FINAL EXAM TOPICS
Civil Engineering BSc program
Valid: from the Spring semester 2019/2020

Reinforced concrete structures

1. Design of reinforced concrete beams for compression, simple bending, transverse shear, unaxial and biaxial bending. Ultimate and serviceability limit state analysis.
2. Elastic and plastic design of one way and two way reinforced concrete ribbed, wall and beam supported slabs. Introduce the construction methods
3. Design and construction of mild steel reinforced concrte flat slabs. Punching shear problem.
4. Reinforced concrete frames. Approximate calculations. Combined loading of columns and frames. Beam-column connections.
5. The main structural elements of highrise buildings. What are the criteria for structural regularities (in plan and in elevation)? Describe briefly.
6. Describe the main types of crane loads, the crane load combinations and the design methods according to Eurocode.
7. Compare the shear wall structural system of reinforced concrete buildings with moment-rigid frame system from the response perspective. Which one is associated with higher displacement and which is associated with higher base shear? Why?
8. Analyze an internal frame joint subjected to lateral loads. Derive the equations for calculating joint shear.

Steel Structures

9. Design of tensioned and compressed steel bars. Structural solutions and design of steel trusses according to EC3.
10. Strength, stability and serviceability design of steel beams under shear and bending according to EC3.
11. Design of simple steel connections according to EC3: sheared, tensioned and pre-stressed bolts, welded connections.
12. Design of industrial steel buildings – statical behaviour, ultimate and serviceability limit states, design of main structural elements according to EC3.
13. Design of industrial steel buildings – structural solutions and design of secondary steel elments, bracings and their connections at ultimate and serviceability limit states according to EC3.

Composite Structures of Steel and Concrete

14. Application of steel-concrete composite structures. Adavantages and disadvantages. Introduction of typical structural elements.
15. Plastic design of steel-concrete composite beams.
16. Serviceability limit state analysis of steel-concrete composite beams.
17. Interaction between srtuctural elements in steel-concrete composite structures. Full and partial interaction. Design of shear connectors. Force-slip diagrams.
18. Design of steel-concrete composite beams

Timber

19. Timber's mechanical properties. What parameters influence these mechanical properties? Describe the effect of fiber orientation and moisture content on the strength properties of timber
20. Analysis of timber structures in ultimate limit states, subjected to simple and combined actions.
21. Modern timber connection types (bolts, nails). Structural analysis and main rules of builtup.

Bridge construction

22. Typical structural systems and elements of bridges. Approximate geometry of bridges for preliminary design.
23. The substructures and bearings of bridges.
24. Traditional and modern construction methods of bridges.

Dynamics

25. What are the basic mathematical formulae describing a free, undamped vibration system? Provide the mathematical solution, and describe its physical content. Show simple examples.
26. What are the basic mathematical formulae describing a free, damped vibration system? Provide the mathematical solution, and describe its physical content. Show simple examples.

Statics

27. Introduce the force systems (concurrent, paralell, general), define their resultants and their equilibrant forces.
28. Internal forces of sipmle structures. Introduce the normal, the shear and the moment functions of simply supported, overhanging straight and angled beams.
29. Static equilibrium of determinate compound structures. Introduce the internal force diagrams of gereber beams and three hinged frames.

Strength of materials

30. Material models in strength design, Hooke-law, generalized Hooke-law
31. Geometric properties of an area: area, moment of the area, moments of inertia for an area. Major and minor axes and importances.
32. Determination of simple stresses: pure tension-compression, flexural buckling of columns, pure bending, coupled bending, pure shear, torsion.
33. Determination of stresse at coupled internal forces: excentric normal force (tension/compression and bending), determination of the neutral axis, bending and shear, shear and torsion.

Underground structures, geotechnics

34. Types of shallow foundations, design process. Design of foundation level, and geometry (B, L, m) based on Eurocode 7. Stresses below foundation, settlement calculations, protection against uneven, high settlement.

35. Types of deep foundations. Categorization of pile foundations (material, size, load bearing, technology). Single pile design methods, pile density, geometry. Box,- and shell foundations, type, structural elements. Diaphragm wall foundations, type, structural elements.

Building materials – concrete technology

36. Describe the typical composition of concrete. What are the most important properties of fresh concrete? What methods can be used to measure consistence of concrete?
37. Describe the principles and steps of concrete mix design.
38. Explain ways of heat transfer in construction materials and structures. What is thermal conductivity and what parameters influence it? Explain U value.

Masonry structures

39. Describe the main mechanical properties and the testing methods of unreinforced masonry.
40. Describe the main types of masonry structures and the design method of vertically loaded unreinforced masonry walls.