GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Structural dynamics, PG_00041521		
Field of study	Civil Engineering		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Optional subject group
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Katedra Wytrzymałości Materiałów -> Faculty of Civil and Environmental Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Tomasz Ferenc	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	0.0	0.0	0.0	45

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	45	5.0	25.0	75

Subject objectives

The aim of the course is to solve the problems of Structural Dynamics using discrete models with one and n degrees of freedom.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W03] has knowledge of Continuum Mechanics, knows rules of static analysis, stability and dynamics of complex rod, shell and volume structures, both in linear and basic nonlinear regime	The student designs simple engineering structures including vibrations forced by initial conditions and harmonic excitations.	[SW1] Assessment of factual knowledge
[K7_U01] can evaluate and list any loads acting on constructions	Student can assess and compute external load that can act on analyzed structure	[SU1] Assessment of task fulfilment
[K7_U08] Is able to evaluate technical conditio of a road, to design its pavement and choose proper construction technology using mechanistic methods and material investigations	Student can conduct experiment that allow to obtain properties of studied material	[SU1] Assessment of task fulfilment
[K7_U09] is able to design railway tracks of complex geometry on sections and stations, both newly designed and renovated; can make a plan and perform diagnostic of railway track and to interpret its results, propose conclusions; can evaluate durability and reliability of railroad elements	Student can plan and conduct experimental dynamic analysis which allow to asses mode shapes and corresponding natural frequencies	[SU1] Assessment of task fulfilment
[K7_U03] can perform classic statical and dynamical analysis of rod structures stability (trusses, frames and ties), both statically determined and undetermined as well as surface structures (plates, membranes and shells)	Student builds a dynamic model of frame and truss systems. It determines the stiffness and flexibility matrix of the system. It determines the frequency of natural vibration of frame and truss structures.	[SU1] Assessment of task fulfilment

Subject contents	Introduction. Basic definitions. Modelling of dynamic systems Basic dynamics laws. Forces in dynamic systems. Equation of motion. Introduction to MATLAB Free undamped (natural) vibrations of 1-DOF systems Free damped vibrations of 1-DOF systems Forced vibrations of 1-DOF systems: harmonic loading Forced vibrations of 1-DOF systems: periodic and impulse loading Forced vibrations of 1-DOF systems: arbitrary loading Design of 1-DOF system under dynamic loading Free undamped (natural) vibrations of N-DOF systems Free damped vibration of N-DOF systems. Forced vibrations of N-DOF systems Vibration measurement technology. Vibrations reduction systems in engineering structures Experimental dynamic analysis Introduction. Basic definitions. Modelling of dynamic systems
Prerequisites and co-requisites	Determination of internal forces in statically determinate structures (beams, frames, trusses, mixed frame-truss schemes)Determination of internal forces in statically indeterminate structures (beams, frames, trusses, mixed frame-truss schemes using the force method or the displacement (stiffness) methodDetermination of displacements using principle of virtual workDetermination of geometric properties of area (centroid, moment of inertia)Determination of stresses and strains (in bending) Matrix analysis of structures (stiffness matrix, flexibility matrix)Programming in MATLAB/FreeMat
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Test	60.0%	100.0%

Recommended reading	Basic literature	Chopra A.K.: Dynamics of structures. Upper Saddle River, New Jersey: Prentice Hall 2001 Rucka M., Wilde K.: Dynamika Budowli z przykładami w środowisku Matlab. Wydawnictwo Politechniki Gdańskiej, Gdańsk 2008 Branicki C., Wizmur M.: Metody macierzowe w mechanice budowli i dynamika budowli. Wydawnictwo Politechniki Gdańskiej. Gdańsk 1980 Chmielewski T., Zembaty Z.: Podstawy dynamiki budowli. Arkady, 1998 Lewandowski R.: Dynamika konstrukcji budowlanych. Wydawnictwo Politechniki Poznańskiej 2006
	Supplementary literature	Clough R.W., Penzien J.: Dynamics of structures. McGraw-Hill Inc. 1993 Śliwiński A.: Ultradźwięki i ich zastosowania. Wydawnictwa Naukowo-Techniczne Warszawa 2001 Kucharski T.: Systemy pomiarów drgań mechanicznych. Wydawnictwa Naukowo-Techniczne Warszawa 200
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Determine the natural frequency of a frame system with one dynamic degree of freedom. Determine the damping ratio based on the measured displacement of free vibrations. Determine the frequencies and mode shapes of the frame system with n-dynamic degrees of freedom.	
Work placement	Not applicable	

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