

4.00 credits

20.0 h + 15.0 h

Q2

Teacher(s)	Saraiva Esteves Pacheco De Almeida 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: Earthquake problematic: 1 ' 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	Assignments (70%) + written evaluation (30%).
Teaching methods	Lectures based on course slides and exercise solving with student participation.
Content	<ul style="list-style-type: none"> • 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		