

MSc Specialisation in Structures

Final exam questions

Structures II. (BMEEOHSMT-1)

1. Shape of shell structures, membrane behaviour of simple shells and the required boundary conditions, reasons for deviations from the membrane behaviour.
2. Eurocode partial fact design concept: background, limit states, load combinations, calibration of partial factors.
3. Structural arrangement and behaviour of shell like 3D trusses: single- and multi-layered trusses, plane and curved surfaces trusses, truss domes, geodetic spherical networks and dome, grid shells.
4. Structural arrangement and behaviour of cable structures: types and behaviour of cable structures, cable without and with considering its self weight; structural configuration and behaviour of cable roofs, structural behaviour cable domes.

Stability of Structures (BMEEOHSMT-2)

1. Static, energy, and kinetic method, in structural stability. Flexural buckling of compressed columns with various end conditions, including pinned and fixed supports, and supports with rotational springs.
2. The flexural behaviour of a pinned-pinned compressed column with an initial geometric imperfection. Derivation and application of the Ayrton-Perry formula. Buckling of columns with discrete lateral spring. Buckling of columns with elastic foundation.
3. Torsion of thin-walled members: St Venant torsion, warping, sectoral coordinates, warping constant, bimoment, stresses associated with warping. Basics of flexural-torsional and lateral-torsional buckling.
4. Buckling of simply supported rectangular plates under uniaxial compression. The concept of 'k' factor. Buckling of rectangular plates with a free edge. Shear buckling. The effect of stiffeners on plate buckling. The effective width approach.

Seismic design (BMEEOHSMT-3)

1. Complex and simplified dynamic modelling of structures for seismic analysis.
2. Lateral static force method, modal response spectra analysis, pushover analysis, time history analysis of SDOF and MDOF systems.
3. Principles of dissipative structural design. Influence of ductility, plasticity.
4. Analysis and design in accordance to Eurocode 8. Capacity design rules illustrated on a freely selected (steel or RC, building or bridge) structure.

Structural dynamics (BMEEOTMMN-1)

1. Partial differential equation of the lateral vibration of a continuous beam; solution of the free vibration problem for a simple supported girder; response of the beam to a harmonic excitation force.
2. Dynamic stiffness matrix and the exact mass matrix of a frame structure undergoing a harmonic forcing; approximate mass matrices (lumped mass matrix, consistent mass matrix), accuracy of the approximation.
3. Consideration of the structural damping as a complex stiffness; complex dynamic stiffness matrix of a beam element; physical background of proportional damping, rate-independent damping.
4. Elastic stiffness of the supporting soil body modelled as an infinite elastic half-space; dynamic stiffness of the soil due to harmonic forcing; radiation damping.