GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00065678		
Field of study	Mechanical Engineering		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	
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	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Institute of Manufacturing and Materials Technology -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Bogdan Ścibiorski	
	Teachers	dr inż. Bogdan Ścibiorski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	20.0	0.0	30.0	0.0	0.0	50
	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	50	20.0	30.0	100

Subject objectives	The goal of this course is to deepen students knowledge of designing and analyzing the mechanical properties of composite materials, with particular emphasis on their structure, manufacturing processes, and strength assessment. Students will learn testing methods and how to interpret the results of mechanical tests on composites, enabling effective engineering design of components while taking into account strength, economic, and environmental criteria.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K03] understands the importance of the necessity of solving dilemmas connected with practicing a profession and providing safe working conditions in manufacturing processes and in operation of machines and devices	The student identifies potential hazards associated with manufacturing and using composite materials (e.g., dust, resins, fibers). The student is familiar with basic health and safety procedures when designing and manufacturing composite components.	[SK5] Assessment of ability to solve problems that arise in practice
[K7_K01] is aware of the need for complementing the knowledge throughout the whole life, is able to select proper methods of teaching and learning	The student understands the evolving nature of composite technologies and the necessity of continuously monitoring new developments.The student can use available sources (standards, scientific publications, patent databases) to constantly broaden competencies and share them with others.	[SK5] Assessment of ability to solve problems that arise in practice
[K7_W11] possesses organized knowledge useful in understanding ex-technical conditioning connected with performing the profession of an engineer and taking it into consideration in engineering practice; possesses well-established knowledge within the range of intellectual property, management and organization of manufacturing processes, including the management and life-cycle of a product	1. The student knows detailed principles for selecting types of fibers and resins in composites based on strength requirements and operating conditions. The student understands the methodology of conducting strength tests (including tensile, compression, and bending) for composites.	[SW3] Assessment of knowledge contained in written work and projects
[K7_W04] possesses specialized knowledge on design, construction, properties and testing methods of construction materials	The student knows the detailed principles of selecting types of fibers and resins in composites based on strength requirements and operating conditions. The student understands the methodology for conducting strength tests (including tensile, compression, and bending tests) of composites	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

The course provides an introduction to composite materials, including their types and characteristics, with a focus on fiber-reinforced composites. It will cover the mechanical properties of composite materials, such as tensile strength, compressive strength, shear strength, elasticity, hardness, and fatigue strength. Methods for testing these mechanical propertiestensile, compression, bending, and impact testswill be presented, with particular emphasis on procedures specific to composites. The course will also address damage mechanisms in composite materials, such as delamination and fiber cracking. Finally, case studies of the application of composite materials in the automotive industry will be presented.

The practical sessions include examining the mechanical properties of composite materials using standard testing proceduresspecifically, tensile strength tests. The test results will be analyzed and compared with data from the literature, providing a deeper understanding of the theoretical underpinnings of the course content.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Written documents (e.g., reports, presentations) documenting the results of analyses, simulations, and conclusions	60.0%	50.0%
discussion	60.0%	50.0%

<table>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Robert M. Jones - Mechanics of composite materials

J.L. Clarke - Structural Design of Polymer Composites

A.Petras, M.P.F Sutcliffe - Failure mode maps for honeycomb sandwich panels

ISO 527, ISO 14126, ISO 14129, ISO 14130, ISO 2818</td></tr>
<tr><td>Supplementary literature</td><td>Timoshenko, S. P., & Gere, J. M. (1972). Mechanics of Materials. Van Nostrand Reinhold.

Hibbeler, R. C. (2013). Mechanics of Materials. Pearson.</td></tr>
<tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Introduction to Composite Materials

• definition, classification, examples of engineering composites
• fiber-reinforced composites types of fibers, matrices, selection principles

Mechanical Properties of Composite Materials

• tensile strength, compressive strength, shear strength
• elastic modulus, hardness, fatigue strength
• factors influencing properties (ratio of components, fiber orientation, bonding quality)

Methods of Testing Mechanical Properties

• tensile, compression, bending, and impact tests
• standard norms (ASTM, ISO) and specific procedures for composites
• analysis of test results, interpretation, and comparison with literature data

Damage Mechanisms in Composites

• delamination, fiber cracking, crack propagation mechanisms
• modeling and diagnosing damage

Applications of Composites in Industry

• case studies in the automotive and aerospace industries
• material selection criteria: cost, weight, strength, safety

Practical Sessions (Laboratories/Projects)

• measuring the mechanical properties of composites (tensile testing, result analysis)
• comparison with catalog and literature data, drawing design conclusions</td></tr>
<tr><td>Work placement</td><td colspan="2">Not applicable</td></tr>
</table>

Document generated electronically. Does not require a seal or signature.