RTU Course "Theory of Elasticity"

15E03 Lidaparātu teorijas un konstrukcijas katedra

General data

Code	TAS503
Course title	Theory of Elasticity
Course status in the programme	Compulsory/Courses of Limited Choice; Courses of Free Choice
Course level	Post-graduate Studies
Course type	Academic
Field of study	Mechanics, Mechanical Engineering, Machine Building
Responsible instructor	Pavelko Vitālijs
Academic staff	Pavelko Igors
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN, RU
Possibility of distance learning	Not planned
Abstract	Theory of stresses. Theory of strains. Generalized Hooke's law. Basic problems of theory of elasticity. Generalized theoremes of theory of elasticity. Opposite and semi-opposite methods. Plane problems of theory of elasticity. The method of theory of complex variable in plane problem. The method of integral transformations. Approximate Ritz's method. The finite element method. The boundary element method. (JAR-66,Section 2,p.2.1,6.1-6.3,11.2,11.3,12.5)
Goals and objectives of the course in terms of competences and skills	To be able to analyze some real problem and formulateits solution based on the theory of elasticity. To be able to reasonably choose parameters of the model (geometry, material properties, boundary conditions). To be able to analyze the calculation results with the help of standard computer programs.
Structure and tasks of independent studies	Preparation of home work reports: stress state analysis (2 h); strain state analysis (2h) plane problem solution by finite element method (2 h); Working with the literature (10 h).
Recommended literature	1. V. Pavelko. Elastības teorija. Lekciju konspekts– Rīga: RTU, 2005. – 85 lpp. 2. Mechanical Engineering Handbook SECTION 1: Mechanics of Solids. Bela L. Sandor Ed. Frank Kreith Boca Raton: CRC Press LLC, 1999. 3. Timosshenko S.P., Goodier J.N. Theory of Elasticity. New York. 1970. 4. H.Han.Teorija uprugosti. M.:Mir,1988. 5. E.Lavendelis, A.Valdmanis. Materiālu pretestība. Rīga: Zvaigzne, 1970.
Course prerequisites	Mathematics, physics, mechanics, strength of materials

Course outline

Theme	Hours
The theory of elasticity as a part of deformable solid theory. External and internal forces.	1
Stress state, the tensor of stresses.	2
Octahedral stress. Spherical tensor and deviator. Principal stresses and planes.	1
Infinitely small element equilibrium. Shear stress properties.	1
Ostrogradsky – Gaus formula and equilibrium equations.	1
Displacements and strains.	1
Strain state. Small strain tensor.	1
Principal directions of deformation and principal strains.	2
Strain spherical tensor and deviator. Infinitely small rotation.	1
Displacement definition, using the strain tensor. Conditions of compatibility.	2
Elasticity of materials. Energy of deformation and elastic potential.	2
General Hooke’s Law	2
Equations system of the theory of elasticity. Boundary conditions.	2
Basic problems of the theory of elasticity.	1
Opposite method. Semi-opposite method.	4
Plane problem of the theory of elasticity.	4
Numerical methods for solution of the problem of the theory of elasticity.	4

Learning outcomes and assessment

Learning outcomes	Assessment methods
To be able to execute the stress state analysis.	Calculation Work: stress state analysis.
To be able to solve a problem of strain analysis.	Calculation Work: stress state analysis.
To be able to use numerical methods in solving problems of the theory of elasticity.	Calculation Work: Plane problemsolution by FEM.

To be able to use theory for solution of practical problem of stress and strain analysis.	Final examination

Study subject structure

Part	CP	ECTS	Hours per Week			Tests			Tests (free choice)		
			Lectures	Practical	Lab.	Test	Exam	Work	Test	Exam	Work
1.	2.0	3.0	1.5	0.5	0.0		*				