UCLouvain

lgciv2046

2020

Earthquake engineering

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).

4 credits	20.0 h + 15.0 h	Q2

Teacher(s)	Saraiva Esteves Pacheco De Almeida João ;
Language :	English
Place of the course	Louvain-la-Neuve
Main themes	The objective of the course is to present, discuss, and apply the fundamental set of tools to understand, analyse, and design civil engineering structures subjected to earthquakes.
Aims	**Specific learning outcomes of the course :** AA 1.1, AA 1.2, et AA 1.3 **At the end of the course, students will be capable of:** - Understanding basics of seismology on generation, propagation, recording, and measurement of earthquakes. - Explaining the components of seismic risk (Belgium as a case study). - Identifying favourable and dangerous conceptual design features. - Applying the relevant concepts of structural dynamics for single-degree-of-freedom and multiple-degree-of-freedom systems. - Understanding the important concept of elastic, inelastic, and design response spectra (with focus on Eurocode 8), together with force reduction factors. - Understanding and applying the main seismic design and analysis methods, namely: response spectrum, equivalent lateral forces, nonlinear static analysis (pushover), and nonlinear time history analysis. - Designing structures based on capacity design concepts (and Eurocode 8). - Being aware of common myths and fallacies in earthquake engineering. - Applying seismic design and analysis methods to reinforced concrete structures. 1 - - - - *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.** Assignments and written exam. Specific details indicated in the Moodle course page. NOTE: These instructions take into account a "green" or "yellow" Covid scenario at UCLouvain. Modifications can be made in case of "orange" or "red" scenario, or restrictions in classroom capacities.
Teaching methods	**Due to the COVID-19 crisis, the information in this section is particularly likely to change.** 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	Aims
Master [120] in Civil Engineering	GCE2M	4		🔍