CIVIL-323

Reinforced concrete structures

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Cursus	Sem.	Type
Civil Engineering	BA5	Obl.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Written
Workload	150h
Weeks	14
Hours	**5 weekly**
Courses	3 weekly
Exercises	2 weekly
Number of positions	

Summary

This course introduces the student to the behaviour and design of reinforced concrete structures. The student will learn the principles of analysis of reinforced concrete and how to design common concrete elements including columns, beams, and slabs.

Content

Introduction:General background; History of reinforced concrete; Sustainability
Material behaviour of concrete; Shrinkage, creep, temperature effects; Material behaviour of reinforcing steel
Equilibrium, compatibility, constitutive laws; Linear elements in compression; Linear elements in tension; Bond and development
Basic principles of flexure; Uncracked, cracked elastic, plastic behaviour; Design of singly and doubly reinforced beams
Combined flexure and axial load; M-N interaction diagrams; Biaxial bending
Beam shear; Truss model; Longitudinal demand due to shear
Serviceability; Long-term deflection; Crack opening
Column design; Second-order effects
Elastic vs. plastic design; Upper bound, lower bound
Background of slabs; Strip method for slabs
Yield line method for slabs
Punching in slabs
Strut-and-tie analysis
Detailing; Frame corners; Changing sections

Keywords

Structures, Concrete, Stress fields, Design

Learning Prerequisites

Required courses

Structural mechanics (for GC), Continuum mechanics (for GC)

Important concepts to start the course

Statics, mechanics of materials

Learning Outcomes

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

- Apply the principles of equilibrium, compatibility, and constitutive behaviour to reinforced concrete

- Identify the appropriate design method for a given element
- Design reinforced concrete beams, slabs, and columns
- Analyze the effects of long-term loading
- Compare different methods for shear design

Transversal skills

- Plan and carry out activities in a way which makes optimal use of available time and other resources.
- Respect relevant legal guidelines and ethical codes for the profession.
- Manage priorities.
- Set objectives and design an action plan to reach those objectives.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.
- Access and evaluate appropriate sources of information.

Teaching methods

- Ex cathedra
- Powerpoint
- Discussion
- Computational tools
- In-class exercises
- Problem sets

Expected student activities

- Attend lectures
- Participate in exercises
- Home study
- Problem sets

Assessment methods

- Continuous assessment (40% of total grade)
- Final written exam (60% of total grade)

Supervision

Office hours	Yes
Assistants	Yes
Forum	Yes

Resources

Moodle Link

- https://go.epfl.ch/CIVIL-323

Prerequisite for

Reinforced concrete structures - Advanced topics, Ponts en béton