RTU Course "Structures Dynamics"

15E03 Lidaparātu teorijas un konstrukcijas katedra

General data

Code	TAS505
Course title	Structures Dynamics
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	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	25
Maximum number of students per semester	25
Abstract	Fundamentals of structural dynamics are considered: dynamic load, natural and forced vibration, natural frequency and mode, dynamics of elastic systems; structural elements with continuously distributed parameters. More details of the methods practical application are considered: analytical and numerical solutions, including the finite elements method.
Goals and objectives of the course in terms of competences and skills	Structures dynamics is a subject about general ideas and common principles of structure dynamic loading and its reaction (internal forces, stresses and strains). THe aim of the subject is to acquire the methods of dynamic forces, stresses and strains analysis and their application to different kinds of structural elements and units.
Structure and tasks of independent studies	Calculation work: frequencies and forms of natural vibration of a beam with variable parameters (4h). Calculation work: Influence of the boundary conditions to the frequencies and forms of natural vibration of a beam with variable parameters (4h). Laboratory work: Experimental definition of the frequencies and forms of natural vibration (2h).
Recommended literature	1. V. Pavelko. Konstrukciju dinamika. Lekciju konspekts – Rīga: RTU, 2005. – 26 lp. 2. V. Pavelko. Konstrukciju dinamika. Kursa darba uzdevumi un izpildīšanas metodiskie norādījumi – Rīga: RTU, 2005. – 10 lpp. 3. Karnopp, B. "Dynamics and Vibrations". The Engineering Handbook. Ed. Richard C. Dorf Boca Raton: CRC Press LLC, 2000. 4. Beards C. E, Engineering Vibration Analysis with Application to Control Systems,Edward Arnold, 1995. 5. Melderis I., Teters G. Būvmehānika: Mācību grāmata augstskolu studentiem. -Rīga: Zvaigzne, 1977. 6. Blevins R. D., Formulas for Natural Frequency and Mode Shape, Van Nostrand, 1979. 7. Vibration problems in engineering, By S.Timoshenko. -Toronto, 1984. 8. С.П.Тимошенко. Колебания в инженерном деле. - М.: Наука, 1985. – 444 с.
Course prerequisites	Bachelor program. Especially: Mechanics, strength of materials, thin-walled structure analysis.

Course outline

Theme	Hours
Concepts of structures dynamics. Main definitions. Dynamic loading.	2
Natural and forced vibration. Dynamic reaction. Frequency and form of natural vibration.	2
Classification of problems of structures dynamics.	2
Dynamics of elastic systems. The concept of dynamic system. Types of dynamic systems and their classification.	2
Dynamics linear theory. Analysis methods of dynamic systems. Equations system of structures dynamics.	2
Rod longitudinal vibration. Boundary conditions. Methods of the problem evaluation.	2
Dynamic bending of a beam. Equations system of dynamic bending of a beam.	2
Boundary conditions. Methods of problem evaluation.	2
Methods of concentrated mass. The frequency and form of natural vibration.	4
Forced vibration. Damping.	2
Dynamics of beam system. Equations of dynamics of a beam system. Boundary and compatibility conditions.	2
Methods of problem evaluation. Methods of concentrated mass. Frequency and form of natural vibration.	2
Accuracy of solution. Approximated solution.	2
Application of the finite elements method. Stiffness and mass matrices.	2
The forms of natural vibration.	2

Learning outcomes and assessment

Learning outcomes	Assessment methods
To obtain theoretical knowledge about structures dynamics, methods of dynamic forces, stress and strain analysis.	Exam.
To be able to use theoretical knowledge for solving of structures dynamics problems.	Calculation work: The frequencies and forms of natural vibration of a beam with variable parameters. Exam.
To be able to select and use the most rational method of solving a dynamic problem.	Calculation work: Influence of the boundary conditions on the frequencies and forms of natural vibration of a beam with variable parameters. Exam.
To be able to use modern software for solving of structures dynamics problems.	Effect of the boundary conditions to the frequencies and forms of natural vibration of a rod with variable parameters. Exam.
To be able to estimate the accuracy of solution.	Laboratory work: Experimental definition of the frequencies and forms of natural vibration. Exam.

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		*			*	