GDAŃSK UNIVERSITY OF TECHNOLOGY

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 knowlege 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	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
presentation	60.0%	20.0%
report from laboratory tests	60.0%	60.0%
project	60.0%	20.0%

Recommended reading

Basic literature	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, 2011 5. 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	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