Degree course	PostGrad Course: Architecture-Restoration LM4
Course code	
Lecturer	Aurora Angela Pisano, Raffaele Pucinotti
Course name	Laboratory of Solids/Structural Mechanics and Structural Engineering, Part 1: Engineering Mechanics of Solids and Structures Part 2: StructuralEngineering
Disciplinary area	Civil Engineering and Architecture
Disciplinary field of science	ICAR/08 Solids and Structural Mechanics ICAR/09 Structural Engineering
University credits - ECTS	8
Teaching hours	80
Course year	First
Semester	First and Second

Synthetic description

The Laboratory is aimed at providing an understanding of the physical-mechanical behavior of buildings made by different construction materials such as reinforced concrete, masonry, wood and steel. Such a goal is achieved by identifying the recognizable structural elements/parts and subsequently by investigating the computational models suitable for their accurate analytical description.

Students are required to acquire skills to carry out complete structural analyses, in the fields of statics and dynamics, aimed to plan interventions for repairing and restoring existing buildings as well as to design new structures. The learning process does not imply a clear distinction between theoretical and practical matters because the introduction of theoretical concepts is made only when they turn out to be operatively necessary to solve specific classes of real problems related to a design process.

Course entry requirements

Calculus, Statics, Solids and Structural Mechanics

Course programme

PART 1: ENGINEERING MECHANICS OF SOLIDS AND STRUCTURES

Analysis of structural elements: tests on construction materials, stress-strain relationships, generalized Hooke's law.
Simple states of stress: axial force problem, pure bending problem, simple shear problem, torsion problem.
Sections subjected to bending: bending in homogeneous materials, bending of members made of several materials, unsymmetric bending, shear stress in bending problems.
Solids and no-tension materials under axial force: masonry problem (general remarks), beams under axial force and bending, the arches.
Deformation in structural elements: introductory concepts, strain analysis under axial force, strain analysis under bending, examples (cantilever beam, simple supported beam).
Simple statically undetermined structures: methods for solving statically undetermined structures, one-span statically undetermined beam, applicative examples.
Methods of verification: the ultimate-limit-state method.

PART 2: STRUCTURAL ENGINEERING

Existing structures: main deterioration causes in reinforced concrete-, steel-, wood- and masonry-structures. Structural diagnosis techniques: destructive (drilling cores) and non-destructive evaluations. Interpretation of results of laboratory findings and of non-destructive tests.
Structural types: analysis of the most common structural types and identification of the main structural parts.
Computational methods for reinforced concrete structures: suggestions by technical rules.
Seismic action effects: probabilistic approach in safety assessment of buildings.
Static theory of reinforced concrete: semi-probabilistic method at ultimate-limit-states.

Expected results

Students are required to acquire, specifically, the ability to recognize the main structural parts within existing buildings or those necessary within a new structure to be designed and constructed. Students should therefore acquire all the necessary skills to define a new structural intervention strategy which, starting from the computational model adopted, eventually provides implementing requirements in accordance with suggestions given by current technical rules with emphasis to the strength of structures under seismic actions.

Course structure and teaching

Lectures *(hours/year): 60*
Exercises *(hours/year): 20*

Student's independent work

Exercises, Applicative work and practical tests.

Testing and exams

The acquired knowledge will be verified through examinations taking place during and / or at the end of the course. An oral exam is scheduled at the end of the course, during which each student is expected to be prepared on the subjects dealt with in the Course. The oral exam concerns both theoretical, general concepts and a discussion on the applicative work, if any, developed along the year.

Suggested reading materials

In Italian:
S. Di Pasquale, C. Messina, L. Paolini, B. Furiozzi- *Nuovo Corso di Costruzioni- Vol. 1-7*. Le Monnier 2009
F. P. Beer, E. R. Johnston, *Scienza delle Costruzioni, introduzione alla meccanica dei materiali*, Ed.McGraw-Hill libri Italia s.r.l., Milano, 1997.
E. Viola, *Esercitazioni di Scienza delle Costruzioni – vol. I:* Strutture Isostatiche e Geometria delle Masse, Ed. Pitagora, Bologna, 1977.
Esercizi svolti -- http://www.pau.unirc.it/scheda_persona.php?id=612.

Cosenza E., Manfredi G., Pecce M., Strutture in Cemento Armato, Hoepli, 2010;
Raffaele Pucinotti, Patologia e diagnostica del cemento armato, Dario Flaccovio Editore (2006).
Bursi Oreste S.; Pucinotti Raffaele; Zanon Gabriele, Progettazione di Giunzioni e Strutture Tubolari in Acciaio, Dario Flaccovio Editore (2012).
Lessons' notes

In English:
F. P. Beer, E. R. Johnston, J.T. DeWolf, D.F. Mazurek. *Mechanics of Materials*, McGraw-Hill Education, 7th Edition, 2014.
E.P. Popov. *Engineering mechanics of solids*, Prentice Hall 2nd Edition, 1998.
R. Park, T. Paulay. *Reinforced concrete structures*, New York, London, etc.: Wiley, 1975.
T. Paulay, M.J.N. Priestley. *Seismic design of reinforced concrete and masonry buildings*, New York, Wiley 1992.