RTU Course "Calculation Methods in Mechanics"

15E03 Lidaparātu teorijas un konstrukcijas katedra

General data

Code	TAS507
Course title	Calculation Methods in Mechanics
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 Ozoliņš Ēriks
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
Maximum auditorium capacity	20
Maximum number of students per semester	20
Abstract	Numerical methods in mechanics study general ideas and common principles of engineering methods of calculation of different mechanical problems (dynamic characteristics, internal forces, stresses and strains). The subject includes mathematical description of typical problems of mechanics and their solution numerical methods (operations with matrix, linear equations of algebra, problems of eigen values, ordinary and partial differential equations and others), and their application to different kinds of mechanical phenomena.
Goals and objectives of the course in terms of competences and skills	The main goal of the given subject is to provide students with stable theoretical knowledge and practical skills to use numerical methods for solution of mechanics problems, and use modern software (Matlab, MatCAD and similar).
Structure and tasks of independent studies	Calculation work: dynamic parameters of a beam with variable parameters determination by methods of concentrated mass.(4h) Calculation work: Accuracy of dynamic problem solution of a beam with variable parameters.(4h) Work with literature (8h)
Recommended literature	1. V.Pavelko. Skaitliskās metodes mehānikā: Lekciju konspekts. -Rīga:RTU,2001. 2. Gilat, Amos (2004). MATLAB: An Introduction with Applications (2nd edition ed.). John Wiley & Sons. 3. Hildebrand, F. B. (1974). Introduction to Numerical Analysis (2nd edition ed.). McGraw-Hill. 4. Leader, Jeffery J. (2004). Numerical Analysis and Scientific Computation. Addison Wesley. 5. Blevins, R. D., Formulas for Natural Frequency and Mode Shape, Van Nostrand, 1979. 6. Beards, C. E, Engineering Vibration Analysis with Application to Control Systems,Edward Arnold, 1995. 7. Matlab, MathCAD helps. 8. Applied Finite Element Analysis //Larry Segerlind. -John Wi-ley and Sons, Inc., New York, 1976.
Course prerequisites	Strength of materials, Structural analysis, Aerodynamics, Structure dynamics

Course outline

Theme	Hours
Mechanics problems and numerical methods.	4
Dynamics of elastic systems.	4
Numerical methods of dynamic system analysis.	4
Problem of buckling and numerical methods of analysis.	4
Dynamic bending of a beam and methods of concentrated mass.	4
Dynamics of beams system.	2
Mathematics problem of frequency and form of natural vibration.	4
Accuracy of solution. Selection of model solution.	2
Estimation of parameters of the calculation scheme.	2
Application of the finite elements method.	2

Learning outcomes and assessment

Learning outcomes	Assessment methods
To be able to use theoretical knowledge about numerical methods in mechanics and algorithms of their practical realization.	Final examination.

To be able to solve dinamic problems of elastic systems using numerical methods of analysis.	Calculation work: dynamic parameters of a beam with variable parameters determination using the methods of concentrated mass. Final examination.
To be able to solve the problem of buckling using numerical methods of analysis.	Calculation work: Accuracy of the dynamic problem solution of a beam with variable parameters. Final examination.
To be able to solve the problem of natural frequencies and modes using numerical methods of analysis.	Calculation work: dynamic parameters of a beam with variable parameters determination using the methods of concentrated mass. 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	1.0	0.5	0.5		*			*	