GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00065831		
Field of study	Materials Engineering		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Specialty 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	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of New Functional Materials For Energy Conversion -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Beata Bochentyn	
	Teachers	dr hab. inż. Beata Bochentyn	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	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	5.0	40.0	75

Subject objectives

The aim of the course is to provide students with a broad knowledge of advanced engineering composites and their applications in key sectors such as energy, construction and transport. The student will learn the influence of material parameters on individual properties of composite materials and will learn to predict and describe them. Then, the student will become familiar with the possibilities and limitations of composite materials in specific application areas (e.g. wind energy, nuclear energy, thermoelectric generators, electrochemical energy conversion devices, etc.).

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U06] Can evaluate usefulness and feasibility of using new achievements (techniques and technologies) within the scope of materials science.	Can critically search for information on composite materials in terms of specific applications. Can justify their choices based on substantive information.	[SU2] Assessment of ability to analyse information [SU5] Assessment of ability to present the results of task
[K7_W01] Has extended knowledge of the fields of science and scientific disciplines relevant to materials engineering, and their historical development and importance for the progress of exact and natural sciences, knowledge of the world and evolution of humanity.	Has extended knowledge of the properties and manufacturing techniques of composite materials and understands their development over the years to contemporary applications in energy, construction and transport.	[SW1] Assessment of factual knowledge
[K7_K02] Is aware of the importance of non-technical aspects and effects of engineering, including the influence on the environment and resulting responsibility for the decisions.	Can propose using specific types of composite materials, including those used in ecological energy sources, low-emission transport, and energy-efficient construction. Knows also the process of recycling composite materials.	[SK5] Assessment of ability to solve problems that arise in practice [SK4] Assessment of communication skills, including language correctness [SK1] Assessment of group work skills

<table>
<tr><td>Subject contents</td><td>Course content – lecture

1. Introduction to composite materials - definition, classification, properties2. Material properties of composites (mechanical, thermal, electrical)3. Percolation theory for describing the properties of composite materials4. Influence of the matrix/reinforcement interface on the properties of composite materialModern structural composites supporting energy conversion processes:5. Composite thermoelectric materials6. Composites with catalytically active nanoparticles for electrochemical processes7. Composites with carbon fibers8. NanocompositesSelected industrial applications of composite materials:9. Composites for energy-efficient construction10. Composites for wind turbines11. Composites in nuclear power12. Composites for the aviation industry13. Recycling of composite materials</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Knowledge of the basics of physics and materials engineering. Composite materials course recommended for first-cycle studies.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written exam</td><td>50.0%</td><td>70.0%</td></tr>
<tr><td>Group study on selected composites</td><td>50.0%</td><td>30.0%</td></tr>
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<tr><td>Recommended reading</td><td><table>
<tr><td>Basic literature</td><td>William D. Caliser, Materials Science and Engineering. Introduction, Willey.

T.Trzepieciński, Application of Composite Materials for Energy Generation Devices, Journal of Composites Science 7. 55. 10.3390/ jcs7020055.</td></tr>
<tr><td>Supplementary literature</td><td>Ross Harnden, David Carlstedt, Dan Zenkert*, and Göran Lindbergh, Multifunctional Carbon Fiber Composites: A Structural, Energy Harvesting, Strain-Sensing Material, ACS Appl. Mater. Interfaces 2022, 14, 29, 3387133880</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Propose a type of composite (example component materials and structural form of reinforcement) that is currently used as a material for the skin of a passenger plane.Provide and describe industrial methods of manufacturing fiber-reinforced composites.How does fiber orientation affect the mechanical properties of fiber-reinforced composites?</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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