



Subject card

Subject name and code	Materials Science, PG_00072614						
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		English		
Semester of study	1		ECTS credits		5.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Division of Structural Materials Technology and Welding -> 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		prof. dr hab. inż. Dionizy Czekaj				
	Teachers		prof. dr hab. inż. Dionizy Czekaj dr inż. Artur Sitko dr inż. Gabriel Strugała dr inż. Krzysztof Krzysztofowicz				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	45.0	0.0	0.0	75
	E-learning hours included: 0.0						
	eNauczanie source addresses: Moodle ID: 7555 Materials Science, L, MiBM (ang), sem.01, zimowy 26/27 https://enauczanie.pg.edu.pl/2025/course/view.php?id=7555 Moodle ID: 7555 Materials Science, L, MiBM (ang), sem.01, zimowy 26/27 https://enauczanie.pg.edu.pl/2025/course/view.php?id=7555						
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	Introducing students to the fundamentals of contemporary materials science and materials engineering.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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 possesses knowledge regarding the atomic structure of engineering materials, their crystal structure, and the fundamental properties determining strength and reliability.	[SW1] Assessment of factual knowledge
	[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 possesses knowledge regarding engineering material technologies and methods for testing material properties.	[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 able to present the principles of material selection and the appropriate technological process.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
Subject contents	Course content – lecture Classification of materials, advanced materials. Atomic structure; The periodic table of elements; Atomic bonding in solids. Crystal structures - unit cells; crystal systems; close-packed crystal structures; defects and imperfections of crystal structure; Mechanical properties of metals, concepts of stress and strain; elastic deformation; plastic deformation, hardness; Dislocations; slip systems; deformation by twinning; Mechanisms of strengthening in metals; Recovery, recrystallization, and grain growth; Fracture; Fatigue; Creep behaviour; Phase diagrams; definitions and basic concepts; Binary phase diagrams, interpretation of phase diagrams, ceramic and ternary phase diagrams, the Gibbs phase rule; The iron-carbon system - the iron-iron carbide (Fe-Fe₃C) phase diagram, development of microstructure in iron-carbon alloys, Course content – laboratory 1. Introduction. Macroscopic metallographic examination, microscopy, hardness measurement methods 2. Fe-Fe₃C phase equilibrium diagram 3. Non-alloy steels in the annealed state 4. Cast iron alloys 5. Hardening and tempering of non-alloy steels 6. Steel hardenability. Hardness measurements 7. Thermochemical treatment of steel 8. Tool steels 9. Corrosion-resistant steels 10. Copper alloys 11. Aluminum alloys 12. Bearing alloys		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written examination	75.0%	60.0%
	Laboratory	100.0%	40.0%
Recommended reading	Basic literature	1. W. D. Callister, Jr., Materials science and engineering, an introduction, 7th ed., Wiley, 2007, 2. M. Ashby, H. Shercliff and D. Cebon, Materials Engineering, Science, Processing and Design, Elsevier Ltd, 2007 3. M. Ashby, D. Jones, Engineering Materials 1, An Introduction to Properties, Applications, and Design, Elsevier Ltd, 2012 4. W. Bolton, <i>Materials for Engineering</i>, Routledge, Taylor & Francis Group, NY, 2011 5. A.J. Moulson, , J.M. Herbert, Electroceramics, Materials Properties and Applications, Chapman and Hall, 1990 6. R. Pampuch, An Introduction to Ceramics, Springer International Publishing Switzerland, 2014	

	Supplementary literature	1. Blicharski M., <i>Wstęp do inżynierii materiałowej</i>, Wydawnictwo Naukowo Techniczne, Warszawa 2001 2. M. Kaczorowski, A. Krzyńska, <i>Konstrukcyjne materiały metalowe, ceramiczne i kompozytowe</i>, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2017 3. Dobrzański L. A., <i>Podstawy nauki o materiałach i metaloznawstwo. Materiały inżynierskie z podstawami projektowania materiałowego</i> ., WNT Warszawa, 2002 4. M.Ashby, H.Shercliff, D.Cebon, <i>Inżynieria materiałowa</i>, T1, T2, Wydawnictwo Galaktyka, Łódź, 2011 5. M. Ashby, D. Jones, <i>Engineering Materials 2, An Introduction to Microstructures and Processing</i>, Elsevier Ltd, 2013 6. M.Głowacka, A. Zieliński, (Red.) <i>Podstawy materiałoznawstwa</i>, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2011 (skrypt). 7. M. Głowacka (Red), <i>Metaloznawstwo</i>, Wydawnictwo Politechniki Gdańskiej, Gdańsk 1996 (skrypt) 8. J. Hucińska (Red), <i>Metaloznawstwo. Materiały do ćwiczeń laboratoryjnych</i>, Wydawnictwo Politechniki Gdańskiej, Gdańsk 1995(skrypt).
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Definitions of stress, strain and modulus of elasticity. 2. Mechanical properties of materials. 3. Crystal structure of advanced ceramics 4. Phase diagrams	
Practical activities within the subject	Not applicable	

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