RTU Course "Finite and Boundary Element Methods"

15325 Teorēt.mehānikas un materiālu pretestības katedra

General data

Code	MMP519
Course title	Finite and Boundary Element Methods
Course status in the programme	Courses of Free 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, 4.0 Credit Points, 6.0 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	Finite element method. Approximations. Variation of the finite element method. Digitization. Element in the equation. Boundary conditions. Network generation. Settlement of the representation. Accuracy assessment. Time-varying problems. A computer program is continued. Two-dimensional problems. Eigenvalues problem. Boundary element method.
Goals and objectives of the course in terms of competences and skills	The aim of the study course is to help students to acquire skills required to calculate and analyze the structures using the finite element method, taking into account the given requirements and criteria. The task - to assess the strength designed in the structure.
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. O.C. Zienkiewicz. The Finite Element Method. UK. 1985. 2. E. Lavendelis. Raschet rezino-tehnicheskih izdeliji. Rīga. 1976. 3. A Finite Element Primer. NEL. UK. 1991. 4. R. Rikards. Metod konechnih elementov v teorii obolochek I plastin.Rīga. 1975. 5. V. Gonca, S. Gluhihs. Mehānika. Galīgo elementu metode. Rīga.2002.
Course prerequisites	Mechanics. Math. Resistance of materials. Numerical methods. Computer training.

Course outline

Theme	Hours
Basic assumptions. Mechanics of continuous environment and its models. Variation method. Approximations.	4
Finite element method. Finite element configuration. Finite element method algorithms.	4
Inverse matrix. Stress and displacement calculation algorithm. Potential energy minimum principle.	4
Stacionarity theorems. Lagrange factors.	4
The dynamic equations. Equation into three groups. Time-varying problems. Stability tasks.	4
Potential and extra energy. Minimum principle. Stacionaritātes theorems. Lagrange factors.	4
A computer program is continued. Network generation. Two-dimensional problems. Small deformation.	4
Finite element methods for geometrically and physically nonlinear tasks.	4
Boundary element method. Theorem. Approximations. Boundary element method algorithms.	4
Variation of the principles and methods of resolution by a computer program.	4
The differences and common finite element method and Boundary element method.	4
Optimal design method by finite element methods.	4

Learning outcomes and assessment

Learning outcomes	Assessment methods
Students are able to analyze and write an approximation function transfers of any type of finite element.	Exam on the finite element choice.
Students are able to analyze and solve environmental tasks applying the continuous finite element method.	Test and examination tasks: a flexible body calculations applying the finite element method.
Students are able to analyze the stresses and strains of a structure using the finite element method with a computer program.	Coursework: a structural strength calculation of the finite element with the computer program help.

Study subject structure

Part	CP	ECTS	Hours per Week			Tests			Tests (free choice)		
			Lectures	Practical	Lab.	Test	Exam	Work	Test	Exam	Work

1.	4.0	6.0	2.0	1.0	0.0		*			*	