



## Subject card

Subject name and code	, PG_00058719						
Field of study	Materials Engineering, Materials Engineering						
Date of commencement of studies	February 2024		Academic year of realisation of subject			2024/2025	
Education level	second-cycle studies		Subject group			Optional subject group 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	1		Language of instruction			Polish	
Semester of study	2		ECTS credits			2.0	
Learning profile	general academic profile		Assessment form			exam	
Conducting unit	Department of Materials Engineering and Bonding -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Michał Landowski				
	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						
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		15.0	50
Subject objectives	Student learns basic techniques for the preparation of metal composites, and polymer matrix. Discussed techniques for the production of laminates and the impact of technology on the durability of a composite structure.Designs and makes a laminate of available materials. Selects laminate aging parameters to determine the resistance of the laminate to the environment. Performs, in practice, strength tests, three-point bending and a test of falling mass. Learns the methods of testing the properties of composite materials.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	K7_W04	The student is able to prepare a metallographic sample, is able to recognize technological defects during macro and microscopic examinations. Compares the durability of two different laminates (different type of matrix, the effect of additives to the matrix or the type and arrangement of the reinforcement) aged in an aqueous environment.	[SW3] Assessment of knowledge contained in written work and projects
	K7_K02	The student is able to determine the durability of structural elements made of composite materials. The student consciously chooses ways to increase the durability of elements working in a given environment.	[SK5] Assessment of ability to solve problems that arise in practice
	K7_U04	The student is able to determine the reasons for the reduction of the mechanical properties of the laminate on the basis of strength tests and microscopic tests.	[SU4] Assessment of ability to use methods and tools
	K7_U01	The student is able to use literature databases and obtain information necessary to complete the task.	[SU3] Assessment of ability to use knowledge gained from the subject
	K7_W05	The student is able to use technical drawing, knows the basic techniques of laminate production. Can determine the appropriate parameters of the composite manufacturing process.	[SW1] Assessment of factual knowledge
Subject contents	<p>Lecture: Technologies of composite materials production. Basics of making reinforcements and their types. The effect of the type of reinforcement placement on the mechanical properties of the composite. Laminating methods - manual, RTM, autoclave, vacuum bag and infusion. Environmental durability of laminates. Basic application areas. Advantages and disadvantages of manufacturing methods. Examples of products.</p> <p>Laboratory: 1. Preparation of laminate production (preparation of a plate for further testing). 2. Analysis of technological defects of the laminate - selection of samples for testing. 3. Resistance of gel coat systems to water environment. 4. Programming and selection of parameters of the aging process in a climatic chamber. 5. Test of the strength of laminates. 6. Survey of impact resistance of laminates. 7. Microscopic examination..</p>		
Prerequisites and co-requisites	<p>The student should have basic knowledge in the field of materials science, strength tests and experiment planning.</p>		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		50.0%	40.0%
		50.0%	60.0%
Recommended reading	Basic literature	<p>A. Boczkowska, J. Kapuściński, Z. Linderman, D. Witemberg-Perzyk, S. Wojciechowski : Kompozyty. PW 2003.</p> <p>W. Królikowski, Polimerowe kompozyty konstrukcyjne, PWN 2012</p> <p>4. J. Sobczak, Kompozyty metalowe, 2002</p> <p>K. Imielińska, G.C. Papanicolaou, Wprowadzenie do nauki o materiałach kompozytowych Kompozyty polimerowe, Wybrane zagadnienia, Skrypt PG, Gdańsk 1998.</p> <p>F.L. Matthews, R.D. Rawlings, Composite Materials. 2008</p>	

	Supplementary literature	Dobrzański L.A.: Podstawy nauki o materiałach i metaloznawstwo. WNT, Warszawa, 2002.  M. Reyne, Composite solutions , JEC Group 2006
	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	Techniques for producing laminates, durability of composite materials, methods of modeling the properties of composite materials, material testing methods for composite materials, factors affecting the formation of technological defects, impact resistance of laminates	
Work placement	Not applicable	

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