UCLouvain

lgciv1051a

2022

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%), and on a written test about the exercises (20%). Oral exam for the theoretical part (60%). If a students does not deliver the laboratory or project reports, or does not participate in the exercises test, he will obtain an absorming mark of 0 for the corresponding activity. This means that he will only be able to obtain the final mark at the end of teh september session, when all requested works are completed.
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
Content	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: stream lines and velocity potential, application of complex variables, conformal mapping, applications to the flow around bridge piers in rivers, to weir flows and to hydrodynamic profiles - Dynamics: Euler equation, integral equations of Lagrange and Bernoulli • Laminar flow - Constitutive equation for Newtonian fluid (Stokes assumptions) 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) - Simple pipes

	- Branched networks - Meshed networks (Hardy-Cross) and nodal methods (Newton- Raphson)
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	Notes de cours Streeter, "Fluid mechanics" Lencastre, "Hydraulique générale" Liggett, "Fluid mechanics"
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		