**TOPICS**
**FOR STUDENTS OF CIVIL ENGINEERING BSC**
**Valid from the Spring semester 2019/2020**

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| | **REINFORCED CONCRETE STRUCTURES** |
| 1. | Ultimate and serviceability limit state design methods of mild steel reinforced concrete beams for bending, with or without the simultaneous presence of shear or torsional forces, in accordance with EC2. |
| 2. | Simplified method for evaluating the biaxial capacity of rectangular reinforced concrete sections. |
| 3. | Elastic and plastic design of one way and two way reinforced concrete ribbed, wall and beam supported slabs according to EC2. |
| 4. | Load bearing capacity of reinforced concrete slabs using Johansen's yield-line theory. |
| 5. | Design and construction of reinforced concrete flat slabs. How to avoid punching shear failure? |
| 6. | Present approximate manual calculation methods for internal forces in reinforced concrete frame structures. Describe the verification process of slender columns in frames. |
| 7. | Primary and secondary loadbearing structures of high-rise concrete buildings. Bracing against lateral load of wind and earthquake |
| 8. | Structural design of reinforced concrete industrial halls. Static and dynamic effects of bridge cranes |
| | **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. |
| | **COMPOSITE STRUCTURES OF STEEL AND CONCRETE** |
| 13. | Pros and cons of using steel-concrete composite structures in buildings. Explain the efficiency. |
| 14. | Ultimate limit state design of steel-concrete composite simple, and continuous beams |
| 15. | Serviceability limit state analysis of steel-concrete composite beams |
| 16. | Interaction between structural elements in steel-concrete composite structures. Full and partial interaction. Design of shear connectors. Force-slip diagrams. |
| 17. | Design of steel-concrete composite columns. |
| | **TIMBER** |
| 18. | 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 |

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| 19. | Analysis of timber structures in ultimate limit states, subjected to simple and combined actions. |
| 20. | Modern timber connection types (bolts, nails). Structural analysis and main rules of builtup |
| | **BRIDGE CONSTRUCTION** |
| 21. | Describe the types, typical structural systems and main elements of bridges. |
| 22. | The substructures and bearings of bridges |
| 23. | Traditional and modern construction methods of bridges. |
| | **DYNAMICS** |
| 24. | What do we mean by one DoF, free, undamped, harmonic and linear vibrations? How do we model such a system? What do we mean by the following terms: period, amplitude, natural angular frequency? What is the mathematical form of the displacement in function of time? Give simple examples. |
| 25. | What do we mean by one DoF, free, damped vibrations? How do we model such a system? What do we mean by the following terms: dissipation force, relative damping coefficient, natural angular frequency of the damped system, amplitude of the damped system? Give simple examples. |
| | **STATICS** |
| 26. | Introduce the force systems (concurrent, parallel, general), define their resultants and their equilibrant forces. Show an example for a structural static model and its application. |
| 27. | Internal forces of simple structures. Introduce the normal, the shear and the moment functions of simply supported, overhanging straight and angled beams. Present the interdependence of them. |
| 28. | Static equilibrium of determinate compound structures. Introduce the internal force diagrams of Gerber beams and three hinged frames. Present an example of reality. |
| | **STRENGTH OF MATERIALS** |
| 29. | Material models in strength design, Hooke-law, generalized Hooke-law. Present some material model of structural materials. |
| 30. | Geometric properties of an area: area, moment of the area, centroid, moments of inertia for an area. Major and minor axes and importances. |
| 31. | Determination of simple stresses: pure tension-compression, flexural buckling of columns, pure bending, coupled bending, pure shear, torsion. |
| 32. | Determination of stresses at coupled internal forces: eccentric normal force (tension/compression and bending), determination of the neutral axis, bending and shear, shear and torsion. |
| | **UNDERGROUND STRUCTURES, GEOTECHNICS** |
| 33. | 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 |
| 34. | 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** |
| 35. | 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? |

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| 36. | Describe the principles and steps of concrete mix design |
| | **MASONRY STRUCTURES** |
| 37. | Describe the main mechanical properties of unreinforced masonry. |
| 38. | Describe the main types of masonry structures and the design method of vertically loaded unreinforced masonry walls. |