



Subject card

Subject name and code	, PG_00070574						
Field of study	Civil Engineering						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2025/2026		
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	8	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Mechanics of Materials and Structures -> Faculty of Civil and Environmental Engineering -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Magdalena Rucka					
	Teachers	prof. dr hab. inż. Magdalena Rucka dr inż. Erwin Wojtczak Tomasz Ciborowski Błażej Woźny					
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	10.0	20.0	0.0	0.0	0.0	30
	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	30	0.0		0.0		30
Subject objectives	<ul style="list-style-type: none">• Acquisition of knowledge in the field of diagnostic methods for building materials and structures.• Ability to interpret diagnostic test results.• Ability to assess the stiffness of a structural element based on deflection and vibration measurements.• Ability to locate damage using non-destructive methods.• Developing engineering competences in the field of preparing technical diagnostics opinions.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U05] Conducts research (obtaining information, simulations, experimental methods) in the field of construction in order to solve specific tasks and report research results.	The student is able to design and conduct diagnostic investigations of structural elements (deflection measurements, dynamic analysis, non-destructive testing), analyse the obtained results, and prepare a technical report including interpretation of structural condition and engineering conclusions.	[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
	[K6_W03] Demonstrate knowledge and understanding of the processes, established standards and design methods in the civil engineering subject area and of their limitations.	The student demonstrates knowledge of degradation mechanisms of construction materials, principles of structural stiffness and load-bearing capacity assessment, and understands the limitations of standard design codes in the context of existing structures diagnostics.	[SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects
	[K6_K01] Is aware of the key aspects of professional, ethical and social responsibility related to management, business operation, decision making and opinion formulation in civil engineering.	The student understands the professional responsibility of an engineer in assessing structural safety and making decisions regarding their use.	[SK5] Assessment of ability to solve problems that arise in practice
	[K6_K04] Engages in independent lifelong learning and individually follows the development of science and technology in the field of civil engineering.	The student demonstrates readiness for independent learning and continuous professional development in modern diagnostic methods and structural strengthening technologies.	[SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills
	[K6_K03] Can effectively, clearly and unambiguously convey information, describe activities and communicate their results/ outcomes to engineers or a wider audience using appropriate communication methods and tools.	The student is able to clearly and effectively present diagnostic results and formulate technical conclusions in the form of reports, presentations and expert opinions.	[SK2] Assessment of progress of work [SK3] Assessment of ability to organize work [SK4] Assessment of communication skills, including language correctness
Subject contents	<p>Course content – lecture Material damage, structural damage. Diagnostic methods in civil engineering. Assessment of element stiffness based on deflection measurements. Diagnostics based on structural vibrations. Diagnostics using ground-penetrating radar. Thermographic diagnostics. Ultrasonic diagnostics of metal and concrete structures.</p> <p>Course content – exercises</p> <ul style="list-style-type: none"> Diagnostic testing using thermography. Diagnostics of structural damage using structural vibrations. Ultrasonic diagnostics of metals. Ultrasonic diagnostics of concrete. Assessment of reinforced concrete beam stiffness based on deflection measurements (identification of the cracking mechanism of reinforced concrete beams, design and execution of reinforcement of cracked elements, experimental verification of the effectiveness of reinforced concrete beam reinforcement in bending tests). Structural diagnostics using ground-penetrating radar. 		
Prerequisites and co-requisites	<p>The student should have:</p> <ul style="list-style-type: none"> fundamental knowledge of structural mechanics and strength of materials, understanding of reinforced concrete and steel structural design principles, ability to analyse structural systems and determine internal forces and deflections, basic knowledge of concrete technology and structural steel properties, ability to perform basic engineering calculations. <p>Additional requirements:</p> <ul style="list-style-type: none"> is interested in structural diagnostics and condition assessment, is able to work effectively in a laboratory team environment, is willing to analyse experimental results and formulate engineering conclusions, has basic skills in using spreadsheets and programming environment for data processing and analysis. 		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	test	60.0%	30.0%
	laboratory exercise report	60.0%	70.0%

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, 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	<ol style="list-style-type: none"> 1. Articles from specialist journals on diagnostics and technical condition assessment. 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	
Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none"> • Explain the difference between material damage and structural damage. Why is this distinction crucial in diagnostics? • How is the stiffness of a structural element assessed on the basis of deflection measurements? What diagnostic information can be obtained in this way? • Why can a change in the natural frequency of a structure indicate damage? What are the limitations of this method? • Compare non-destructive and destructive methods. In what order should they be used in engineering practice? • What factors can cause an increase in the deflection of a structural element without significant material degradation? 	
Practical activities within the subject	Not applicable	

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