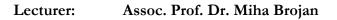
University of Ljubljana Faculty of Mechanical Engineering

Advanced Strength of Materials



Lectures: 30h

Tutorials: 10h

Project: 65h



Lang. :

5 ECTS

Objectives

The objectives of this course are to learn how to use advanced mathematical tools in mechanics, learn how to build physical and mathematical models of complex stress-strain states in deformable bodies, rheological responses and to learn how to design statically multiply indeterminate structures. With this course the students will get the following competences:

ability to use advanced mathematical tools in mechanics,

Labs: 20h

- ability to build physical and mathematical models of complex stress-strain states in deformable bodies,
- design statically multiply indeterminate structures.

Programme	Obligations for following and completing the course; Presentation of relevant study literature; Overview of course topics; Concept of a 3D continuum; Cauchy's definition of stress vector, normal and shear stresses, static equilibrium on a finite volume in a deformed body, Cauchy's stress theorem; Stress tensors (Cauchy, 1st Piola-Kirchhoff, 2nd Piola-Kirchhoff, Biot, etc.); Deviatoric and hydrostatic part of the stress tensor; Principal stresses and maximum shear stresses in 3D; Invariants of the stress tensor and invariants of the deviatoric part of the stress tensor; Strain theory; Displacement vector, deformation gradient, deformation tensors, small/finite strain theory; Geometric interpretation of the small strain tensor; Compatibility conditions for strains; Elastic strain energy of a body due to external loads; Energy methods, strain energy density per unit volume; Principle of virtual work; Ideally elastic material, Green elasticity; Material anisotropy; Isotropy, Linearly elastic material; Determining material constants from experiments; Hooke's law, Hyperelasticity; Volumetric and distortion work/energy; Effects of temperature; Navier-Lame equations; Specific stress-strain states; Airy stress function; Computer simulations with FEM; Complex real-life examples and case studies
Prerequisites	Meeting the enrolment conditions for the Master's study programme of Mechanical Engineering - Research and Development program.
Learning outcomes	 Thorough professional theoretical and practical knowledge in a selected field of expertise that is supported with a broad theoretical and methodological basis. In-depth understanding of stress and strain states in general deformable bodies In-depth understanding of the failure mechanisms in structural elements In-depth understanding of mathematical structure of rheological models
Assessment	 20% Examination (lectures - theory) 60% Examination (exercises - design calculations) 10% Laboratory exercises 10% Homework
Literature	 J.N. Reddy: An Introduction to Continuum Mechanics A. Bower: Introduction to continuum mechanics W.D. Lai, M. Rubin, E. Krempl: Introduction to Continuum Mechanics Y.C. Fung: First Course in Continuum Mechanics M.E. Gurtin: An Introduction to Continuum Mechanics G.T. Mase, G.E. Mase: Continuum mechanics for engineers G.E. Mase: Schaum's outline of theory and problems of continuum mechanics S. Timoshenko: Theory of elasticity.

- G.A. Holzapfel: Nonlinear Solid Mechanics: A Continuum Approach for Eng.
- R.W. Ogden: Non-Linear Elastic Deformations