TECHNICAL UNIVERSITY OF KOŠICE
Faculty of Mechanical Engineering

Institute of Design Machine and Process Engineering
Department of Applied Mechanics and Mechanical Engineering
Letná 9/B | 042 00 Košice

State questions from subject: The application of computer and experimental methods of mechanics in engineering
Study programme: Mechanical engineering (master), Study specialization: Mechanical engineering (compulsory)
AY: 2020/2021

1. a) Direct methods for solving the basic FEM equation.
   b) Methods and means of experimental determination of residual stresses.
2. a) The principle of virtual displacements and the Lagrange variational principle.
   b) Influence of operating conditions on tensometric measurements.
3. a) Basic quantities and equations in the theory of elasticity.
   b) Stages of the experiment.
4. a) Iterative methods for solving the basic FEM equation.
   b) Types and distribution of strain gauges according to the number and configuration of measuring grids.
5. a) Discretization of the solved area and types of finite elements.
   b) Connection of resistance strain gauges (measurement of torsion with exclusion of thrust and bending; bending with exclusion of thrust; thrust with exclusion of bending).
6. a) Modal analysis.
   b) Characteristics of technical experiment, theory of experiment.
7. a) Frontal method
   b) Digital image correlation - the principle of the method and its use.
8. a) Solution using subdomains.
   b) Brittle coating method and Moire method.
9. a) Influence of node or elements numbering on the calculation speed.
   b) Types of experiment, characteristics of the current experiment.
10. a) Dynamics in finite element method. Mass matrix and stiffness matrix.
    b) Principles of photoelasticimetry (transmission and reflection), arrangement of polariscope.
11. a) Structural optimization.
    b) Characteristic lines in photoelasticity, their interpretation in terms of optics and mechanics. Calibration, stress separation, compensation.
12. a) Explicit method.
    b) Mechanical and optical-mechanical sensors (principle, advantages, disadvantages, field of application).
13. a) Implicit method.
    b) Separation of stress, calibration, compensation in photoelasticity.
14. a) Assembling global stiffness matrix.
    b) Pneumatic and string strain gauges (principle, advantages, disadvantages, field of application).
15. a) Equations for calculating nodal displacements.
    b) Spatial photoelasticimetry (principle, advantages, disadvantages, field of application).
16. a) Estimation of calculation errors. Adaptive remeshing.
    b) Wheatstone bridge of circuit, determination of the deformation sensitivity constant of electrical resistance strain gauges.

prof. Ing. Štefan Segľa, CSc.
Guarantor of study programme