



COURSE DETAILS

"LABORATORY OF STRUCTURAL ENGINEERING"

SSD ICAR/09

DEGREE PROGRAMME: ARCHITETTURA 5UE

ACADEMIC YEAR 2022-2023

GENERAL INFORMATION – TEACHER REFERENCES

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE (IF APPLICABLE): NO

MODULE (IF APPLICABLE): NO

SSD OF THE MODULE (IF APPLICABLE): NO

CHANNEL (IF APPLICABLE): D

YEAR OF THE DEGREE PROGRAMME: IV

SEMESTER: ANNUAL

CFU: 12

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE “REGOLAMENTO”)

Scienza delle costruzioni

PREREQUISITES (IF APPLICABLE)

Knowledge of structural mechanics

LEARNING GOALS

The main goal of the course is to provide the basis of a methodology for the analysis and design of structures, in accordance with current national and international regulations. The issues are related to the conception, sizing and verification of simple structures made of typical building materials. Particular attention is devoted to seismic risk reduction strategies, both with reference to new buildings and to the vulnerability of existing ones.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding

During the five years and through lectures, seminars and laboratory activities, the student knows the issues related to the conception and general calculation of the structures as integrated elements of the elaboration of the architectural project in the various fields of its application. He/she also understands the interconnections with the other disciplines that contribute to the formation of the architectural project.

Ability to apply knowledge and understanding

The student develops the ability to apply the theoretical and methodological knowledge related to the structural aspects of the architectural project and to produce general and simple design drawings by comparing themselves with different degrees of in-depth analysis of the architectural project, at different scales and in different areas of its application.

COURSE CONTENT/SYLLABUS

STRUCTURAL SAFETY

- Reference limit states. Serviceability and ultimate limit states
- Structural load analysis
- Current national and international building codes
- Methods of analysis for civil/ordinary buildings

DESIGN AND VERIFICATION OF REINFORCED CONCRETE CROSS SECTIONS, ELEMENTS AND STRUCTURES USING LIMIT STATE ANALYSIS

- R.C. beams under shear-bending conditions
- R.C. cross section: serviceability and ultimate limit states
- Failure modes of the R.C. cross section under normal stresses and propagation of cracks in R.C. beams
- Ductility of R.C. members at the cross-section, element and structural level
- Capacity design
- Design and analysis of the R.C. cross section in terms of bending capacity and ductility requirements, with and without normal compression

STEEL STRUCTURES

- Elastic and plastic behaviours of steel
- Theory of plasticity for steel elements subjected to axial forces
- Theory of plasticity for steel elements subjected to bending moments. Clamped-clamped beam subjected to increasing vertical loads till collapse
- Plastic hinge
- Plastic limit theorems. Static and kinematic theorems. Uniqueness of the solution
- Limit analysis design

SEISMIC ANALYSIS OF STRUCTURES

- Dynamic analysis of the single-degree-of-freedom (SDOF) system
- Introduction to the seismic design
- Response spectrum analysis

MASONRY STRUCTURES

- Masonry as no-tension material. Masonry behaviour in the elastic and post-elastic fields till collapse
- Box-type behaviour
- In-plane and out-of-plane failure modes
- Limit analysis
- Seismic vulnerability of structural typologies: the wall, the arch, the three-wall system

READINGS/BIBLIOGRAPHY

Cosenza E., Manfredi G., Pecce M. – Strutture in cemento armato - HOEPLI, Milano, 2021.

Jossa P. – Problemi della Tecnica delle Costruzioni – II Edizione, 2 Voll, Aracne Editrice, Roma, 2011.

Mezzina M. - Fondamenti di Tecnica delle Costruzioni - CittàStudi Edizioni, 2021.

Perrone V. – Plasticità - stampato dalla Litografia Nicola Libero, Napoli 1997.

D.M. – 17/01/2018, Norme Tecniche per le Costruzioni (NTC 2018), G.U. n. 42 del 20/02/2018, Suppl. Ordinario n. 8, 2018.

C.S.LL.PP. – Istruzioni per l'Applicazione dell'Aggiornamento delle 'Norme Tecniche per le Costruzioni' di cui al D.M. 17/01/2018 - Circolare 21 gennaio 2019, n. 7, Poligrafico dello Stato, Roma, 2019.

D.P.C.M. – Linee Guida per la valutazione e riduzione del rischio sismico del patrimonio culturale – allineamento alle nuove Norme tecniche per le costruzioni (relative al D.M. 14/ 01/2008) – G.U. n. 47 del 26/02/2011, Suppl. Ordinario n. 54, 2011.

TEACHING METHODS

Lessons and exercises.

Inter-course tests:

- 1) Design of a simple steel structure using limit analysis
- 2) Limit analysis of masonry wall systems under out-of-plane loading

Lab project:

Design of a steel or R.C frame in seismic area, to be mostly developed within the course lessons.

EXAMINATION/EVALUATION CRITERIA

a) Exam type:

Exam type

written and oral	
only written	
only oral	X
project discussion	X
Other: 2 inter-course tests (1 per semester)	X

In case of a written exam, questions refer to: (*)	Multiple choice answers	
	Open answers	
	Numerical exercises	

(*) multiple options are possible

b) Evaluation pattern:
Overall evaluation