



Subject card

Subject name and code	Materials Science, PG_00072239						
Field of study	Mechanical Engineering						
Date of commencement of studies	October 2026		Academic year of realisation of subject		2026/2027		
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 nd		
Semester of study	1		ECTS credits		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Division of Materials Science and Technology -> Institute of Manufacturing and Materials Technology -> Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Krzysztof Krzysztofowicz				
	Teachers		dr inż. Krzysztof Krzysztofowicz				
			dr inż. Artur Sitko				
			dr hab. inż. Agnieszka Ossowska				
			dr inż. Magdalena Jażdżewska				
Lesson types			dr inż. Grzegorz Gajowiec				
			dr inż. Beata Majkowska-Marzec				
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	75	5.0		45.0		125
	Subject objectives						
	Acquainting with the basic concepts of materials science as well as the constitution and application of construction materials						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W03] possesses structured and theoretically grounded knowledge of design, manufacturing technologies, metrology, quality control, and operation of machine components and mechanical systems, including technical documentation and the life cycle of engineering objects	The student knows and understands the basic technologies for the production and processing of metallic materials. The student identifies the material based on data from technical documentation. The student understands the impact of service conditions on material behavior	[SW1] Assessment of factual knowledge
	[K6_W02] understands the properties of engineering materials as well as phenomena related to strength of materials and analysis of mechanical structures, including their importance for assessing durability, safety, and reliability of technical solutions	The student understands the basic concepts regarding the properties of metallic materials. The student understands the impact of material properties on the reliability and safety of technical solutions.	[SW1] Assessment of factual knowledge
	[K6_U09] selects engineering materials taking into account operational requirements and conditions for proper functioning of devices	The student is familiar with the basic criteria for material selection. The student explains the impact of operational requirements on material selection. The student understands the influence of the structural material on the proper functioning of the device	[SU3] Assessment of ability to use knowledge gained from the subject
Subject contents	Course content – lecture Lecture Materials and their significance in engineering. Structure of matter. Characteristics of major material groups. General principles for selecting engineering materials in machine design. Crystalline structure of materials. Crystal structure defects. Influence of structural defects on mechanical properties. Polymorphism. Crystallization of metals and alloys. Mechanical properties of materials. Material testing methods. Property anisotropy. Material degradation. Brittle fracture. Material fatigue. High-temperature degradation. Chemical, electrochemical, and biological corrosion. Metal alloys. Strengthening mechanisms for metals and alloys; phase transformations. Phase equilibrium systems. Classification of phase transformations. Solid-state transformations. Iron-carbon phase equilibrium system. Phase and structural constituents of the system. Production of iron and its alloys. Pig iron metallurgy. Steel metallurgy. Steelmaking processes. Cast iron metallurgy. Methods for producing semi-finished and finished products. Classification of steels. Alloy and non-alloy steels. Structural steels. Tool steels. Steels with special properties: corrosion-resistant, heat-resistant, and high-temperature resistant steels. Ferrous casting alloys. Cast steel and cast iron. Standardization, classification, and designation systems for steels and cast irons. Modification of the structure and properties of engineering materials through processing methods. Strain hardening and recrystallization. Heat treatment and thermochemical treatment. Phase transformations during the heating and cooling of iron alloys. TTT (CCT) diagrams. Steel hardenability. Steel annealing, through-hardening and surface hardening, carburizing, nitriding. Industrial non-ferrous metal alloys. Copper and its alloys. Light metals and their alloys. Zinc and its alloys. Bearing alloys. Nickel, titanium, and cobalt alloys. Low-melting-point alloys. Trends in materials development.		
	Course content – laboratory Laboratory Metallography. The Fe-Fe₃C phase equilibrium system. Unalloyed steels in the annealed state. Cast iron alloys. Hardening and tempering. Corrosion-resistant steels. Tool steels. Non-ferrous metal alloys.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture - egamin	50.0%	50.0%
	Laboratory - active participation	50.0%	50.0%
Recommended reading	Basic literature	M. Głowacka A. Zieliński: Podstawy Materiaoznawstwa. WPG Gdańsk 2014 M. Blicharski: Stal WNT Warszawa 2019 K. Przybyłowicz Metaloznawstwo WNT Warszawa 2007 M. Blicharski: Inżynieria powierzchni. WNT Warszawa 2021	

	Supplementary literature	M. Ashby Materiały Inżynierskie t.1 i 2 WNT Warszawa 1995 M. Ashby Inżynieria Materiałowa t. 1 i 2 Galaktyka Łódź 2011
	eResources addresses	
Example issues/ example questions/ tasks being completed	Metal structure. The structure of metals. Crystal networks. Properties of materials. Equilibria systems. Basics of heat treatment.	
Practical activities within the subject	Not applicable	

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