GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Advanced engineering materials, PG_00057024		
Field of study	Mechatronics		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2023/2024
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	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	prof. dr hab. inż. Jerzy Łabanowski dr inż. Krzysztof Krzysztofowicz	

Lesson types and methods of instruction

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

Acquirement of the essential knowledge in modern structural materials and maintain their at industrial work environment.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U06] is able to evaluate feasibility and possibility of application of new achievements (technical and technological) in terms of mechatronics	Student uses proper method of testing and calculation technique for evaluation the working time and reliability of material.	[SU4] Assessment of ability to use methods and tools
[K7_U09] is able to evaluate feasibility of advanced methods and tools (including programmistic and for computer aided design and manuacturing) for solving complex, practical engineering task, characteristic for mechatronics, and to choose and apply proper method and tools	Student uses the basis knowledge for application modern structural materials taking into account working conditions.	[SU3] Assessment of ability to use knowledge gained from the subject
[K7_W10] knows development trends and most important new achievements in technical sciences and science disciplines: Mechanical Engineering, Automation, Electronics and Electrical Engineering and related: Informatics and Materials Engineering	Student knows groups of modern structural materials; methods shaping their properties and methods essential investigations for life-time evaluation.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents	LECTURE: Weldable structural steels AHSS (Advanced High Strength Steels). Modern steel grades for automotive industry. Corrosion-resistant steels: ferritic, austenitic, duplex, and precipitation hardening steels. Surface treatments of the stainless steels needed to prevent corrosion. The causes of corrosion damages of austenitic stainless steel in industrial systems. Low alloy steels operating at elevated temperature. Creep; influence of temperature, time and stresses to mechanical properties of metals. Creep-resisting steels and super alloys on the base of iron, nickel, and cobalt used in power industry, petrochemical or chemical systems. Heat-resisting steels; chemical composition, operating temperature. Refractory metals; Mo, Nb, W, Zr, Hf and their alloys. Materials on the intermetallic phase matrix. Creep-resisting light metal alloys. Wear resistant materials. LABORATORY: 1. Weldable structural steels AHSS (Advanced High Strength Steels). Vickers hardness of welded joints. 2. Corrosion-resistant austenitic steels and duplex steels. Case study of austenitic steel damages. 3. Low alloy Cr-Mo steel operating at elevated temperature; evaluation of the steel degradation process after long term operating in creep conditions. 4. Heat-resisting steels (ferritic and austenitic) and creep-resisting alloys;(austenitic and martensitic), evaluation of the degradation processes after long term operating in industrial systems. 5. Wear-resistant materials.
Prerequisites and co-requisites	Completed courses: Material Science I and Material Science II

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
	100.0%	30.0%
	60.0%	70.0%

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	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	Weldability of steel, equivalent CEV. Application of the welded carbon steels Strengthening mechanisms of steel. Bainitic steels, alloying elements, TTT diagram, application. Corrosion-resistant austenitic steel, the role of chromium and nickel, essential heat treatment. Examples of modern steel grades for automotive industry.
Work placement	Not applicable