



ROSE
**Master of
Science**

Civil Engineering
for Mitigation
of Risk from
Natural Hazards

Reinforced Concrete Structures

Lecturer: G. Guerrini - S. Kallioras
Date: 25/09/2026 – 18/12/2026
Credits: 6 ECTS (CFU)

Course Description

The course focuses on advanced topics about the mechanics and design of reinforced and prestressed concrete structures. The focus is placed on using fundamental principles (flow of forces, compatibility of deformations, stress-strain relationships, equilibrium) to solve different design problems from 1D (beams and girders) to 3D members and structures (spread footings, pile caps and wall systems).

To maximize the learning outcome, the course will use a variety of different teaching methods. The classes will include a combination of slide presentations, blackboard lectures, solved demonstration problems, individual and group work, video materials, and critical analysis of reading materials.

The students will participate actively by using first principles to solve analysis and design problems which are aimed at providing an important insight into the behavior of concrete structures. They will be guided towards the final solution by solving intermediate problems with increasing complexity.

Topics

1. Strut-and-tie design of slender beams/members.
2. Design for torsion.
3. Design of deep beams.
4. Design of joints and connections.
5. Design of wall structures.
6. Axial behavior of prestressed concrete members.
7. Flexural behavior of prestressed concrete members.
8. Design of prestressed concrete beams.
9. Calculation of prestress losses.
10. Design of slabs.
11. Design of foundations.

Learning Outcomes

The main objective of the course is to develop knowledge and skills necessary for the design of a variety of important reinforced and prestressed concrete members and structures as listed in the course topics. By focusing on the application of fundamental principles, the course develops a general understanding of structural design which the students can apply to any other type of concrete structures not covered in the syllabus.

Suggested reading material/Reference textbooks

In addition to specific handouts, presentations, and papers indicated/delivered during classes, the following textbooks are recommended:

- R. Park R. and T. Paulay (1975), Reinforced Concrete Structures, John Wiley & Sons;
- T. Paulay and M.J.N. Priestley (1992), Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley & Sons;
- M.P. Collins and D. Mitchell (1997), Prestressed Concrete Structures, Response Publications, Canada;
- A.E. Naaman (2012), Prestressed Concrete Analysis and Design - Fundamentals, Techno Press 3000.

Assessment Methods

The evaluation will be based on homework assignments (30%) and a written final exam (70%). The final exam will consist of two parts: exercises (open book) and theory (closed book); only paper material and traditional calculators will be allowed during the open book exercise part, no electronic or communication devices.

Schedule

-  **Virtual Classroom** - Prof. G. Guerrini¹
-  **Virtual Classroom** - Prof. S. Kallioras²
-  **Classroom: Aula Ricciardi** - DICAr building

Note:

- Due to unforeseen circumstances, online lectures will be delivered during the first few weeks.
- **October 23:** no classes (Graduation day).
- **December 9:** no classes (Local holiday).
- **Office hours:** Wednesdays, right after class.

Week	Time	Hours
1	Friday, September 25 Introduction Gabriele Guerrini & Stylianos Kallioras	14-16 1:45
2	Wednesday, September 30 Strut-and-tie design of slender beams/members Stylianos Kallioras	9-13 3:45
	Friday, October 2 Strut-and-tie design of slender beams/members Gabriele Guerrini	11-13 1:45
	Friday, October 2 Design for torsion Gabriele Guerrini	14-16 1:45
3	Wednesday, October 7 Design for torsion Stylianos Kallioras	9-13 3:45
	Friday, October 9 Design of deep beams Stylianos Kallioras	11-13 1:45
	Friday, October 9 Design of deep beams Stylianos Kallioras	14-16 1:45
4	Wednesday, October 14 Design of deep beams ■ Homework #1 deadline Stylianos Kallioras	9-13 3:45
	Friday, October 16 Design of joints and connections Stylianos Kallioras	11-13 1:45



¹ <https://unipv-it.zoom.us/j/8524837389?pwd=M3RkdEx1dHh2RVM3ZDNCcGcxZD245dz09>

² <https://us04web.zoom.us/j/7240214599>

	Friday, October 16	14-16	1:45
	Design of joints and connections		
	Stylianos Kallioras		
5	Wednesday, October 21	9-13	3:45
	Design of joints and connections		
	Stylianos Kallioras		
6	Wednesday, October 28	9-12	2:45
	Design of wall structures		
	■ Homework #2 deadline		
	Stylianos Kallioras		
	Friday, October 30	11-13	1:45
	Design of wall structures		
	Stylianos Kallioras		
	Friday, October 30	14-16	1:45
	Design of wall structures		
	Stylianos Kallioras		
7	Wednesday, November 4	9-12	2:45
	Design of wall structures		
	Stylianos Kallioras		
	Friday, November 6	11-13	1:45
	Axial behavior of prestressed concrete members		
	Gabriele Guerrini		
	Friday, November 6	14-16	1:45
	Axial behavior of prestressed concrete members		
	Gabriele Guerrini		
8	Wednesday, November 11	9-12	2:45
	Flexural behavior of prestressed concrete members		
	■ Homework #3 deadline		
	Gabriele Guerrini		
	Friday, November 13	11-13	1:45
	Flexural behavior of prestressed concrete members		
	Gabriele Guerrini		
	Friday, November 13	14-16	1:45
	Flexural behavior of prestressed concrete members		
	Gabriele Guerrini		
9	Wednesday, November 18	9-12	2:45
	Design of prestressed concrete beams		
	Gabriele Guerrini		
	Friday, November 20	11-13	1:45
	Design of prestressed concrete beams		
	■ Homework #4 deadline		
	Gabriele Guerrini		

	Friday, November 20	14-16	1:45
	Design of prestressed concrete beams		
	Gabriele Guerrini		
10	Wednesday, November 25	9-12	2:45
	Design of prestressed concrete beams		
	Gabriele Guerrini		
	Friday, November 27	11-13	1:45
	Calculation of prestress losses		
	Gabriele Guerrini		
	Friday, November 27	14-16	1:45
	Calculation of prestress losses		
	Gabriele Guerrini		
11	Wednesday, December 2	9-12	2:45
	Design of slabs		
	Gabriele Guerrini		
	Friday, December 4	11-13	1:45
	Design of slabs		
	■ Homework #5 deadline		
	Gabriele Guerrini		
	Friday, December 4	14-16	1:45
	Design of slabs		
	Gabriele Guerrini		
12	Friday, December 11	11-13	1:45
	Design of slabs		
	Gabriele Guerrini		
	Friday, December 11	14-16	1:45
	Design of slabs		
	Gabriele Guerrini		
13	Wednesday, December 16	9-12	2:45
	Design of foundations		
	Gabriele Guerrini		
	Friday, December 18	11-13	1:45
	Design of foundations		
	■ Homework #6 deadline		
	Gabriele Guerrini		
	Friday, December 18	14-16	1:45
	Design of foundations		
	Gabriele Guerrini		