UCLouvain

lbrte2101

2019

Aquatic and soil biological and physical chemistry

In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	37.5 h + 15.0 h	Q1

Teacher(s)	Delmelle Pierre ;Gerin Patrick (coordinator) ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	The course explores the physico-chemical and (micro) biological processes that govern the functioning of aquatic and soil, natural or anthropised, (eco-)systems. It describes how the principles of thermodynamics and kinetics are applied to these systems to understand their state and their evolution, in particular taking account of biological catalysis. The course focuses on the contextualisation of theoretical knowledge by analyzing specific/ real environmental issues (eutrophic waters, wastewater treatment, soil pollutants, ...). The various factors and physico-chemical and (micro) biological processes involved in these systems are presented and analyzed, with investigation of the complexity of their interactions. The course aims to highlight the scientific background neede to develop strategies for environmental management.
Aims	a. <u>Contribution de l'activité au référentiel AA (AA du programme)</u> 1.1, 1.2, 1.4 2.1, 2.2, 2.3, 2.4 3.1, 3.7 4.1, 4.2, 4.3, 4.4 6.1, 6.2, 6.4, 6.5 8.5 b. <u>Formulation spécifique pour cette activité des AA du programme (maximum 10)</u> At the end of this activity, the student is able to quantitatively solve a complex problem concerning the functioning or evolution of aquatic or soil ecosystems , natural or affected by man, that is conditioned by interactions between physical, chemical and biological processes. More specifically, the student is able to : 1 - Interpret data on the characteristics of a soil or water, natural, polluted or industrial (eco)system; - Identify and explain the basic phenomena (physical, chemical, biological , transfers, thermodynamics) involved in the functioning of this system; - Propose strategies to control these phenomena with the perspective of environmental protection , pollution control or industrial production; - Choose the stoichiometric , thermodynamic and kinetic models appropriate to formalize the key processes of the problem in the adequate system of equations; - Use these models and corresponding simulation tools to calculate the evolution of state variables (eg concentrations, flux .) that characterize the system; - Based on the data and results, take a position with respect to the adequacy of the proposed solution ; - Identify the processes not described by the lectures and document autonomously these processes, in ordre to be able to explain in a report the processes and their interactions with other processes involved in the evolution of the considered (eco) systems. - - - - *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	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** *The assessment will be based on:* *- Five or six group assignments to be completed during the course weeks. Feedback will be provided on each assignments. They are an integral part of the learning support;* *- An individual written (open book) exam asking each student (i) to solve problems through the use of the tools practiced during the course, and (ii) to interpret his/her results by mobilizing the concepts discussed in class.*

Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Lectures Supervised resolution of exercises, tutoring and access to exercices solutions Group assignments (distributed during the semester) using the concepts and tools developped during the course, with feedback.
Content	Lectures and exercises:- Reminding of basic concepts and contextualized deeper investigation of equilibria: atmospheric gas - water, acid-base , complexation - dissolution , oxidation-reduction (electron cycles in the biosphere, redox potential of natural waters and soil) - Characterization of soil and water: biotic and physico - chemical parameters - Analysis of the functioning of environmental systems : pollution of aquatic ecosystems (pollution profile, eutrophication), background of waste water purification processes (primary, secondary , tertiary), substances dynamics in the soil profile (not reactive and reactive solutes, complexes) , chemistry and biochemistry of the rhizosphere and root. Personal work (tutoring by teachers) . analysis of a scientific paper on the functioning of aquatic or soil systems. Personal developement and deepening of an original topic related to the course and the research paper. This course aims to prepare students to professional activities that involve analysis or management of aquatic and soil environments. It is based primarily on the structuring and integration of knowledge of basic chemistry, (micro) biology and engineering in the previous academic years, and their implementation to understand the functioning of the natural environment or designing technologies for soil remediation or water treatment .
Inline resources	Moodle Autre: Scientific journals in the field of soil and water, available though UCL libraries subscriptions
Bibliography	Ouvrages de référence (facultatifs): Werner Stumm, James J. Morgan. 1996. Aquatic Chemistry: chemical equilibria and rates in natural waters. 3rd Edition. Wiley-Interscience Publication, John Wiley and Son Inc. ISBN 0-471-51184-6, ISBN 0-471 ou Laura Sigg, Werner Stumm, Philippe Behra. 1994. Chimie des milieux aquatiques: chimie des eaux naturelles et des interfaces dans l'environnement. 2d edition. Masson. ISBN 2-225-84498-4.
Other infos	Activities following the proposed activity: Courses of effluent and soil treatments, Project in Environmental Science and Technology, master thesis. This course can be given in English.
Faculty or entity in charge	AGRO

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Chemistry and Bioindustries	BIRC2M	5		
Master [120] in Agricultural Bioengineering	BIRA2M	5		
Master [120] in Environmental Bioengineering	BIRE2M	5		
Master [120] in Agriculture and Bio-industries	SAIV2M	5		