UCLouvain

lgciv2046

2024

Earthquake engineering

4.00 credits	20.0 h + 15.0 h	Q2

This learning unit is not being organized during this academic year.

Teacher(s)	Saraiva Esteves Pacheco De Alm João ;
Language :	English > French-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	It is advised to have a grounding in the fundamental concepts of material resistance, structural mechanics, stability and the bases of design of steel, composite steel-concrete and reinforced concrete structures, as taught in LGCIV1022, LGCIV1031, LGCIV1023, LGCIV1032, LGCIV2033.
Main themes	The course concerns exceptional accidental actions that can affect the structures such as earthquakes or exceptional vibrations. The themes are: - The characteristics of the action (earthquake); - The structural responses in dynamic terms; - The principles of anti-seismic design; - The notions of response spectra and capacity design in seismic design; The main lines of the Eurocodes prescriptions in terms of seismic calculation
Learning outcomes	**At the end of this learning unit, the student is able to :** With reference to the AA reference system of the "Master of Civil Engineering" program, this course contributes to the development, acquisition and evaluation of the following learning outcomes: AA1.1, AA1.2, AA1.3., AA5.5 and AA5.6 More specifically, at the end of this course, the student will be able to: 1 Earthquake problematic: ' Know the actions generated by an earthquake and the behavior of the structures that are subjected to it; ' Master and apply the notion of response spectrum; ' Understand and apply the basics of earthquake design; ' Master the principles of seismic design and predesign in the case of a simple structure.
Evaluation methods	I. Assignments (70%); II. Written or oral evaluation during the quarter (30%). The assignments, which constitute the continuous evaluation grade, are done in groups of 2/3 students and cannot be repeated in the second session; the continuous evaluation grade acquired in the first session is retained in the event of a second session. The written or oral evaluation is individual. The oral evaluation can address the assignments, in which case it will also be considered part of the continuous evaluation. Failure to comply with the methodological guidelines set out on Moodle, particularly with regard to the use of online resources or collaboration between students for the assignment/project, will result in an overall mark of 0 for the continuous evaluation. The use of generative artificial intelligence (such as ChatGPT, Consensus, Perplexity, Bard...) is forbidden for this course.
Teaching methods	Lectures based on course slides and exercise solving with student participation.
Content	• Basics of seismology: plate tectonics theory, faulting, seismic waves, recording an earthquake, measuring an earthquake, source-to-site effects. • Overview of seismic risk: seismic hazard, exposure, response of structures and vulnerability. • Conceptual design of buildings: joints and discontinuities in plan, soft storeys and discontinuities in height, symmetry and torsional effects, bracing systems, short columns and partially infilled frames, non-structural elements, etc. • Seismic analysis and design – Part I: dynamic response of elastic SDoF and MDoF systems (revision), the fundamental period, elastic response of SDoF and elastic spectra, inelastic response of SDoF and inelastic spectra, force reduction factors, design spectra (Eurocode 8), vertical component of the ground motion. • Seismic analysis and design – Part II: response spectrum method, equivalent lateral force method, nonlinear static analysis, nonlinear time history analysis, conventional design versus capacity design, design according to Eurocode 8, myths and fallacies in Earthquake Engineering.

	• Reinforced concrete structures: capacity design of wall (buildings), plastic hinge analysis, drawbacks of force-based design (and intro to displacement-based design). • Overview on seismic behaviour of structures with other structural materials, base isolation, technological advances, current research, curiosities.
Inline resources	Available on Moodle
Bibliography	- « Dynamics of structures: Theory and Applications to Earthquake Engineering », Anil K. Chopra, Prentice Hall, 2012. - « Génie parasismique: Conception et dimensionnement des bâtiments », Pierino Lestuzzi, Marc Badoux, Presses polytechniques et universitaires romandes, 2011.
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	4		🔍