GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Advanced engineering materials, PG_00064783		
Field of study	Mechatronics		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2026/2027
Education level	second-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	2.0
Learning profile	general academic profile	Assessment form	assessment
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. Jerzy Łabanowski	
	Teachers	prof. dr hab. inż. Jerzy Łabanowski dr hab. inż. Agnieszka Ossowska	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	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	4.0	16.0	50

Subject objectives

Obtaining basic knowledge of modern construction materials and their behavior in working environment in industry

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W04] demonstrates knowledge encompassing selected issues in the field of detailed knowledge, particularly in the scope of methods, techniques, tools, and algorithms specific to Mechatronics	Interprets differences in the properties of modern construction materials, explains the mechanisms of material degradation during use	[SW1] Assessment of factual knowledge
[K7_U15] evaluates the feasibility of advanced methods and tools for solving complex engineering tasks of a practical nature, characteristic of the field of study, and selects and applies appropriate methods and tools for this purpose	The student uses appropriate research methods and computational techniques to assess the durability and reliability of materials.	[SU4] Assessment of ability to use methods and tools
[K7_W12] identifies and interprets the main developmental trends and significant new achievements in the field of engineering and technical sciences and disciplines relevant to the course of study	The student knows the groups of modern construction materials; methods of shaping their properties and research methods necessary to assess durability.	[SW1] Assessment of factual knowledge

Subject contents	Course content – lecture LECTURE:Weldable structural steels of increased and high strength. Steels for the automotive industry. Stainless steels: ferritic, austenitic, ferritic-austenitic duplex and precipitation hardened. Passivation treatment of stainless steels to protect against corrosion. Causes of corrosion damage to austenitic steels in industrial installations. Low-alloy steels for operation at elevated temperatures. Creep; the effect of temperature, time and stress on the mechanical properties of alloys. Chilling-resistant steels and superalloys based on iron, nickel and cobalt, used in power engineering and for equipment in the petrochemical and chemical industries. Heat-resistant alloys; chemical composition, operating temperatures. High-melting metals; molybdenum, niobium, tungsten, zirconium, hafnium and their alloys. Materials with the structure of intermetallic phases. Heat-resistant light metal alloys. Materials resistant to abrasive wear.LABORATORY:1. Weldable structural steels of increased and high strength. Vickers hardness distribution in welded joints.2. Austenitic and duplex stainless steels. Analysis of operational damage cases.3. Low-alloy Cr-Mo steels for operation at elevated temperatures; assessment of the degree of degradation after long-term operation in creep conditions.4. Heat-resistant alloys (ferritic and austenitic) and creep-resistant alloys (austenitic and martensitic), assessment of the degree of degradation after long-term operation.5. Materials resistant to abrasive wear.
Prerequisites and co-requisites	Knowledge of basic engineering materials at the first-cycle level in technical fields.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
passing all laboratory exercises	100.0%	40.0%
Final colloquium - lecture	56.0%	60.0%

Recommended reading

Basic literature	1. Adamczyk J.: Inżynieria materiałów metalowych. Monografia. Cz. 1 i Cz. 2. Wyd. Politechniki Śląskiej. Gliwice 2004. 2. Ashby M.F., Jones D.R.H.: Materiały inżynierskie. Tom 1. Właściwości i zastosowanie. WNT, W-wa 1995. Tom 2. Kształtowanie struktury i właściwości, dobór materiałów. WNT. Warszawa 1996. 3.Blicharski M.: Inżynieria materiałowa. Stal. WNT W-wa 2004. 4. Bala H.: Korozja materiałów Teoria i praktyka. Wyd. WIPMiFS. Częstochowa 2002. 5. Baszkiewicz J., Kamiński M.: Korozja materiałów. Wyd. Polit. Warsz. Warszawa 2006. 6. Boczkowska A., Krzesiński G.: Kompozyty i techniki ich wytwarzania, Oficyna Wyd. PW, Warszawa 2016 7. Dobrzański J.: Materiałoznawcza interpretacja trwałości stali dla energetyki. Open Access Library vol. 3, 2011. 8. Dobrzański L.A.: Podstawy nauki o materiałach i metaloznawstwo. PWN 2004. 9. Hernas A.: Żarowytrzymałość stali i stopów. Wyd. Polit. Śląskiej. Gliwice 2000. 10. Łabanowski J.: Stale odporne na korozję i ich spawalność. Wyd. Politechniki Gdańskiej. Gdańsk 2018. 11. Oczoś K.E., Kawalec A.: Kształtowanie metali lekkich. PWN. Warszawa 2012. 12. Tasak E., Ziewiec A.: Spawalność materiałów konstrukcyjnych. T1. Spawalność stali. Wyd. Fotobit. Kraków 2008 13. Skrzypek S., Przybyłowicz K. (red): Inżynieria metali i ich stopów. Wyd. AGH Kraków 2012. 14. Głowacka M., Zieliński A. (red.): Podstawy materiałoznawstwa Wyd. Polit. Gdańskiej. Gdańsk 2014.
Supplementary literature	1. Chodorowski J., Ciszewski A., Radomski T.: Materiałoznawstwo lotnicze. Oficyna Wyd. Politechniki Warszawskiej. Warszawa 1996 2. Głowacka M., Łabanowski J.: Inżynieria powierzchni. Wybrane zagadnienia. PWSZ w Elblągu. Elbląg 2015.
eResources addresses	

Example issues/ example questions/ tasks being completed

Metallurgical weldability of steel, carbon equivalent.

Application of weldable unalloyed steels.

Steel strengthening mechanisms.

Bainitic steels, alloying additions, CTP diagram, application.

Austenitic stainless steels, role of chromium and nickel, basic heat treatment.

Examples of modern steel grades for the automotive industry.

Practical activites within the subject	Not applicable

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