Final exam questions

Subject group name: **Finite Element Analysis**

Neptun code: ZVEGEMMNWFE

Credit points: 5

Subject in this subject group:

Finite Element Analysis (BMEGEMMNWFE)

Program: Mechanical Engineering Modelling, MSc (2N-MW0)

Specialization: Solid Mechanics

Responsible person: Dr. András Szekrényes, szekrenyes@mm.bme.hu
Department of Applied Mechanics
Faculty of Mechanical Engineering

You can check the current subject forms at the Educational Portal of the Faculty of Mechanical Engineering.

https://oktatas.gpk.bme.hu/

Always check the for updates at edu.gpk.bme.hu before preparing for the exam, especially if the subject group contains at least one subject from your final semester!

Valid from 01 September 2024

Dr. András Szekrényes
professor

Finite Element Analysis (BMEGEMMNWFE)

1. Linear stability (bifurcation) analysis of elastic systems. Initial stress and perturbed states, field increments. The role of Green-Lagrange strain tensor.
2. The geometric stiffness matrix of the 1D beam element. Interpolation, formulation of the fields, initial stress and perturbed states.
3. Lateral-torsional buckling of an I-section beam subjected to pure bending. Displacement field of the perturbed state, initial stress state. Calculation of the increment of total potential energy.
4. Load stiffness matrix of the 1D beam element. Stability diagrams of a massless column and Beck's column, divergence and flutter.
5. The diverse nature of linear and nonlinear structural problems. Classification of nonlinear structural problems, material and geometric nonlinearities. Practical examples.
6. The basic idea of the Newton-Raphson and modified Newton-Raphson iteration schemes, graphical solution (without equations) through a well-behaved 1 DoF system.
7. Degenerated elastic beam element for moderately large displacements and rotations using von Kármán-type nonlinearity. Formulation of the mechanical fields, stress resultants.
8. FE interpolation for the degenerated beam element. Load-displacement curve of beams having immovable ends.
9. Geometrically nonlinear beam element for large displacements and rotations. Reference and current configurations. Formulation of the displacement field. Nonlinear load-displacement curves of a cantilever beam subjected to concentrated load and concentrated moment.