometric potential</li> <li>- Techniques for characterizing water content and water potential                             <ul style="list-style-type: none"> <li>- Water flow in soils under steady saturated and unsaturated conditions : laws of Poiseuille, Darcy Equation and Richards equation</li> </ul> </li> <li>- Techniques for characterizing the hydraulic conductivity curve</li> </ul>

	<ul style="list-style-type: none"> <li>- Equation of water transport in soil: Examples of analytical solutions</li> <li>- Introduction to solute transport in soils</li> <li>- Transfer of gas and heat in soil : processes</li> <li>- Mechanical properties of soils , compaction, and characterization techniques</li> </ul> <p>Practicals :</p> <ul style="list-style-type: none"> <li>- Sampling of soil</li> <li>- Measurement of bulk density</li> <li>- Measurement of infiltration : constant head infiltrometer and permeameter</li> <li>- Characterization of the water retention curve</li> <li>- Calculation of water potentials</li> <li>- Calculation of water balance</li> </ul>
Inline resources	<p>Moodle MOOC "L'eau et le sol"</p>
Bibliography	<p>Ouvrage de référence :</p> <ul style="list-style-type: none"> <li>- "Environmental Soil physics", D. Hillel</li> <li>- Transparents des cours sur iCampus</li> <li>- MOOC "L'eau et le sol" (EDX)</li> </ul>
Other infos	<p>This course can be given in English.</p>
Faculty or entity in charge	<p>AGRO</p>

<b>Programmes containing this learning unit (UE)</b>				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Agricultural Bioengineering	BIRA2M	4		
Master [120] in Environmental Bioengineering	BIRE2M	4		
Master [120] in Forests and Natural Areas Engineering	BIRF2M	4		
Master [120] in Chemistry and Bioindustries	BIRC2M	4		
Master [120] in Agriculture and Bio-industries	SAIV2M	4		