UCLouvain

lphys1213

2020

Physics of fluids

Due to the COVID-19 crisis, the information below is subject to change, in particular that concerning the teaching mode (presential, distance or in a comodal or hybrid format).

5 credits	37.5 h + 30.0 h	Q2

Teacher(s)	Deleersnijder Eric ;Legat Vincent ;
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	This teaching unit aims to enable one to understand the basic principles of fluid dynamics and the associated reactive transport processes (kinematics, budget of mass, momentum and energy) and comprehend important flow regimes (incompressible viscous, geophysical and free-surface flows).
Aims	1 **a. Contribution of the teaching unit to the learning outcomes of the programme** AA1: 1.1, 1.4, 1.5 AA2: 2.3, 2.4 AA3: 3.4, 3.5 AA6: 6.3 **b. Specific learning outcomes of the teaching unit** At the end of this teaching unit, the student will be able to: 1. understand the difference between physical principles and phenomenological laws; 2. assess the reliability and coherence of mathematical models; 3. estimate relevant orders of magnitude in a mathematical model based on partial differential equations; 4. study the budget of physical quantities on fixed or moving control volumes; 5. select the mathematical models relevant to specific flows; 6. solve simple fluid dynamics and reactive transport problems; 7. grasp the specific aspects of geophysical and free-surface flows. - - - - *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	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Continuous assessment of knowledge based on homeworks, the development of codes in MATLAB (or any other relevant programming language) and/or oral presentations. Written exam consisting of problems.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** Lecture courses. Exercise sessions aimed at solving problems as realistic as possible. Invitation to self learning.
Content	Basic assumptions of continuum mechanics. Lagrangian and Eulerian descriptions. Mass balance, momentum balance, energy and entropy balance. Non-inertial reference frame. Dynamic similitude: dimensionless parameters. Incompressible irrotationnal flows. Incompressible viscous flows. Flows with two space scales: lubrication and boundary layers theory. Natural and forced convection: Boussinesq approximation. Reactive flows. Geophysical flows: geohydrodynamics equations, dimensionless parameters, idealised models. Free surface flows: 1D and 2D models, linear and non-linear waves, tides, tsunamis.

Bibliography	Cushman-Roisin B. and J.-M. Beckers, 2011 (2nd ed.), Introduction to Geophysical Fluid Dynamics - Physical and Numerical Aspects, International Geophysics Series (Vol. 101), Elsevier, Amsterdam, 828 pages. Kundu P., I. Cohen and D. Dowling, 2015 (6th ed.) (ou éditions précédentes), Fluid Mechanics, Elsevier, Amsterdam, 928 pages.
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Bachelor in Physics	PHYS1BA	5	LPHYS1112	
Minor in Physics	MINPHYS	5		