

FUNDAMENTAL METHODS OF DYNAMICS OF LINEAR SYSTEMS

Subject code: **06.4-WILŚ- BUD- DYKO- KC07**

Subject type: Obligatory

Language of instruction: English

Responsible for the subject: Person currently conducting lectures

Providing education: Department of Building Mechanics

Type of class	Number of classes per semester	Number of classes per week	Semester	Type of credit	ECTS points
Full time studies					3
Lecture	15	1	I	credit with a grade	
Project	15	1		credit with a grade	
Part time studies					
Lecture	9	1	I	credit with a grade	
Project	9	1		credit with a grade	

SUBJECT OBJECTIVE:

Presentation of basic problems of construction dynamics and methods for solving them. Teaching the ability to calculate the frequency and form of natural vibrations and the amplitude of forced vibrations for systems with discrete mass distribution. Familiarization with the computer software available in this field.

INITIAL REQUIREMENTS:

Knowledge of mathematical analysis and matrix calculus, building mechanics - statics, basics of computer mechanics.

SUBJECT SCOPE:

Lecture

Dynamic degrees of freedom. A system with one degree of freedom: individual vibrations, resonance, forced vibrations, damping. Systems with n degrees of freedom: the mass granulation method, stiffness matrix, damping matrix, individual vibrations, eigenvectors, harmonic forced vibrations. Continuous systems. The finite element method: equations of the motion of a bar element, the global equation of motion.

Project

Project classes include:

Project 1: Determination of the frequency of natural vibrations and internal forces, taking into account dynamic influences in the beam with one degree of dynamic freedom.

Project 2: Determination of the frequency and form of natural vibrations and internal forces, taking into account dynamic influences in a frame with several degrees of dynamic freedom.

Educational methods:

- Lecture - conventional lecture,
- Project - individual and team work on a project.

EDUCATION RESULTS:

Results after completion of the course	Symbol	Verification method	Type of class
Knowledge			
<p>The student has basic knowledge of building vibrations and dynamics, knows methods and techniques for calculating the frequency and form of natural vibrations and the amplitude of forced vibrations for systems with discrete mass distribution. The student has knowledge of the basic methods for including attenuation in such systems. The student has basic knowledge of the analysis of vibrations using the finite element method and available computer software.</p> <p>The student has expanded and profound knowledge of mathematics and solid state mechanics useful for formulating and solving complex tasks in the field of structural analysis concerning: modelling with the Finite Element Method (FEM), analysis of individual problems, dynamics of structures</p>	K_W03	Test with points	L
Skills			
<p>The student can calculate the frequency and form of natural vibrations and the amplitude of forced vibrations for beams and frames with discrete mass distribution with several degrees of dynamic freedom. The student can use available computer software to analyse structure vibrations using the finite element method.</p> <p>The student can use known methods and mathematical models - if necessary,</p>	K_U07 K_U12	Projects	P

modifying them - to analyse and design complex engineering structures			
Social competences			
The student is aware of the limitations of computer software used. The student can think and act in a creative and entrepreneurial way	K_K01	conversation during lectures initiated by the teacher; checking competences during the introduction to classes	L, P

VERIFICATION OF EDUCATION RESULTS AND REQUIREMENTS TO OBTAIN A CREDIT:

Lecture	A credit for a test with points:
	50% - 60% correct answers satisfactory,
	61% - 70% satisfactory plus,
	71% - 80% good,
	81% - 90% good plus,
	91% - 100% very good.
Project	The condition for a credit is a positive grade for all projects (2 projects) and for a written test with the same criteria as for the lecture.
Credit for the subject:	The final grade is the average of the grades: $G = (L+P)/2$

STUDENT WORK:

Fill time studies

Interaction with the teacher 15l+15p+5cons, total	35 h.
Preparation for the test (exam)	15 h,
Projects – individual – 2 proj x 20 h	40 h,
Total 35+15+40	90 h,
ECTS for the subject 90/30	3 ECTS.

BASIC LITERATURE:

1. Ciesielski R. i inni: Mechanika budowli – ujęcie komputerowe, tom 2, Arkady, Warsaw 1992
2. Nowacki W.: Mechanika budowli, PWN, Warsaw 1974
3. Rakowski G., Kacprzyk, Z.: Metoda elementów skończonych w mechanice konstrukcji, Oficyna Wydawn. Polit. Warsz., Warszawa 1993
4. Kucharski T.: Drgania mechaniczne, rozwiązywanie zagadnień z MATHCAD-em, WNT, Warsaw 2004

COMPLEMENTARY LITERATURE:

1. Wilmański, K.: Building dynamics – notes for lectures, compilation at www.mech-wilmanski.de.

SYLLABUS PREPARED BY

Tomasz Socha, Ph.D. Eng.