


In view of the health context linked to the spread of the coronavirus, the methods of organisation and evaluation of the learning units could be adapted in different situations; these possible new methods have been - or will be - communicated by the teachers to the students.

5 credits	37.5 h + 30.0 h	Q2
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Teacher(s)	Deleersnijder Eric ;Legat Vincent ;Legat Vincent (compensates Deleersnijder Eric) ;
Language :	French
Place of the course	Louvain-la-Neuve
Prerequisites	LPHYS1112 or equivalent teaching unit from another programme. Having followed LPHYS1202 and having followed and passed LMAT1121 are assets. <i>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.</i>
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	<p>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</p> <p>b. Specific learning outcomes of the teaching unit At the end of this teaching unit, the student will be able to:</p> <p>1</p> <ol style="list-style-type: none"> 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. <p>----- <i>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".</i></p>
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 irrotational flows. Incompressible viscous flows. Flows with two space scales: lubrication and boundary layers theory. Natural and forced convection: Boussinesq approximation.

	<p>Reactive flows.</p> <p>Geophysical flows: geohydrodynamics equations, dimensionless parameters, idealised models.</p> <p>Free surface flows: 1D and 2D models, linear and non-linear waves, tides, tsunamis.</p>
Bibliography	<p>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.</p> <p>Kundu P., I. Cohen and D. Dowling, 2015 (6th ed.) (ou éditions précédentes), Fluid Mechanics, Elsevier, Amsterdam, 928 pages.</p>
Faculty or entity in charge	PHYS

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Aims
Minor in Physics	LPHYS100I	5		
Bachelor in Physics	PHYS1BA	5	LPHYS1112	