UCLouvain

lgciv1051

2023

Hydraulic

5.00 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Soares Frazao Sandra ;
Language :	French
Place of the course	Louvain-la-Neuve
Main themes	• Hydrostatics and floats • Flow models: perfect fluid, viscous fluid, turbulent fluid • Headlosses: major and minor losses • Hydrodynamic forces • Flow over weirs (introduction) • Design of water distribution systems
Learning outcomes	**At the end of this learning unit, the student is able to :** 1 Contribution of the course to the program objectives (N°) AA1.1, AA1.2, AA1.3, AA2.1, AA2.2, AA4.1, AA4.2, AA4.4, AA5.3 Specific learning outcomes of the course : • Design of reservoir and tanks under hydrostatic pressure load • Design of pressurized pipes and water distribution networks • Design of simple orifices and weirs Transversal learning outcomes of the course: The evaluation of the course includes an oral assignment, which leads the students to develop his ability to synthetize his knowledges in order to write on the blackboard and present orally a clear and concise answer to a question on the course.
Evaluation methods	Continuous evaluation based on laboratories and projects (20%), and on a written test about the exercises (20%). Oral exam for the theoretical part (60%). Continuous assessment includes work/homework, which will result in an overall grade. Failure to comply with the methodological instructions defined on Moodle, in particular with regard to the use of online resources or collaboration between students, for any work/assignment will result in an overall mark of 0 for the continuous assessment (laboratories, projects, exercise test).
Teaching methods	The activities are organised as follows: • Lectures for the main theoretical topics • Practical exercises • Exercises in the classroom on the different chapters • Laboratory work (floats and pipes) • Project work on the calculation of a water distribution network This course also addresses issues related to sustainable development and transition through a session dedicated to SDG 6 "Clean water and sanitation" to identify how the techniques taught can enable students to contribute to this.
Content	The course addresses the following technical contents: 1. Introduction. Hydraulics in Civil Engineering. Properties of liquids. Pressure. 2. Hydrostatics • Differential equations and integrals, manometers, resulting pressure forces • Theory of floats 3. Basic principles • Fundamental equations, Lagrangian and Eulerian approaches • Displacements, deformation and rotations 4. Flow models : • Perfect fluid Kinematics of irrotational flows, dynamics (Euler equation), integral equations of Lagrange and Bernoulli

	• Laminar flow Constitutive equation for Newtonian fluid and Navier-Stokes equations Steady laminar flow in pipes: parabolic velocity profile and discharge integral (Poiseuille) • Turbulent flow Turbulence : statistical approach, Reynolds analogy, Navier-Stokes-Reynolds-Boussinesq equations, velocity profile (smooth and rough boundaries) Headlosses : eddy losses (Darcy, Moody-Nikuradse) and minor losses 5. Applications • Liquid-sold interactions, hydrodynamic forces • Orifices and weirs • Pressurized flow in pipes and water distribution networks (steady flow) In addition to technical content, the course also addresses issues of availability of the “water” resource in the world and relating to the achievement of SDG 6 “Clean water and sanitation” through some examples.
Inline resources	Moodle website where different resources are made available : PowerPoint slides used for the lectures, videos, partial lecture notes, exercises with solutions, other useful documents (practical information about the exercises, schedule of the activities, ...)
Bibliography	Streeter, "Fluid mechanics" Lencastre, "Hydraulique générale" Liggett, "Fluid mechanics"
Other infos	The use of generative Artificial Intelligence (AI) tools is tolerated as long as they are used responsibly and in accordance with academic and scientific integrity practices. In particular, the student is required to systematically indicate all parties having used AI, e.g. in a footnote specifying whether AI was used to search for information, to draft the text or to correct it. Furthermore, sources of information must be systematically cited while respecting bibliographic referencing standards. The student also remains responsible for the content of his or her production, regardless of the sources used.
Faculty or entity in charge	GC

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Learning outcomes
Specialization track in Construction	FILGCE	5		🔍
Minor in Construction	LMINOGCE	5		🔍
Mineure Polytechnique	MINPOLY	5		🔍