



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 2020	Academic year of realisation of subject			2023/2024		
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						
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_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.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
		[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.			[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		
		[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.			[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment		
		[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.			[SK1] Assessment of group work skills [SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness		

Subject contents	<p>Lecture:</p> <p>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.</p> <p>Laboratory:</p> <p>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.</p>														
Prerequisites and co-requisites	Courses: Engineering Mechanic, Strength of Materials, Structural Analysis, Structural Dynamics and Computational Methods should be completed.														
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="453 763 794 797">Subject passing criteria</th> <th data-bbox="794 763 1139 797">Passing threshold</th> <th data-bbox="1139 763 1492 797">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="453 797 794 831">presentation</td> <td data-bbox="794 797 1139 831">60.0%</td> <td data-bbox="1139 797 1492 831">20.0%</td> </tr> <tr> <td data-bbox="453 831 794 864">report from laboratory tests</td> <td data-bbox="794 831 1139 864">60.0%</td> <td data-bbox="1139 831 1492 864">60.0%</td> </tr> <tr> <td data-bbox="453 864 794 898">project</td> <td data-bbox="794 864 1139 898">60.0%</td> <td data-bbox="1139 864 1492 898">20.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	presentation	60.0%	20.0%	report from laboratory tests	60.0%	60.0%	project	60.0%	20.0%
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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 żelbetonowych. 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, 2011 5. Rucka M., Wilde K.: Dynamika Budowli z przykładami w środowisku Matlab®. Wydawnictwo Politechniki Gdańskiej, Gdańsk 2008. 6. Runkiewicz L.: Wzmacnianie konstrukcji żelbetonowych. 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 żelbetonowych. 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	<p>Identify the damage in the examined structure on the basis of results of ultrasonic testing.</p> <p>Deliver a presentation related to defects, diagnostics or strengthening of structures or their components.</p>														
Work placement	Not applicable														