



## Subject card

Subject name and code	Advanced engineering materials, PG_00057255						
Field of study	Power Engineering, Power Engineering, Power Engineering						
Date of commencement of studies	February 2023	Academic year of realisation of subject			2022/2023		
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	dr inż. Michał Landowski					
	Teachers	dr inż. Michał Landowski prof. dr hab. inż. Jerzy Łabanowski					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	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	5.0		15.0		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_W02] has extended and deepened knowledge of physics, chemistry, thermodynamics, fluid mechanics, material science, necessary to understand and describe basic thermal and flow phenomena occurring in and around power equipment and systems, transmission networks and internal installations	Student has an extensive knowledge of materials science and techniques of shaping the properties of modern engineering materials, including composite materials.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
	[K7_W06] knows the extended issues of reliability of power equipment and diagnostics of defects in this equipment	Student has knowledge of the degradation processes of materials used in the energy industry.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		
	[K7_K05] is aware of the impact of engineering activities on the environment	Student has knowledge of the impact of techniques for the production of elements from modern materials on the environment.			[SK5] Assessment of ability to solve problems that arise in practice		
	[K7_W08] as knowledge about development trends in the field of known technologies and non-technical aspects to solve simple engineering tasks in the field of power systems and equipment or transmission networks and internal installations	Student has knowledge of modern engineering materials used in the energy industry.			[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge		

Subject contents	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. Composite 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
Recommended reading	<p>Basic literature</p> <p>Supplementary literature</p> <p>eResources addresses</p>	<p>60.0%</p>	<p>100.0%</p> <p>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. Oczó 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.</p> <p>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.</p> <p>Adresy na platformie eNauczanie:</p>
Example issues/ example questions/ tasks being completed	<p>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.</p> <p>Composite materials manufacturing techniques.</p>		
Work placement	Not applicable		