RTU Course "Resistance of Materials (for mechanical engineering)"

15325 Teorēt.mehānikas un materiālu pretestības katedra

General data

Code	MMP219
Course title	Resistance of Materials (for mechanical engineering)
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Undergraduate Studies
Course type	Academic
Field of study	Mechanics, Mechanical Engineering, Machine Building
Responsible instructor	Gonca Vladimirs
Academic staff	Kononova Olga Kalinka Juris Strautmanis Guntis
Volume of the course: parts and credits points	2 parts, 5.0 Credit Points, 7.5 ECTS credits
Language of instruction	LV, EN, RU
Possibility of distance learning	Not planned
Abstract	Basic hypotheses. Mathematik's model. Calculation chart. Forces. Stress.Deformation. Strain.comressions. Strength calculation. Strength theory. Torsion. Bend. The experimental tasks. Flexibility grounds. The general principles and theorems. Displacements. Buckling. Dynamic tasks. Impact at. Long term strength. Plate and shell. FEM Method: Bending Beam and Buckling. System stability.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to provide studying ability to calculate and analyse beams, and squared beams, taking technical constructions attention the set requirements and criteria. The task is to estimate stress and stability set for a beam.
Structure and tasks of independent studies	Studying the main topics of the study subject and preparing for test works on the beam construction. Development of the study project consulting recommended literature and attending the tutorials of the lecturer.
Recommended literature	1. E. Lavendelis. Materiālu pretestība. Rīga. 1986. 2. E. Lavendelis., A. Valdmanis. Materiālu pretestība. Rīga. 1976. 3. W.B. Bickford. Advanced mechanics of materials. USA. 1998. 4. S. Timoshenko. Strength of materials. USA. 1985. 5. V. Gonca, S. Gluhihs. Mehānika. Galīgo elementu metode. Rīga.2002.
Course prerequisites	Mathematics, physics, theoretical mechanics.

Course outline

Theme	Hours
Strength of materials and their models. Basic tasks.	3
Mechanical verifications of materiāls. Samples. Deformations, stress. Experiments.	3
Strain (compression). Internal forces. Verifications of epures. Algorithms of calculation of strength.	3
Strain (compression). Permissible strain. Deformed state of beam. Scale effects.	3
Bend. Hypotheses. Stress and deformations of bend. Complete checking of beam for strength and stiffness.	6
Twisting of round and unround beams. Hypotheses. Stress and deformations. Membran's analogy.	3
Theory of strength. Potential energy of deformation. Mora theory of strength.	3
Calculation of strength of beam(squared beam) at a difficult ladening. Center of bend. Stiffness of construction's el.	2
Determination of the deformed position of the system of the beams. Mora integral. Ritz method.	6
Statically indefinable constructions. Drafting of three groups of equalizations. Frames with the closed contour.	4
Beam on the elastic founding. Hypotheses. Endless long beam with the various loading.	4
Buckling failure (loss of stability) Cross-bending. Algorithm of Euler's method. „?" method.	4
Bases of theory of bend of plate. Round plate. Bend of plate. Determination of the critical loading.	4
Shell theory. Basic suppositions. symmetric, momentless shells.	4
Tiredness of materials in time variable stress. Factors of safety.	4
Dynamic loading. Method of forces. Method of displacement. Resonances.	4
Being of eigenfrequencies. Harmful and useful vibrations. Calculation of strength in case of vibrations.	4
Loading of blow. Dynamic coefficient. Twisting blow.	2
Experimental works: buckling, oscillation, impact.	4
Viscous elastic properties of materials compliance calculations.	4
Finite element method. FEM and Ritz method for beam.	2
Beam bending and buckling calculation of the FEM program.	4

Learning outcomes and assessment

Learning outcomes	Assessment methods
Students are able to analyze the stability of structures.	Study project and exam on the beam's construction stability.
Students are able to analyze and count on plate and shell at the symmetric load.	Test and examination task: plate and shell.
Students are able to analyze beam construction and the variation of impact, for the criteria.	Study project and exam tasks on oscillation and impact.
Students are able to construction, using the FEM method and computer program.	Test: the beam bending calculation of buckling and the FEM program.

Study subject structure

Part	CP	ECTS	Hours per Week			Tests		
			Lectures	Practical	Lab.	Test	Exam	Work
1.	2.0	3.0	1.0	1.0	0.0		*	
2.	3.0	4.5	1.0	2.0	0.0		*	