



Final exam questions

Subject group name: **Advanced Mechanics**

Neptun code: ZVEGEMMNWAM

Credit points: 4

Subject in this subject group:

Advanced Mechanics (BMEGEMMNWAM)

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

Specialization: Solid Mechanics

Responsible person: Dr. Gábor Stépán, stepan@mm.bme.hu
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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 2021

Dr. Gábor Stépán
full professor

Advanced Mechanics (BMEGEMMNWAM)

1. Dynamical effects in strength of materials; rigid bodies, elastic bodies, and the application of D'Alembert's Principle.
2. Lagrangian equation, its linearization at equilibria, stability in conservative systems.
3. Vibration modes and natural frequencies of multi-degree-of-freedom systems. Rayleigh's Ratio, Stodola Iteration, and Dunkerley's method for estimation of natural frequencies.
4. Bending vibration of continuum beams. Partial differential equations derived by D'Alembert's Principle. Typical boundary conditions.
5. Bending vibration modes and natural frequencies of continuum beams. Fourier solution. The Sturm-Liouville problem and its solution.
6. Estimation of the first natural frequency of continuum beams. Rayleigh's Principle.
7. Longitudinal vibration of continuum beams. Partial differential equations derived by D'Alembert's Principle. Typical boundary conditions. Vibration modes and natural frequencies.
8. Longitudinal vibration of continuum beams with rigid body at boundary condition. Impact of rigid body and elastic beam. D'Alembert solution. Travelling waves.
9. Bending vibration of rotating shafts. Matrix differential equation of small oscillations of rotors. Gyroscopic effects. Critical speeds. Forward and backward whirl.