UNIVERSITÀ DI PAVIA

Anno Accademico 2019/2020

STRUCTURAL DESIGN - MODULE	
Enrollment year	2015/2016
Academic year	2019/2020
Regulations	DM270
Academic discipline	ICAR/09 (CONSTRUCTION TECHNIQUES)
Department	DEPARTMENT OF CIVIL ENGINEERING AND ARCHITECTURE
Course	
Curriculum	PERCORSO COMUNE
Year of study	5°
Period	(02/03/2020 - 12/06/2020)
ECTS	9
Lesson hours	90 lesson hours
Language	
Activity type	WRITTEN AND ORAL TEST
Teacher	SILVA MOURA PINHO RUI JORGE (titolare) - 9 ECTS
Prerequisites	The course foresees that students will have already successfully followed the courses on Structural Mechanics and Structural Engineering.
Learning outcomes	The course aims at introducing and initiating students in the structural design process, starting from the architectural requirements in order to arrive at a structural configuration, then passing on to the design and detailing of structural members, with a particular focus on earthquake resistance. At the completion of the course it is expected that students will find themselves equipped with the necessary knowledge to independently pre-design a reinforced concrete building, correctly model the latter in a structural analysis software package, undertake the necessary static and dynamic analyses, and then design and detail columns, beams, walls and nodes, all with the explicit consideration of seismic actions.

Course contents

The course can be considered as structured in four main parts, listed below. In addition, during the course the students will also be asked to undertake a design project in which a building, whose architectural project will have been previously developed by the students, will need to be designed.

STRUCTURAL DESIGN – SOME GENERAL ISSUES AND CHALLENGES
Construction materials (concrete, steel, masonry, timber...); structural configuration (frames, structural walls, cores...); examples of different structural configurations (frames, warehouses, skyscrapers...); actions on structures and their influence on the structural response (vertical loads, wind, thermal variations, explosions, fire, ground settlements...); seismic action (intensity, scales, factors influencing the ground motion, action definition for structural design, response spectrum...).

INTRODUCTION TO STRUCTURAL MODELLING
Objective of the numerical analysis; use of structural analysis; selection of appropriate modelling and analysis method; modelling of frames; representation of structural elements (columns, beams, beam-column joints, structural walls...); representation of constraints and restraints (joints, foundations...); introduction to adopted structural analysis program (materials, sections, elements, nodes, constraints, loads, "rigid-ends", "end-releases"); example case-studies.

REVIEW OF THE BASICS OF REINFORCED CONCRETE DESIGN
Ultimate and Serviceability limit states; material properties (mean and characteristic values); safety coefficients; internal actions (axial, bending, shear); reinforcement design; design of slabs, beams and columns.

DESIGN OF A REINFORCED CONCRETE FRAME
Load combinations, characteristic values, design values, combination factors, etc; load distribution; predesign; choice of slab system; sizing of beams and columns; computer modeling; structural verification; modal analysis; seismic action calculation; design of structural elements and foundations.

Teaching methods

Lectures (hours/year in lecture theatre): 80
Tutorials (hours/year in lecture theatre): 40
Workshops (hours/year in lecture theatre): 0

Reccomended or required readings

The slides presented during the course lectures will be made available for download by the students from an FTP server that will be indicated at the start of the course, as will be also Excel files useful for some of the practical exercises. Some textbooks and software pertinent to the course are also listed in what follows:

- Nuove Norme Tecniche per le Costruzioni. D.M. 14/01/ 2008.
- L. Petrini, R. Pinho, G.M. Calvi. Criteri di Progettazione Antisismica degli Edifici. IUSS Press, 2004.
- E. Cosenza, G. Magliulo, M. Pecce, R. Ramasco. Progetto Antisismico di Edifici in Cemento Armato. IUSS Press, 2004.
- M. Mezzina, D. Raffaele, A. Vitone. Teoria e pratica delle costruzioni in cemento armato (Vol. 1 e 2). Città Studi Edizioni, 2007.
- AICAP. Guida all'uso dell'Eurocodice 2 - con riferimento alle Norme Tecniche D.M. 14.1.2008 (Vol. 1 e 2). AITEC, 2008.
- V. Nunziata. Teoria e pratica delle strutture in cemento armato (Vol. 1 e 2). Dario Flaccovio Editore, 2004.
- F. Angotti, M. Guiglia, P. Marro, M. Orlando. Progetto delle strutture in calcestruzzo armato. Hoepli, 2011.
- E. Giangreco. Teoria e tecnica delle costruzioni (Vol. 1). Liguori Editore, 2003.
- B. Furiozzi, C. Messina, L. Paolini. Prontuario per il calcolo di elementi strutturali. Le Monnier, 2010.
- F. Rossi, F. Salvi. Manuale di ingegneria civile 2 - Scienza delle costruzioni. Tecnica delle costruzioni. Ponti. Zanichelli, 2001.

Assessment methods

Two intermediate written exams are foreseen. In addition, a design project is also compulsory and its progress will be monitored throughout the course; at the end of the latter, the project undertaken by the students will be assessed through a discussion of both the results obtained as well as the procedure adopted. The final exam will be oral and available only to those students who will have successfully undertaken the aforementioned written exams and also completed and delivered the course project.

Further information

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