FINAL EXAM TOPICS

Structural Engineering MSc course

Valid: from September 2022.

	STRUCTURES 1.
1.	Matrix equilibrium equation system of plane trusses. Computation of statically determinate and statically indeterminate plane trusses.
2.	Matrix equilibrium equation system of space trusses. Computation of statically determinate and statically indeterminate space trusses.
3.	Computation of rod structures using displacements-based matrix method. Determine of element stiffness matrix. Determine the displacements-based matrix equilibrium equation system.
4.	Finite element modelling of rod structures.
5.	Matrix equilibrium equation system of frame structures in case of rigid beam-column connections.
6.	Matrix equilibrium equation system of frame structures in case of semi-rigid beam-column connections.
	STRUCTURES 2.
7.	Classify the surface structures according to materials, shapes and loadbearing systems. Pros and cons of application. Analyse the efficiency in comparison to more common load bearing structures.
8.	Description of structural slab systems. Define simple methods predicting the required minimum thickness. Approximate, manual design methods of one- and two-way slabs.
9.	Membrane theory of shells, determination of membrane forces using Pucher's differential equation.
10.	Comparison of loadbearing shells, plates and membranes. Show the differences, pros and cons
11.	Finite element analysis of surface structures

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	INTERACTION BETWEEN SOIL AND STRUCTURE
12.	Interaction between soil and structure related to shallow foundation (methods of settlement calculation, definition of limit depth, description of modelling methods).
13.	Interaction between soil and structure related to deep foundation (methods of settlement calculation, definition of limit depth, description of modelling methods, single pile and pile group).
14.	The interaction between soil and structure related to retaining structures. (Earth pressure types, calculation methods, structural types of retaining structures, list the types of Ultimate Limit State (ULS)).
	GEOTECHNICAL DESIGN
15.	Description of the Eurocode 7 limit states.
16.	Determination of soil shear strength and Earth pressures.
17.	Slope stability analysis according to Eurocode 7.
18.	Shallow foundation, construction technology, bearing capacity and settlement calculations according to Eurocode 7
19.	Deep foundation, construction technology, bearing capacity and settlement calculations according to Eurocode 7
20.	Methods of deep excavations, calculation, Earth retaining structures and stabilization methods
	PRESTRESSED CONCRETE STRUCTURES
21.	Explain the prestressing systems and differences between them. Advantages and disadvantages
22.	Effective prestressing force. Loss of prestressing stress in pre-tensioned and post-tensioned systems
23.	Describe briefly the design of pre-tensioned structures according to Eurocode 2 (ULS and SLS design).
24.	Design and execution of prestressed floor systems (design principles, ultimate and serviceability limit states, technology)

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	STABILITY OF STRUCTURES
25.	Buckling of columns. The buckling shape of the compressed bars and the determination of the buckling length
26.	Buckling resistance of compressed columns according to Eurocode 3
27.	Stability functions and applications
28.	Plate buckling resistance according to Eurocode 3 (classification of cross sections).
	STRUCTURAL DYNAMICS
29.	Free vibrations of linear MDF systems
30.	Matrix differential equation. Mass matrix. Stiffness matrix.
31.	Solution of two-degree of freedom system
32.	Vibration analysis of beam-structures by using second-order effects
33.	MDOF systems with harmonic excitation
34.	Vibration damper. Example for two DOF system
35.	Planar or symmetrical plan systems: ground motion. Support excitation
36.	Wind actions. Dynamic effect of wind load. Structures wind load
37.	SDOF system under pulse load. Falling mass collision with supported structures

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