



Subject card

Subject name and code		Advanced engineering materials, PG_00057024						
Field of study		Mechatronics						
Date of commencement of studies		February 2022	Academic year of realisation of subject			2021/2022		
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 mgr inż. Adrian Wolski dr inż. Gabriel Strugała dr inż. Aleksandra Świerczyńska				
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						
		Zaawansowane materiały inżynierskie,W, Mechatronika, sem. 01, lato 21/22, PG_00057024 - Moodle ID: 23496 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=23496 Zaawansowane materiały inżynierskie,L, Mechatronika, sem. 01, lato 21/22, PG_00057024 - Moodle ID: 23497 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=23497						
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 manufacturing) 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	<p>LECTURE:</p> <p>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.</p> <p>LABORATORY:</p> <ol style="list-style-type: none"> 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	<table border="1" data-bbox="451 797 1487 898"> <thead> <tr> <th data-bbox="451 797 794 831">Subject passing criteria</th> <th data-bbox="794 797 1137 831">Passing threshold</th> <th data-bbox="1137 797 1487 831">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="451 831 794 864"></td> <td data-bbox="794 831 1137 864">100.0%</td> <td data-bbox="1137 831 1487 864">30.0%</td> </tr> <tr> <td data-bbox="451 864 794 898"></td> <td data-bbox="794 864 1137 898">60.0%</td> <td data-bbox="1137 864 1487 898">70.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade		100.0%	30.0%		60.0%	70.0%
Subject passing criteria	Passing threshold	Percentage of the final grade										
	100.0%	30.0%										
	60.0%	70.0%										
Recommended reading	Basic literature	<ol style="list-style-type: none"> 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. Oczóś 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	<ol style="list-style-type: none"> 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	<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>											
Work placement	Not applicable											