



## Subject card

Subject name and code	Mechanical Methods of Materials Testing, PG_00039819						
Field of study	Materials Engineering, Materials Engineering, Materials Engineering						
Date of commencement of studies	October 2021		Academic year of realisation of subject		2023/2024		
Education level	first-cycle studies		Subject group		Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	3		Language of instruction		Polish		
Semester of study	6		ECTS credits		1.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Mechanics and Mechatronics -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Alicja Stanisławska				
	Teachers		dr inż. Alicja Stanisławska				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	15.0	0.0	0.0	15
	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	15		1.0		9.0	25
Subject objectives	The aim of the course is to present the methods applied for testing of mechanical properties of different types of materials.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K6_W04		The student learns the mode of operation and construction of: nanoindenter, Vickers, Rockwell, Brinell hardness testers and a drop hammer		[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge		
	K6_K01				[SK5] Assessment of ability to solve problems that arise in practice		
	K6_U02		The student learns how to operate a nanoindenter, hardness testers and a drop hammer and is able to analyze the results obtained during the research.		[SU4] Assessment of ability to use methods and tools		
Subject contents	Determination of hardness and reduced Young's modulus, plastic and elastic work during the nanoindentation test.  Determining the type and amount of residual stresses in the material.  Fracture mechanics. Determination of the stress intensity factor.  Testing the deformation velocity during material creep.  Brinell, Rockwell and Vickers hardness testing.  Impact resistance test of metals with an oxide layer.						

Prerequisites and co-requisites	Knowledge of mechanics, materials science and strength of materials		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Colloquium	55.0%	100.0%
Recommended reading	Basic literature	[1] Bachmacz W.: Wytrzymałość materiałów. Badania doświadczalne. Skrypt Politechniki Częstochowskiej, Częstochowa 1973.  [2] Banasik M.: Ćwiczenia laboratoryjne z wytrzymałości materiałów. PWN, Warszawa 1977.  [3] Boruszak A., Sykulski R., Wrześniowski K.: Wytrzymałość materiałów. Doświadczalne metody badań. Wydawnictwo Politechniki Poznańskiej, Poznań 1977.  [4] Dyląg Z., Orłóś Z.: Wytrzymałość zmęczeniowa materiałów. Warszawa. WNT 1962.  [5] Jastrzębski P., Mutermilch J., Orłóś W.: Wytrzymałość materiałów. Warszawa. Arkady 1985.  [6] Katarzyński S., Kocańda S., Zakrzewski M.: Badania właściwości mechanicznych metali. WNT, Warszawa 1967.  [7] Łączkowski R.: Wytrzymałość materiałów. Gdańsk. WPG 1988.  [8] Mazurkiewicz S.: Laboratorium z wytrzymałości materiałów. Wydawnictwo Politechniki Krakowskiej, Kraków 1978.  [9] Niezgodziński M.E., Niezgodziński T.: Wzory wykresy i tablice wytrzymałościowe. Warszawa. WNT 1996.  [10] Orłóś Z.: Doświadczalna analiza odkształceń i naprężeń. PWN, Warszawa 1977.  [11] Walczyk Z.: Wytrzymałość materiałów. Gdańsk. WPG 1998.	
	Supplementary literature	Standards of PKN	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1. What does the area under the loading-unloading curve mean in the diagram force versus displacement indenter?  2. What sign / character are the residual stresses in the material if in the nanoindentation measurement after in stress relief annealing, the maximum force is greater than the maximum force for the material before stress relief annealing (with the same indenter displacement)?  3. How can be determined, the critical stress intensity factor in the nanoindentation test?  4. How can be determined, the creep speed of a material in the nanoindentation test?  5. What is the measure of hardness in the Rockwell and Vickers methods?  6. Draw a graph of force versus displacement during the impact test for material that shows elastic properties.		
Work placement	Not applicable		