



ROSE
Master of
Science

Civil Engineering
for Mitigation
of Risk from
Natural Hazards

Steel Structure

Lecturer: R. Nascimbene
Date: 26/10/2026 – 18/11/2026
Credits: 6 ECTS (CFU)

Course Description

Steel material has been used in construction since the 19th century for slender and tall structures, and nowadays has also become an option for smaller buildings and personal residence. This unit teaches you about design and analysis procedures for steel structure members and connections focusing on the seismic design. Furthermore this course will drive you insight the design of suitable bolt and welded connections. First, the types of steel structures for seismic resisting systems are introduced, along with a description of relevant engineering properties of the steel material. Then the course deals with limit states design, tension, bending, shear and torsional analysis of structural steel members; bolted and welded connections; stability; analysis and design of braced and unbraced steel frames. Subsequently, specific information is provided on the seismic design and analysis of two structural types: (i) concentrically braced frames (CBFs) and (ii) moment resisting frames (MRFs). Eventually, fundamental issues for the seismic response of alternative structural systems (e.g., eccentrically braced frames, buckling-restrained braced frames) are introduced and discussed.

Course Methodology

1. Lecture by instructor;
2. Problem solving by instructor;
3. Problem solving assignment (Homework).

Material for studying

Slides calculation tutorials are shared with the students on electronic media during the course.

In addition, interested readers might consult the following books:

- Michel Bruneau, Chia-Ming Uang, Rafael Sabelli (2011), Ductile design of Steel Structures, Mac Graw Hill (2nd Edition);
- Robert Englekirk, Steel Structures.

Assessment Methods

Homework.....	50%
Final Written Exam.....	50%

Schedule

 **Classrooms at Palazzo del Broletto** – IUSS Pavia, Piazza della Vittoria 15

Week	Time	Hours
1	Monday, 26/10 Basics of steel: production, guidelines, material properties Aula 1-17 Broletto	3
	Tuesday, 27/10 Steel structures: CBF and MRF. Seismic resistant steel structures Aula 1-17 Broletto	3
	Wednesday, 28/10 Section classification. Limit states and capacity design. Gravity and lateral load resisting systems Aula 1-17 Broletto	4
	Thursday, 29/10 Analysis and design tutorials on section classification Set Homework #1 on section classification Aula 1-17 Broletto	3
	Thursday, 29/10 Types of Analyses: first and second order. Non linearity in material and geometry. Displacement limitations Aula 1-17 Broletto	4
2	Tuesday, 3/11 Analysis, verification and capacity design of beams and columns: tension, compression, bending, shear and torsion (and combined actions) Aula 1-17 Broletto	3
	Wednesday, 4/11 Analysis and design tutorials on element verification Due Homework #1 and correction and set Homework #2 on element verification Aula 1-16 Broletto	4
	Wednesday, 4/11 Analysis and capacity design of columns: buckling under compression Aula 1-16 Broletto	3
	Thursday, 5/11 Analysis and capacity design of columns and beams: lateral-torsional buckling and LTB under compression Aula 1-17 Broletto	4
3	Monday, 9/11 Analysis and design tutorials on buckling Due Homework #2 and correction. Set Homework #3 on buckling Aula 1-17 Broletto	4
	Tuesday, 10/11 Capacity design of bolted connections and welded connections Aula 1-17 Broletto	3

	Wednesday, 11/11	14.00-17.00	3
	Analysis and design tutorials on bolted and welded connections		
	Set Homework #4 on bolted connections		
	Aula 1-16 Broletto		
4	Monday, 16/11	9.00-11.00	2
	The paramount role of joints and exam preparation. Basics of alternative seismic resisting systems.		
	Due Homework #3 and #4		
	Aula 1-17 Broletto		
	Monday, 16/11	14.00-18.00	4
	Hours of availability for questions in preparation for the exam.		
	Aula 1-17 Broletto		
5	Wednesday, 18/11	Starting from 14.00	4
	Final exam		
	Aula 1-17 Broletto		

Office hours: daily, by appointment.