GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Construction Materials , PG_00064111		
Field of study	Mechanical and Medical Engineering		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
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	5.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Institute of Manufacturing and Materials Technology -> Faculty of Mechanical Engineering and Ship Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Marek Szkodo	
	Teachers	dr hab. inż. Marek Szkodo dr inż. Magdalena Jażdżewska dr inż. Beata Majkowska-Marzec dr inż. Łukasz Pawłowski dr inż. Magda Rościszewska	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	30.0	0.0	0.0	60

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	60	5.0	60.0	125

Subject objectives

Providing fundamental knowledge in the broadly understood field of materials science. The student learns about the components of matter, chemical bonds, the microstructure of materials, as well as selected material properties and methods of their testing. The individual studying the subject understands the significant importance of phase equilibrium systems on the crystallization processes of alloys and is able to interpret the microstructure using them. The student becomes familiar with material manufacturing technologies, various types of heat treatment, and aspects related to plastic deformation.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U06] can identify and formulate specifications for simple practical engineering tasks, and critically analyze existing technical solutions, evaluating their functionality, particularly in the context of designing mechanical and medical-mechanical devices	The student is able, at a basic level, to select the appropriate material based on technical literature and design its heat treatment according to its working conditions. The student also has fundamental knowledge regarding materials and their manufacturing methods depending on the material's properties or production scale.	[SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information [SU1] Assessment of task fulfilment
[K6_W02] has knowledge of structure, properties, and testing methods of construction materials or knowledge of materials and selected technologies in biomedical engineering	The student is able to independently identify the microstructure of materials covered in the course. The student can relate material properties to its microstructure.	[SW2] Assessment of knowledge contained in presentation

Subject contents	The syllabus includes: Characteristics of engineering materials; Defects and microstructure of materials; Structure of metal alloys; Iron-cementite phase equilibrium system; Mechanical properties of materials; Material manufacturing technologies; Heat treatment of metallic materials; Plastic deformation of metallic materials; Iron alloys; Non-metallic materials; Material degradation.
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
laboratory	100.0%	50.0%
lecture	50.0%	50.0%

Recommended reading

Basic literature	L. Dobrzański: Podstawy nauki o materiałach i metaloznawstwo, WNT, Gliwice-Warszawa, 2002 (i wcześniejsze od 1998).M. Blicharski: Wstęp do inżynierii materiałowej. WNT, W-wa, 1998.M. Ashby, D. Jones: Materiały inżynierskie. Właściwości i zastosowania, WNT, W-wa, 1995.M. Ashby, D. Jones: Materiały inżynierskie. Kształtowanie struktury i właściwości, dobór materiałów. Praca zbiorowa. Metaloznawstwo. Materiały do ćwiczeń laboratoryjnych pod red. Joanny Hucińskiej, Wydawnictwo Politechniki Gdańskiej, Gdańsk, 1995.Praca zbiorowa. Metaloznawstwo pod red. Marii Głowackiej, Wydawnictwo Politechniki Gdańskiej, Gdańsk, 1995.Podstawy Materiałoznawstwa pod red. Marii Głowackiej i Andrzeja Zielińskiego, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2014.M. Blicharski: Inżynieria Materiałowa, WNT, W-wa, 2004.J. Wyrzykowski, E. Pleszakow, J. Sieniawski: Odkształcenie i pękanie metali. WNT, W-wa, 1999.
Supplementary literature	K. Przybyłowicz, J. Przybyłowicz: Materiałoznawstwo w pytaniach i odpowiedziach. WNT, W-wa, 1999.
eResources addresses	Adresy na platformie eNauczanie: Materiały konstrukcyjne, W, L, IMM, I st., sem.1, zimowy 2024/25 - Moodle ID: 41599 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=41599

Example issues/ example questions/ tasks being completed

Draw the unit cell of the A2 (BCC) lattice and mark the <1, 0, 1> plane and the [1, 0, 1] direction on it.

List the types of primary and secondary atomic bonds, and schematically draw an example of a metallic bond.

Using iron as an example, explain the concept of anisotropy and allotropic forms.

List the types of crystal lattice defects and draw a graph showing how their density affects the strength properties of crystals.

What do the following symbols mean: C35, 25CrNi4-4, X5CrNi18-10.

Draw a graph showing how grain size in steel changes during heating and cooling.

Describe the phases in the following equilibrium diagram, provide definitions of the phases present in the diagram, and using the lever rule, calculate: a) The percentage of phases at points A, B, and C. b) Indicate the chemical compositions of the phases present at points A, B, and C. c) Draw a cooling curve for alloy I, and for each segment of this curve, calculate the degrees of freedom, listing the components and phases needed for the calculations.

Provide definitions of the phases present in the Fe-Fe3C system.

Draw a TTT diagram for eutectoid steel, and plot the critical cooling curve and the curve that allows 100% bainitic structure to be obtained.

Describe the principles of hardness testing using the Vickers and Rockwell methods.

Work placement	Not applicable

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