



## Subject card

Subject name and code	Materials science, PG_00055864						
Field of study	Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	October 2023	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	1	Language of instruction				Polish	
Semester of study	1	ECTS credits				3.0	
Learning profile	general academic profile	Assessment form				assessment	
Conducting unit	Department of Materials Engineering and Bonding -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Jerzy Łabanowski					
	Teachers	dr inż. Beata Majkowska-Marzec dr inż. Magda Rościszewska dr hab. inż. Agnieszka Ossowska prof. dr hab. inż. Jerzy Łabanowski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	0.0	45
	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	45		3.0		27.0	75
Subject objectives	The aim of this course is to provide students with the knowledge in the field of materials science and materials technologies necessary for an engineer with a specialization in Power Engineering						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U01] can obtain information from literature and other sources, organize, interpret it and draw and formulate conclusions; has the ability to self-educate, interprets the results of completed engineering tasks, is able to design simple energy systems and their systems	Student can choose the right materials for applications in the power industry. He knows the differences in their properties and processing methods			[SU3] Assessment of ability to use knowledge gained from the subject		
	[K6_W04] has structured knowledge of mechanics, including the issues of material strength and general principles of shaping structures, necessary to conduct basic strength analyzes and design simple mechanical or construction systems for power industry or environmental engineering; knows the basics of machine construction and the most commonly used construction and operating materials	The student has a knowledge of the materials science of iron and its alloys, non-ferrous metals, polymeric and ceramic materials necessary for an engineer with a specialization in Power Engineering. He knows the basic material technologies.			[SW1] Assessment of factual knowledge		

Subject contents	<p><b>COURSE CONTENT</b> The structure of materials. Characteristics of the major groups of materials. Metals. Ceramic materials. Polymers. Composite materials. Rules for the selection of engineering materials. Crystalline structure of materials. Defects in the crystal structure. Polymorphism. Crystallization of metals and alloys. Mechanical properties of materials. Methods of testing materials. Working conditions and wear mechanisms of engineering materials. Alloys. Strengthening of metals and alloys, phase transformations. Phase equilibrium systems. Transformations in the solid state. System phase equilibrium iron-carbon. The division and classification of steel. Structural steels. Steels with special properties - corrosion resistant, heat resistant and creep resistant. Casting alloys. Cast steel and cast iron. Technological methods for structure and mechanical properties modeling. Plastic processing, thermal and thermo-chemical treatment. Annealing, hardening, carburizing, nitriding. Technical non-ferrous alloys. Copper and its alloys. Light metals and their alloys. Metallic materials for power plant industry. Ceramics and glass. Properties of ceramic materials. Methods of manufacture and shaping of ceramic materials. Polymeric materials. Structure of polymers. Thermoplastic polymers. Thermosetting polymers. Elastomers. Processing of polymers. Properties of polymers. Composite materials.</p> <p><b>LABORATORY PRACTICAL TRAINING</b> Practical metallography. Cold plastic processing and recrystallization of metals. Phases and structural components of alloys of iron - coal system. Iron foundry alloys. Alloy and non-alloyed steels. Hardening and tempering heat treatment.</p>														
Prerequisites and co-requisites	Not required														
Assessment methods and criteria	<table border="1" data-bbox="451 656 1487 790"> <thead> <tr> <th data-bbox="451 656 798 689">Subject passing criteria</th> <th data-bbox="805 656 1141 689">Passing threshold</th> <th data-bbox="1149 656 1487 689">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 689 798 723">pass tests in the laboratory</td> <td data-bbox="805 689 1141 723">100.0%</td> <td data-bbox="1149 689 1487 723">20.0%</td> </tr> <tr> <td data-bbox="451 723 798 757">written exam</td> <td data-bbox="805 723 1141 757">50.0%</td> <td data-bbox="1149 723 1487 757">60.0%</td> </tr> <tr> <td data-bbox="451 757 798 790">laboratory reports</td> <td data-bbox="805 757 1141 790">100.0%</td> <td data-bbox="1149 757 1487 790">20.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	pass tests in the laboratory	100.0%	20.0%	written exam	50.0%	60.0%	laboratory reports	100.0%	20.0%
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Example issues/  
example questions/  
tasks being completed

Give the characteristics of metals and metal alloys .

Give the characteristics of polymers.

What are composites ?

Explain the phenomenon of polymorphism .

What allotropic varieties have iron ?

What are defects in the crystal structure ?

The principle of measuring the hardness of the method : a - Vickers , b - Rockwell , c - Brinell

Explain the Charpy impact test method .

What is a hot forming of metals?

Draw the system Fe - Fe<sub>3</sub>C with description

What are the advantages and disadvantages of gray cast iron ?

Give the definition of steel and cast steel.

How the carbon affects the mechanical properties of steels ?

What determines the corrosion resistance of steel ?

What is heat resistance and creep resistance of steel ?

Alloys designed to work at elevated temperatures -

Describe structural steels

Describe stainless steels

Explain annealing heat treatment.

What is the hardening of steel ?

Explain thermo-chemical heat treatment carburizing of steel

Explain thermo-chemical heat treatment nitriding of steel

Give the definitions of basic copper alloys.

Characteristics of aluminum wrought and cast alloys.

Characteristics of polymers

	What are elastomers .  What are plastomers .  Enter the properties and methods of the processing of thermopl
Work placement	Not applicable

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