RĪGAS TEHNISKĀ
UNIVERSITĀTE

RTU Course "The Finite Element Method (Expanded Course)"

31000 Faculty of Civil and Mechanical Engineering

General data

Code	BKA701
Course title	The Finite Element Method (Expanded Course)
Course status in the programme	Compulsory/Courses of Limited Choice; Courses of Free Choice
Responsible instructor	Jevgenijs Barkanovs
Academic staff	Andrejs Kovaļovs Pāvels Akišins
Volume of the course: parts and credits points	1 part, 6.0 credits
Language of instruction	EN
Annotation	The study course acquaints students with the theoretical and practical aspects used in the finite element analysis. The study course includes formulation of the finite element method and numerical procedures used for the building of finite element matrices and estimation of the numerical errors. The study course examines methods used for an efficient solution of the finite element equilibrium equations in nonlinear static, dynamic, buckling and thermal analyses. The study course gives students some modelling aspects and examines modern applications of the finite element method.
Goals and objectives of the course in terms of competences and skills	The study course acquaints students with the finite element analysis and provides a basis for an understanding of the complete solution process. The study course includes the following tasks: 1. To acquaint with a formulation of the finite element method and numerical procedures used for an evaluation of the finite element matrices and estimation of the numerical errors. 2. To provide in-depth knowledge of methods for an efficient solution of the finite element equilibrium equations in static, nonlinear static, dynamic and buckling analyses. 3. To develop skills in finite element modelling and correct application of modern finite elements.
Structure and tasks of independent studies	Mastering of theoretical material furnished in lectures and literature sources, solution and the defence of practical works.
Recommended literature	Obligātā/Obligatory: 1.Barkanov E. Introduction to the Finite Element Method. Textbook. – Riga: RTU Publishing House, 2002. Papildu/Additional: 2.Cook R. D., Malkus D. S., Plesha M. E. and Witt R. J. Concepts and Applications of Finite Element Analysis. – John Wiley & Sons: USA, 2002. 3.Liu G. R. and Quek S. S. The Finite Element Method: A Practical Course. – Butterworth Heinemann: Oxford, 2003.
Course prerequisites	Mathematics, mechanics.

Course contents

Content	Full- and part-time intramural studies		Part time extramural studies	
	Contact Hours	Indep. work	Contact Hours	Indep. work
Introduction. Matrix algebra.	2	3	0	0
Finite element of shaft.	4	6	0	0
Finite element of bending beam.	2	3	0	0
Coordinate transformation.	2	3	0	0
Some modelling considerations.	2	3	0	0
Numerical errors.	2	3	0	0
Solution of equilibrium equations in static analysis.	2	3	0	0
Solution of equilibrium equations in nonlinear static analysis.	2	3	0	0
Solution of eigenproblems.	2	3	0	0
Frequency response analysis.	2	3	0	0
Solution of equilibrium equations in dynamic analysis.	4	6	0	0
Buckling analysis.	4	6	0	0
Finite element method program packages.	2	3	0	0
Practical works. Two dimensional beam. Two dimensional frame. Two dimensional truss. Laminated composite panel.	16	24	0	0
Practical works. Static, nonlinear static, eigenproblem, frequency response, dynamic, and buckling analyses.	16	24	0	0
Total:	64	96	0	0

Learning outcomes and assessment

Learning outcomes	Assessment methods
Can understand and systematic to think as also to solve independently tasks of the finite element method.	Examination.
Knows various design aspects.	Personal work.
Knows various commercial finite element software (ANSYS, NASTRAN, LS-DYNA, ABAQUS) possibilities.	Personal work.
Able to calculate and design the structural elements. Can independently construct, calculate as also to execute the analysis of results.	Practical works.

Evaluation criteria of study results

Criterion	%
Passed examination	50
Completed personal work	30
Completed practical works	20
Total:	100

Study subject structure

Part	CP	Hours			Tests			Tests (free choice)		
		Lectures	Practical	Lab.	Test	Exam	Work	Test	Exam	Work
1.	6.0	2.0	2.0	0.0		*			*	