

Summary

Objective of the course

- design of concrete structures and chosen structural elements
- design for torsion, slender columns
- simplified methods for chosen structural elements

Important points

- Design: ULS (mostly) $R \geq E$
- The design relates to behaviour and failure mode
- Reinforcement in bended element – relates to layout of bending moments

Structural elements

	typical features	designed for
slab		$m, (v),$ deflection
beam		$M, V, (T)$
column		
wall		
deep beam		

Topics

(lectures)

$$R \geq E$$

- properties of material
- dimensions
- structural model
- loading

→ resistance

→ effect of loads
(M, V, N,...)

Structural model (analysis model, calculation model)

- idealization of supporting
- effective span
- reduction
- redistribution

Multi-storey buildings

- structural systems of high-rise buildings
- stiffening
 - principles of arrangement of stiffening elements
- robustness
- progressive collapse

Frames

- braced x sway frames
- distribution of load
- layout of bending moments for simple frames
- reinforcement
- special focus on frame corners

Slabs

- classification
 - slab supported on sides
 - flat slabs

Slab supported on sides

- strip method ($w_x = w_y \rightarrow f_x, f_y$)
- bending moments
- reinforcing
 - point load
 - openings
- loading of supporting elements
- deflection control

Flat slabs – slab on columns

- bending moments
- punching
- M
 - direct design method (M_{tot})
 - width of column and middle strip
 - M_{tot}
 - dividing of mom in inner span
 - equivalent frame method
 - reinforcement

Flat slabs - punching

- types of resistance
 - control perimeters
- } relation
- length of control perimeter
 - calculation of v_{Ed}
 - resistance – relation to failure and control perimeter („resistance depends on: ...“)
 - punching control conditions
 - physical meaning
 - implications (consequences)
 - reinforcement for punching

Staircase

- types of stairs
- terms
- design and reinforcement for all types
 - structural model, moments, reinforcement
- simplified design of scissor staircase (2 flights)
- simplified design of a notch

Foundations

- types of foundations
- design of
 - spread footing
 - strip footing below wall
- strip footing below columns
 - simplified determination of stresses below footing
 - moments
 - reinforcement

Retaining walls

- types of retaining walls
- what is it designed for?
- check of overturning
- gravity wall
 - check of the section above basement
- cantilever retaining wall
 - simplified design of reinforcement
- counterfort wall
 - design of reinforcement in the wall

Shear walls

- types of walls – stiffness
- dividing of load to particular walls

- check of stability
- calculation of stresses at wall bottom

- simplified design of tall wall (bending stiffness)
- design of reinforcement (N_{Rd})

- wall with – without openings (flexible – stiff tie beam)

- layout of reinforcement

Torsion

- failure, cracks
- layout of reinforcement

Slender columns

- interaction diagram
- differences in the design of slender and short columns
- effective length
- simplified methods

Deep beams

- stress and strain distribution
- behaviour
- simplified design of reinforcement