UCLouvain

lgciv2056

2017

Coastal and maritime hydraulics

5 credits	30.0 h + 15.0 h	Q1

Teacher(s)	Deleersnijder Eric ;Spinewine Benoît ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	This course aims at introducing the student to flows within the coastal and marine environment, transport processes and their environmental impacts, as well as their morphological and sedimentary aspects, with a focus on regional scale (estuaries, coastal regions and continental seas). This course is particularly focused on the domains of intervention of the engineer in coastal and maritime industry. It can advantageously be combined with an MSc thesis in one of the R&D aspects pursued by this industry.
Aims	a. Contribution de l'activité au référentiel AA (AA du programme) • AA1.2, AA1.3 • AA3.1, AA3.2 • AA5.2, AA5.3 1 b. Formulation spécifique pour cette activité des AA du programme At the end of the course LAUCE2157, students will be able to understand and derive the equations of applied geohydrodynamics in the coastal and maritime environment, tackle the models governing the sediment dynamics in this environment, and set-up / perform relevant numerical simulations. This course develops competencies of varying nature and across multiple disciplines, and their interconnections to be able to tackle complex problems related to marine engineering. - - - - *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	Exam.
Teaching methods	The course is taught through lectures that include many examples and problems. Part of the lectures will be delivered in the 'flipped classroom' mode.
Content	The course covers the following elements: 1. Hydrodynamics: • equation of fluid mechanics in a non-inertial reference frame and their application to marine hydrodynamics • thin layer approximation, hydrostatic approximation, Boussinesq approximation, geostrophic equilibrium... • interactions between large-scale processes and forcings (stratification, infuence of Earth's rotation) and regional impacts on continental seas and coastal regions • notions about the turbulence closure models of first and second order generally used in marine applications • foundations of the dynamics of tides in open and semi-closed environments, and the penetration of tides into the estuaries ; • transport processes for dissolved and suspended constituents and environmental implications • foundations of wave dynamics ; • principal spatial and vertical reference systems used in maritime hydraulics, main « meteocean » measurement systems. 2. Sedimentary aspects: • general morphology of a « source-to-sink » sedimentary system linking the estuary / delta with the continental margin and abyssal plains ; • typical morphologies of estuaries, their links with sediment influxs and tidal interactions ; • specificities of the marine sediment, main modes of sediment transport along and across shores, implications of sediment transport for engineering ; • laws governing the sediment transport in marine environments, bedload and suspension, cohesive sediment erosion and transport ; • range of sedimentary bedforms (ripples / dunes / sand waves and banks), and links with flow regimes ; • Principles of local scour in marine environments ; local scour evaluation around a marine structure (monopile, pipeline, ...), scour protection methods ; • Principles of various dredging techniques, their domain of application ; methods for cable and pipeline protection through trenching;

	• Sediment-laden submarine flows (turbidity currents, contour currents, debris flows) and their significance for engineering ; basics on modelling of such sediment-laden flows.
Inline resources	Slides available on icampus
Bibliography	• Les copies de transparents utilisés pour le cours disponibles à partir d'iCampus • Des ouvrages de références, disponibles dans la bibliothèque de sciences et technologies : - Savenije H.H.G., 2006, Salinity and Tides in Alluvial Estuaries, Elsevier - Cushman-Roisin B. and J.-M. Beckers, 2011, Introduction to Geophysical Fluid Dynamics - Physical and Numerical Aspects, Academic Press - Garcia, M.H., 2008, Sedimentation Engineering: Processes, Management, Modeling, and Practice, ASCE Manual and Reports on Engineering Practice No. 110 • Des ouvrages de référence additionnels, également disponibles en bibliothèque : - Dyer K.R., 1997 (2nd ed.), Estuaries - A Physical Introduction, Wiley - Fisher H.B. et al., 1979, Mixing in Inland and Coastal Waters, Academic Press - Burchard H., 2002, Applied Turbulence Modelling in Marine Waters, Springer
Faculty or entity in charge	GC

Programmes containing this learning unit (UE)				
Program title	Acronym	Credits	Prerequisite	Aims
Master [120] in Civil Engineering	GCE2M	5		
Master [120] in Architecture and Engineering	ARCH2M	5		