UCLouvain

lbres2204

2024

Integrated water management of water resources

4.00 credits	22.5 h + 22.5 h	Q1

Teacher(s)	Vanclooster Marnik (coordinator) ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	Probability and statistics Basic modelling course. Basic computer programming course.
Main themes	The main objective of the course is to train students in the understanding of the challenges and the use of advanced methodologies for integrated water resources management. The topics that are covered are : - Concepts and challenges of integrated water resources management at different scales (local scale, watershed, country, region, international river basin, global). - Strategic, political and institutional aspects of integrated management of water resources. Introduction in current water policies (eg water policy for sustainable development). - Analytical tools for water management. Modelling of water resources systems (watersheds, reservoirs, perimeter, groundwater body) including technical, economic and social aspects. Analysis,planning, optimization and evaluation of water systems
Learning outcomes	**At the end of this learning unit, the student is able to :** a. Contribution de l'activité au référentiel AA (AA du programme) M2.2 ; M2.3 ; M2.4 ; M2.5 b. Formulation spécifique pour cette activité des AA du programme (maximum 10) After the course, students should be able: - to explain the concept of integrated water resources management (IWRM); - to explain the political, institutional , legal and policy issues associated with integrated water resources management; - to develop policies, strategies and programs for sustainable development of water resources; - to illustrate the international cooperation programs in the field of IWRM in international river basins (eg the Mekong, the Nile ...); - to model a hydro- system, while considering the random nature of the flow ; - to apply optimization methods (dynamic programming, Lagrangian multipliers, linear programming, ...) in simple IWRM planning problems; - to compare the performance of a hydro- system with multiple criteria and objectives formulated by different actors; - to develop a methodology to implement policies, strategies and IWRM programs. 1
Evaluation methods	Theory: Oral examination with written preparation. Exercices: An assignment is transmitted to the students before the opening of the examination session. The student prepares a reply to the question and defend in an oral examintion. This exercice is evaluated by the assistant of the course.
Teaching methods	**Lectures:** • Classic lecture for part I • Inverse class for Part II. On the course website (Moodle), students have access to a syllabus, videos explaining the theoretical foundations and Python notebooks to illustrate certain aspects. Face-to-face classes allow students to answer questions and go into greater depth on the subject. **Practical work:** Exercises in computer rooms. Due to the limited capacity of the auditoriums (COVID-19 crisis), some courses can be given remotely.
Content	Climate change is primarily impacting water resources and the various functions associated with them. The paradigm of Integrated Water Resources Management (IWRM) is proposed to adapt watersheds to the challenges of climate change. In this course, the student will be initiated into the different aspects of IWRM. Part I: Issues, Strategic, Policy, and Institutional Aspects

	• State of freshwater resources at the global and regional scales • State of current uses and future needs for freshwater at the global and regional levels • State of water infrastructure and investment needs • Issues and challenges of the 21st century • Principles of Integrated Water Resources Management (IWRM) • Institutional, political, and legal framework for water management • Elaboration of strategies and programs for the management and development of water resources • International cooperation for water management. Examples of cooperation for water resources management: Mekong River / Nile River Part II: Modelling, Management, and Optimization Tools • Aspects of Hydro system Modelling • Hydroinformatics and management. Contributions of remote sensing. • Programming, planning, and optimization methods. Lagrangian multipliers. Linear programming. Dynamic programming. • Stochastic aspects. Uncertainty and sensitivity analysis. Water risk analysis. • Performance analysis. Multi-criteria and integrated water resources analysis.
Inline resources	Moodle • Cop of the presentations • Video capsules • Exercises (Python Notebooks) • Assignments for the practical work • Link to reference work (https://link.springer.com/book/10.1007/978-3-319-44234-1)
Bibliography	D. Loucks and E. Van Beek: Water Resources System Planning and Management: An introduction to methods, models and applications. UNESCO, 2005.
Other infos	This course can be given in English.
Faculty or entity in charge	AGRO

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Master [120] in Civil Engineering	GCE2M	4		
Master [120] in Forests and Natural Areas Engineering	BIRF2M	4		
Master [120] in Environmental Bioengineering	BIRE2M	4		
Master [120] in Agriculture and Bio-industries	SAIV2M	4		
Master [120] in Agricultural Bioengineering	BIRA2M	4		