CIVIL-435 **Advanced steel design**

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Cursus	Sem.	Type
Civil Engineering	MA2, MA4	Opt.

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

Summary

Advanced topics in structural steel seismic design. Topics include: bolted and welded beam-to-column connections; beam-columns, steel braces, eccentrically braced frame links, capacity design of conventional steel frame buildings; innovative steel lateral load resisting systems for seismic loading.

Content

- Week 1: Introduction and background
- Week 2: Seismic loads, structural analysis for lateral loading
- Week 3: Steel frame ductility and stability under lateral loading
- Week 4: Seismic design of steel moment-resisting frames (MRFs) - General concepts
- Week 5: Seismic design of steel MRFs - Design of beam-to-column cconnections
- Week 6: Seismic design of steel MRFs - Design of beam-to-column web panel zone
- Week 7: Seismic design of steel MRFs - Design of steel columns - Part I
- Week 8: Seismic design of steel MRFs - Design of steel columns - Part II
- Week 9: Seismic design of steel Concentrically Braced Frames (CBFs) - General concepts
- Week 10: Seismic design of steel CBFs - Design of braces and other members
- Week 11: Seismic design of steel Eccentrically Braced Frames (EBFs) - General concepts
- Week 12: Seismic design of steel EBFs - Design of EBF link and other members
- Week 13: Seismic design of innovative lateral load-resisting systems
- Week 14: Special topics related to the seismic behaviour of steel structures

Keywords

steel structural systems, steel design and behaviour, moment frames, braced frames, eccentrically braced frames; capacity design; stability; P-Delta effects; ductility

Learning Prerequisites

Required courses

Structural Analysis, Structural Dynamics, Basic Course(s) in Structural Steel Design

Recommended courses

Nonlinear Analysis, Seismic Engineering

Important concepts to start the course

Basic knowledge in structural steel behaviour and design

Learning Outcomes

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

- Describe the behaviour of various steel lateral load resisting systems and their structural components
- Design steel structures for seismic and wind loading
- Assess / Evaluate the basic behaviour of steel components under cyclic loading

Transversal skills

- Set objectives and design an action plan to reach those objectives.
- Respect relevant legal guidelines and ethical codes for the profession.

Teaching methods

2-hour lecture, 1-hour exercices
Use of:

- Powerpoint
- Online lecture recording system to facilitate learning
- Tools to facilitate learning of stability theory
- in-class exercises

Expected student activities

Class participation, in-class exercise solutions

Assessment methods

1. Midterm written exam (25%), 2. Final written exam (75%).

Supervision

Office hours	Yes
Assistants	Yes
Others	The course lectures will be provided online 3-hours after the end of each class.

Resources

Bibliography

Eurocode 8, AISC-341-10, AISC-358-10, AISC-360-10, Reading material provided through Moodle

Ressources en bibliothèque

- AISC 358-10
- Eurocodes
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- AISC 360-10
- AISC 341-10

Notes/Handbook

-The course lectures, list of in-class exercise problems and midterm/final exams are based on lecture notes that are provided weekly through Moodle.

-The course does not follow a specific Handbook.

Prerequisite for

Master projects in advanced steel design, nonlinear analysis, evaluation and testing of structural steel systems subjected to natural hazards, resilient-based steel design, Performance-Based Earthquake Engineering