RTU Course "Nonlinear Mechanics of Materials"

15325 Teorēt.mehānikas un materiālu pretestības katedra

General data

Code	MMP533
Course title	Nonlinear Mechanics of Materials
Course status in the programme	Compulsory/Courses of Limited Choice
Course level	Post-graduate Studies
Course type	Academic
Field of study	Mechanics, Mechanical Engineering, Machine Building
Responsible instructor	Gonca Vladimirs
Volume of the course: parts and credits points	1 part, 3.0 Credit Points, 4.5 ECTS credits
Language of instruction	LV, EN, RU
Possibility of distance learning	Not planned
Maximum auditorium capacity	25
Maximum number of students per semester	50
Abstract	Material classification. Nonlinearity. Rheology. Plasticity. Stress distortion and nonlinear theory. Flow theory. Viscosity. Nonlinear creep theory. Mechanical models. Models with memory. Aging models. Flow models. The crack theory. Elastic properties of non-linear models. Technology. Calculation program.
Goals and objectives of the course in terms of competences and skills	The objective of the study course is to help students to acquire skills required to calculate and analyze beams and bars of engineering construction, taking into account assigned requirements and criteria. The task - to assess the strength and stability of the designed construction.
Structure and tasks of independent studies	Studying the main topics of the study subject and preparing for the assessment tests and experiments on the application of the typical materials. Development of the study project consulting recommended literature and attending the tutorials of the lecturer.
Recommended literature	1. B. Seely, J. Smith. Advaced mehanics of materials. UK. 1981. 2. W. Olszak. Non-homogeneity in elasticity and plasticity. Polish. 1992. 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. 6. E.Lavendelis.Materiālu pretestība. Rīga,Zinātne,1986.g.,340.lpp. 7. S. Crouch. New materials in mechanical engineering. UK. 1999.
Course prerequisites	Math. Mechanics. Resistance of materials.

Course outline

Theme	Hours
Non-linear mechanics of materials and models, basic assumptions. Classification. Material non-linear physical equations.	6
Stresses, displacements, mathematical models, equations of nonlinear material.	6
Materials research experimental methods of analysis. Laboratory work.	6
Material viscous-elastic properties compliance calculations, relaxation, creep.	6
Nonlinear material fatigue at the transient stress, temperature effects. Woltaire's Principle.	5
Micro-and macro mechanics. Nonlinear optimization nonlinear material properties.	6
Rheology, the profile models. The gap theory, the collapse mechanics.	5
Transient effect on the nonlinear material properties and physical equations.	2
Computer programs for nonlinear material properties and survivability prediction calculations.	6

Learning outcomes and assessment

Learning outcomes	Assessment methods
Students are able to analyze material mathematical models and physical equations.	Test and examination tasks on the nonlinear material models and physical equations.
Students are able to spend and analyze experimental research material.	The examination
Students are able to choose and justify the methods of analysis for nonlinear mechanics.	Study project: prediction of material properties and durability of the calculations with computer programs.

Study subject structure

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