Reinforced Concrete Structures III

Code: MFVBS33SS3-EN
ECTS Credit Points: 3
Evaluation: exam
Year, Semester: 3rd year/2nd semester
Number of teaching hours/week:
Lecture: **2**
Practice: **1**
Prerequisites: Reinforced Concrete Structures II: MFVBS32SS3-EN

Topics:
Shear between web and flange of T section. Shear transfer between different time concrete. Torsion of concrete and reinforced concrete sections. Interaction of shear and torsion. Interaction of bending moment, shear and torsion. Effect of normal force on RC cross-section. The method of the ultimate force and the ultimate eccentricity. Moment – normal force interaction curves for in-plane and for out-plane situations. Types, loads, classification and design considerations for RC columns. Braced and unbraced columns. Eccentricities, imperfections, second order effects. Design possibilities of RC columns. Loads and stresses of RC frames. Approximate determination of frame loads for vertical and horizontal loads. Beam and disturb zones and joints of RC frames, Analyses of different types of frame corners, corbels, half-end beams. Reinforced concrete walls. Loads and design of reinforced concrete walls. Special problems of the under reinforced structures subjected normal force. Elastic analyses of reinforced concrete deep beams and shear walls. Plastic analysis of reinforced concrete walls, shear walls and deep beams by strut-and-tile models.

Literature:
fib Bulletin 51 Structural Concrete – Textbook on behavior, design and performance – Second Edition – Volume 1., Federation International du Béton – International Federation for Structural Concrete, (2009) ISSN: 1562-3610, ISBN:978-2-88394.091-8

fib Bulletin 52 Structural Concrete – Textbook on behavior, design and performance – Second Edition – Volume 2., Federation International du Béton – International Federation for Structural Concrete, (2010) ISSN: 1562-3610, ISBN:978-2-88394.091-8

fib Bulletin 53 Structural Concrete – Textbook on behavior, design and performance – Second Edition – Volume 3., Federation International du Béton – International Federation for Structural Concrete, (2009) ISSN: 1562-3610, ISBN:978-2-88394-093-2

fib Bulletin 54 Structural Concrete – Textbook on behavior, design and performance – Second Edition – Volume 4., Federation International du Béton – International Federation for Structural Concrete (2010), ISSN: 1562-3610, ISBN:978-2-88394-094-9

fib Bulletin 62 Structural Concrete – Textbook on behavior, design and performance – Second Edition – Volume 5., Federation International du Béton – International Federation for Structural Concrete, (2012) ISSN: 1562-3610, ISBN:978-2-88394-102-1

EN 1990:2002/A1:2005 Eurocode - Basis of structural design.

EN 1991-1-1:2002 Eurocode 1: Actions on structures - Part 1-1: General actions - Densities, self-weight, imposed loads for buildings.

MSZ EN 1992-1-1: 2010 Design of concrete structures Part 1-1.:General rules and rules for buildings

MSZ EN 1992-1-2: 2010 Design of concrete structures Part 1-2: General rules. Structural fire design

MSZ 4798-1:2004 Concrete Part 1: Specification, performance production, conformity, and rules of application of MSZ EN 206-1 in Hungary

Robert Park & Thomas Paulay: Reinforced Concrete Structures, Wiley-India Edition (2010), ISBN: 978-81-265-2362-5

Prab Bhatt, Thomas J. MacGinley & Ban Seng Choo: Reinforced Concrete Design Theory and Examples, Taylor & Francis Group (2010), ISBN: 0-415-30796-1

Prab Bhatt, Thomas J. MacGinley & Ban Seng Choo: Reinforced Concrete Design to Euroceodes – Design Theory and Examples, Taylor & Francis Group (2014), ISBN-13: 978-1-4665-5252-4

A. M. Neville: Properties of concrete Fourth and Final Edition Standarts updated to 2002, Pearson Prentice Hall (2004), ISBN: 0-582-23070-

Jack C. McCormac: Design of Reinforced Concrete Fifth Edition, John Wiley &Sons Inc. (2001), ISBN: 0-471-39576-5

Schedule

1st week: **Lecture:** Shear between web and flange of T section. Shear transfer between different time concrete. Design examples for T beams. ***Outgiving and discussion of the 1st Design Task***. **2nd week:** **Lecture:** Torsion of concrete and reinforced concrete sections. Interaction of shear and torsion. Interaction of bending moment, shear and torsion. Examples. **3rd week:** **Lecture:** Effects of normal force on RC cross-section. The method of ultimate force and ultimate eccentricity. Moment – normal force interaction curves for in-plane and for out-plane situations. Examples. ***Outgiving and discussion of the 2nd Design Task.*** **4th week:** **Lecture:** Types, loads, classification and design considerations for RC columns. Braced and unbraced columns. Eccentricities, imperfections, second order effects. Design possibilities of RC columns.	**8th week:** ***Test I*** **9th week:** **Lecture:** Beam and disturbing zones and joints of RC frames, Analyses of corbels, half-end beams. ***Handing in of the 3rd Design Task*** **10th week:** **Lecture**: Reinforced concrete walls. Loads and design of reinforced concrete walls. Special problems of under reinforced structures subjected normal force. Examples. ***Outgiving and discussion of the 4th Design Task***. **11th week:** **Lecture**: Elastic analysis of in-plane structures – in-plane stresses and in-plane displacements. **12th week:** **Lecture**: Elastic analysis of reinforced concrete deep beams and shear walls. Examples. ***Outgiving and discussion of the 5th Design Task***. **13th week:**

5th week: **Lecture:** Loads and stresses of RC frames. Approximate determination of frame loads for vertical and horizontal loads. (I.) ***Outgiving and discussion of the 3rd Design Task.*** ***Handing in of the 1st Design Task*** ***Handing in of the 2nd Design Task*** **6th week:** **Lecture:** Loads and stresses of RC frames. Approximate determination of frame loads for vertical and horizontal loads. (II.) **7th week:** **Lecture:** Beam and disturb zones and joints of RC frames, Analyses of different types of frame corners.	**Lecture:** Plastic analysis of reinforced concrete walls, shear walls and deep beams by strut-and-tile models. Examples. **14th week:** **Practice:** Examples for different types of in-plane RC structures. **15th week:** ***Test II*** ***Handing in of the 3rd Design Task*** ***Handing in of the 4th Design Task*** ***Hand in of the 5th Design Task***

Requirements

Attendance at **lectures** is **strongly recommended**, but not compulsory. Participation at **practice** classes is **compulsory**. Students must attend the practice classes and may not miss more than three times during the semester. In case a student does so, the subject will not be signed and the student must repeat the course. Students can't make up a practice with another group. Attendance at lectures and at practice classes will be recorded by the staff of the department. Being late is equivalent with an absence. In case of further absences, a medical certificate needs to be presented. Missed practice classes should be made up for at a later date, being discussed with the tutor. Students are required to bring a calculator and the printed materials of the lectures to each lecture and practice class. Active participation is evaluated by the teacher in every class. Students' active participation is required.

Students have to **submit all the two tests and the five design tasks** as scheduled minimum at a sufficient level. During the semester there are two tests – the 1st test in the 7th week and the 2nd test in the 15th week – and there are seven design tasks. In order to get the **signature**, minimum points of tests and design tasks have to be taken (min. 50 points from 80 points). In order to take an exam grade (ESE) – minimum (2) pass grade – minimum points of tests and design tasks as well as exam points have to be taken (Summa minimum 61 points from 100 points). The minimum and the maximum points related to the tests and design tasks can be obtained are the following:

Two tests:				
Test I:	Maximum:	**15 points**	Minimum:	**8 points**
Test II:	Maximum:	**15 points**	Minimum:	**8 points**
	Summa:	**30 points**		**16 points**
Five design tasks:				
Design Task 1:	Maximum:	1**5 points**	Minimum**:**	**11 points**
Design Task 2:	Maximum:	**7 points**	Minimum**:**	**4 points**
Design Task 3:	Maximum:	1**5 points**	Minimum**:**	**11 points**
Design Task 4:	Maximum:	**6 points**	Minimum**:**	**4 points**
Design Task 5:	Maximum:	**7 points**	Minimum**:**	**4 points**
	Summa:	**50 points**		**34 points**
Points required for a signature:				
	Maximum:	**80 points**	Minimum**:**	**50 points**

(In case of having min. 50 points from the Tests and from the Design Tasks, signature can be obtained)

Exam:				
	Maximum:	**20 points**	Minimum:	**11 points**
Summa points:				
	Maximum:	**100 points**	Minimum:	**61 points**

The course ends in an **exam grade (ESE)**. Based on the summa points of the tests, the summa points of the design tasks and the summa point of the exam, the exam grade is defined according to the following calculation:

Score		**Grade**	
0 – 60	points:	fail	(no signature)
61 – 70	points:	pass	(2)
71 – 80	points:	satisfactory	(3)
81 – 90	points:	good	(4)
91 – 100	points:	excellent	(5)