lgciv1051a
2024

Hydraulic

2.00 credits	15.0 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	
Evaluation methods	Continuous evaluation based on laboratories and projects (20%, only if the other parts are passed successfully), 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
Bachelor in Engineering : Architecture	ARCH1BA	2		🔍