



Subject card

Subject name and code	Diagnostics and strengthening of engineering structures, PG_00044258						
Field of study	Civil Engineering						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2024/2025		
Education level	first-cycle studies		Subject group		Optional subject group		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	4		Language of instruction		Polish		
Semester of study	7		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		prof. dr hab. inż. Magdalena Rucka				
	Teachers		prof. dr hab. inż. Magdalena Rucka				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	E-learning hours included: 0.0						
	Address on the e-learning platform: https://enauczanie.pg.edu.pl/moodle/course/view.php?id=14578						
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	30		5.0		40.0	75
Subject objectives	Student gains the basic knowledge about diagnosis and strengthening of civil engineering structures.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_K05] can work on his own and in a team to solve a problem		Student can communicate with other students to distribute the tasks to work out the final presentation on the given topic related to damage, diagnostics or strengthening of engineering structure.		[SK4] Assessment of communication skills, including language correctness [SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills		
	[K6_U17] has specialized skills in civil engineering within offered specialization		Student can perform basic diagnostics of elements of civil engineering structures using GPR method, ultrasonic methods and vibration-based methods.		[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task		
	[K6_U02] is able to define basic calculation models used in computer calculations		Student can define a model of a structure for general numerical strength analysis and dynamic analysis.		[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task		
	[K6_W16] Has deeper and adequate knowledge of civil engineering, within offered specialization		Student can describe a type of the given civil engineering structure and can select the diagnostic method that can be used for condition assessment of steel and concrete structural elements.		[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects		

Subject contents	Lecture: Damage of structures. Methods of diagnostics for civil engineering structures. Structure health monitoring systems for civil engineering objects. Diagnostics based on vibrations. Experimental modal analysis. Diagnostics with the use of ground penetration radar method. Diagnostics of concrete and steel elements with the use of ultrasonic waves. Methods of strengthening of engineering structures. Examples of the condition assessment, strengthening and modernization of building objects. Laboratory: Diagnostic tests using ground penetration radar method. Diagnostic tests using vibrations. Diagnostic tests of concrete structures using ultrasonic waves. using vibrations. Diagnostic tests of steel structures using ultrasonic waves. Strengthening of engineering structures - experimental and computational case study.		
Prerequisites and co-requisites	Courses: Engineering Mechanic, Strength of Materials, Structural Analysis, Structural Dynamics and Computational Methods should be completed.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	project	60.0%	20.0%
	report from laboratory tests	60.0%	60.0%
	presentation	60.0%	20.0%
Recommended reading	Basic literature	<ol style="list-style-type: none">1. Bień J.: Uszkodzenia i diagnostyka obiektów mostowych. Wydawnictwa Komunikacji i Łączności, Warszawa, 2010.2. Drobiec Ł., Jasiński R., Piekarczyk A.: Diagnostyka konstrukcji żelbetowych. Metodologia, badania polowe. Badania laboratoryjne betonu i stali. Wydawnictwo Naukowe PWN, Warszawa, 2010.3. Masłowski E., Spiżewska D.: Wzmacnianie konstrukcji budowlanych. Arkady, Warszawa, 2000.4. Rucka M.: Wave Propagation in Structures. Modelling, Experimental Studies and Application to Damage Detection. Wydawnictwo Politechniki Gdańskiej, 20115. Rucka M., Wilde K.: Dynamika Budowli z przykładami w środowisku Matlab®. Wydawnictwo Politechniki Gdańskiej, Gdańsk 2008.6. Runkiewicz L.: Wzmacnianie konstrukcji żelbetowych. Poradnik. Instytut Techniki Budowlanej, Warszawa, 2011.7. Śliwiński A.: Ultradźwięki i ich zastosowania. Wydawnictwa Naukowo-Techniczne Warszawa 2001.	
	Supplementary literature	<ol style="list-style-type: none">1. Papers from international journals related to diagnostics of civil structures.2. Kucharski T.: Systemy pomiarów drgań mechanicznych. Wydawnictwa Naukowo-Techniczne Warszawa 2002.3. Rucka M., Wilde K.: Application of Wavelet Analysis in Damage Detection and Localization. Wydawnictwo Politechniki Gdańskiej, 2007.4. Zybura A., Jaśniok M., Jaśniok T.: Diagnostyka konstrukcji żelbetowych. Badania korozji zbrojenia i właściwości ochronnych betonu. Wydawnictwo Naukowe PWN, Warszawa, 2011.	
	eResources addresses	Adresy na platformie eNauczanie:	
	Example issues/ example questions/ tasks being completed	Identify the damage in the examined structure on the basis of results of ultrasonic testing. Deliver a presentation related to defects, diagnostics or strengthening of structures or their components.	
Work placement	Not applicable		

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