

CIVIL-526

Steel structures

Nussbaumer Alain

Cursus	Sem.	Type
Civil Engineering	MA1, MA3	Opt.
Civil engineering minor	H	Opt.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	3 weekly
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

Design and dimensioning of load-bearing structures using structural steel, with emphasis on the specific methods related to steel-concrete composite elements (for buildings and bridges), fatigue (bridges) and fire (buildings).

Content

- Design of load-bearing systems for multi-storey buildings in steel-concrete composite construction
- Composite structural elements dimensioning: floors, beams, full and partial connection, columns
- Fire protection and dimensioning in buildings
- Fatigue: S-N curves, classification of construction details, fatigue loadings, histograms, cumulative damage, introduction to the influence of cracks (fracture mechanics, LEFM).

Keywords

steel-concrete, floors, columns, fire, fatigue

Learning Prerequisites**Required courses**

Steel structures design (basis: cross-section resistance, buckling, LTB, connections)
Reinforced concrete structures design
Statics
Continuum and structural mechanics

Recommended courses

Numerical modelling of solids and structures

Important concepts to start the course

Structural statics and basic dimensioning in steel construction

Learning Outcomes

By the end of the course, the student must be able to:

- Choose static systems and construction elements
- Perform checks on building and bridge structures

- Formulate a calculation hypothesis
- Analyze a steel-concrete composite load-bearing structure
- Design steel-concrete composite elements
- Identify construction details

Transversal skills

- Respect relevant legal guidelines and ethical codes for the profession.
- Demonstrate the capacity for critical thinking
- Use both general and domain specific IT resources and tools
- Summarize an article or a technical report.

Teaching methods

Ex cathedra, group discussions, exercises, turn-in assignments (in groups)

Expected student activities

Active participation, home reading, assimilating the principles developed in the course

Assessment methods

turn-in assignments (2), written exam (during exam session)

Supervision

Office hours	No
Assistants	Yes
Forum	Yes

Resources

Virtual desktop infrastructure (VDI)

Yes

Bibliography

Charpentes métalliques : conception et dimensionnement des halles et bâtiments / Manfred A. Hirt et Michel Crisinel, 2022

Construction métallique : notions fondamentales et méthodes de dimensionnement / Manfred A. Hirt, Rolf Bez et Alain Nussbaumer, 2015 (ou Stahlbau : Grundbegriffe und Bemessungsverfahren / Manfred A. Hirt, Rolf Bez, Alain Nussbaumer, 2018)

Steel construction tables (SZS C4 and C5)

Ressources en bibliothèque

- [Charpentes métalliques / Hirt, Crisinel](#)
- [Construction métallique / Hirt, Bez, Nussbaumer](#)
- [Stahlbau / Hirt, Bez, Nussbaumer](#)
- [Steel construction tables \(SZS C4\)](#)
- [Steel construction tables \(SZS C5\)](#)

Notes/Handbook

English translation of the presentations used in class (based on the above bibliography), and of the main book sections such as fatigue

Websites

- <https://www.epflpress.org/>
- https://www.steelconstruction.info/The_Steel_Construction_Information_System

Moodle Link

- <https://go.epfl.ch/CIVIL-526>

Prerequisite for

Construction projects, master thesis