UCLouvain

lgciv2013

2021

Hydraulic structures, bridges and roads

5.00 credits	60.0 h	Q2

Teacher(s)	Bousmar Didier ;Gilles Pierre ;Grégoire Colette ;Houdart Sébastien ;
Language :	English
Place of the course	Louvain-la-Neuve
Prerequisites	Basic knowledge of open-channel flows, structural stability, steel and concrete structures, as taught in the courses LGCIV1022, LGCIV1023, LGCIV1032, LGCIV1051, LGCIV2051, LGCIV1072, LGCIV2071
Main themes	The course "Hydraulic structures, bridges and roads" is a general introduction to some of the main civil works types. It presents the main concepts and the vocabulary specific to these works. It identifies the main criteria leading to different technical options during design. The sizing hypotheses are introduced. Details of calculation method are not always covered, but reference is made to related courses.
Learning outcomes	**At the end of this learning unit, the student is able to :** Contribution to the acquisition and evaluation of the following learning outcomes of the programme in civil engineering: AA1.1, AA1.3, AA2.1, AA2.3, AA5.2, AA5.3, AA5.4, AA6.1, AA6.3 More specifically, at the end of the course, the student will be able to: 1 • Sketch a bridge that crosses a given obstacle and choose the most appropriate technical solutions for the final design and for the building process (superstructures, infrastructures, bearings, equipments). • Sketch a fluvial/hydraulic development (local or global) and choose the most appropriate technical solution for the final design, considering building process and environmental constraints. • Define the different parts of a road structure and their functions, identify main elements for the road design (from ground works to revetment) and necessary parameters for the sizing.
Evaluation methods	Oral or written exam, depending on the session and on the course part
Teaching methods	Ex-cathedra presentations, combined with field visit of relevant civil works, completed or in progress; design exercises, and/or case study analysis
Content	Hydraulic structures 1. Waterways Introduction to fluvial transport, waterways classification. Waterways design: free-flowing river, canalized river, artificial canal, lock approaches. Waterways dimensions: ship manoeuvrability, sailing resistance, Schijf approach, standard sections and over-widths, norms and best practice. Bank protection: vertical walls, permeable and impervious banks, naturalized banks 2. Locks Definitions, vocabulary, implantation. Filling/emptying systems: through the head, longitudinal distribution, equi-distribution, valves, valve opening schedule, water saving basin. Chamber design: loads, typical cross-sections, seepage cut-off. Equipments, gates (mitre, sector, radial, flap, lifting, rolling). High drop crossing: ship lifts and inclined planes 3. Mobile weir Weir functions, general design. Main elements: floor, piles, abutment, seepage cut-off, auxiliary works. Fix parts: loads, design of piles and floor, energy dissipation and protection against scouring and internal erosion. Mobile parts: overflow and underflow, gates (lifting, radial, roller drum, sector, flap), old systems (stoplog dam, needle dam, wicket gates). 4. Large dams Typology, application fields, loads, auxiliary works. Gravity dams: design, building process, buttress dams, roller-compacted concreted dams. Arch dams: design principle. Bridges 1. Bridge types

	Historical view of bridge types (slab bridge, beam bridge, rigid-frame bridge, arch bridge, stay bridge, suspension bridge, moveable bridge) in connection with the appearance of new materials and the evolution of users needs. 2. Designing bridges The design principles will be overview in order to know the internal load diagrams, the influence lines, ' As an introduction the actions on bridges will be detailed (dead loads, variable loads, accidental actions) 3. Bridge Erection methods Bridge erection methods either on site and in prefabrication plant (cast in place bridges, erection by displacement, prefabricated elements assembling, ...) with common span for each methods. 4. Specific bridge elements Bearings, expansion joints, waterproofing, drainage system, pedestrian parapet, safety barrier, instrumentation, ' 5. Pathologies Presentation of bridge pathologies. Link will be made with technical prescriptions or details design that can reduce the impact of those pathologies. 6. Bridge management Bridge management system concepts (bridge load testing, inspection, indicators, monitoring, ...). 7. Bridge aesthetics Bridge aesthetics for usual bridges up to special bridges. Roads 1. Typical structure of a road: role and characteristics of the different layers 2. Asphalt concrete and cement concrete roads 3. Roads design 4. Roads geotechnics, drainage and soil treatment
Inline resources	Available on Moodle
Bibliography	Transparents et supports de cours Supports de cours, références bibliographiques recommandées, lectures conseillées qui seront renseignés sur le site iCampus du cours
Faculty or entity in charge	GC

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