UCLouvain

lgciv1051

2018

Hydraulic

5 credits	30.0 h + 30.0 h	Q2

Teacher(s)	Soares Frazao Sandra ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	*The prerequisite(s) for this Teaching Unit (Unité d'enseignement – UE) for the programmes/courses that offer this Teaching Unit are specified at the end of this sheet.*
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
Aims	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. - - - - *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	Written test (25 % of the final mark) on the calculation of flow in pipes and networks Oral exam (75 %) on the theoretical aspects, with a preparation on the blackboard
Teaching methods	The activities are organised as follows: • Lectures for the main theoretical topics • Practical exercises on the different chapters; laboratory work (floats and pipes); small 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, 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	Aims
Bachelor in Engineering	FSA1BA	5	LEPL1103	🔍
Minor in Engineering Sciences: Construction	LGCE100I	5		🔍