Department of Structural Mechanics SvF STU

Questions for the state exam from the subject

STATICS AND DYNAMICS OF STRUCTURES (Civil Engineering)

1. A) Energy principles in continuum mechanics, the principle of minimum of total potential energy. Basic principles of the Finite Element Method (FEM).
   B) Structural models for dynamic analyses. Single degree of freedom (SDOF) and with multi degrees of freedom (MDOF). Formulation of equations for SDOF
2. A) Degree of statical indeterminacy. Truss - Force method.
   B) Multi degrees of freedom MDOF systems. Forced vibration - decomposition into eigen modes.
3. A) Degree of statical indeterminacy. Force method for frame structures.
   B) SDOF Systems. General excitation forces. Time history analysis.
4. A) Application of FEM for frames.
   B) D´Alambert's principle. Degrees of freedom, Guyan reduction.
5. A) Application of FEM for 2D slab structures.
   B) Uniformly distributed mass system. Eigen frequencies and vibration modes of a beam.
6. A) Application of FEM for thin plates.
   B) SDOF free damped vibration, harmonic vibration. Resonance. Amplitude resonance curve.
7. A) Application of FEM for trusses .
   B) Othogonality of eigen modes. Free vibration of MDOF system. Eigen frequencies and modes of vibration
8. A) Bettis principle for analysis of displacements.
   B) Response spectrum
9. A) Reduction theorem – displacemnts on statically indeterminate structures.
   B) Multi degrees of freedom system. Formulation of dynamic equation
10. A) Imposed inelastic displacement of frame structures. Force method
    B) SDOF systems – resonance effects.
11. A) Imposed inelastic displacement of frame structures. FEM method
    B) Newmark beta method. Time history analysis for SDOF
12. A) Temperature effects on statically indeterminate frames and trusses. Force method
    B) Finite element method in dynamics. Derivation of mass matrix - concentrated, consistent
13. A) Temperature effects on frame structures. FEM
    B) Dynamic analyses in FEM, Rayleigh proportional damping - damping matrix,
14. A) FEM shape functions - beam
    B) Seismic effects on buildings. Solution using response spectra for MDOF
15. A) Transformation matrix -FEM. Local (LCS) and Global coordinate systems (GCS). Stiffness matrix in LCS and GCS
    B) Vibration of cable subjected to tensile forces

References:

1. Dický, J. And Tvrdá, K..: Numerical Methods in Sructural mechanics.. STU Bratislava, 2021.
2. Clough, Penzien.: Structural Dynamics. McGRaww-Hill, New York. 2000
3. Ravinger J. – Sokol, M.: Statics of Structures. Bratislava. STU v Bratislave, 2009. 91 pp.

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