



Subject card

Subject name and code	Damage Mechanisms of Construction Materials, PG_00040096						
Field of study	Mechanical Engineering, Mechanical Engineering						
Date of commencement of studies	October 2020		Academic year of realisation of subject		2023/2024		
Education level	first-cycle studies		Subject group		Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Part-time studies		Mode of delivery		at the university		
Year of study	4		Language of instruction		Polish		
Semester of study	7		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Zakład Materiałoznawstwa i Technologii Materiałowych -> 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				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15		5.0		30.0	50
Subject objectives	The aim of the subject is to familiarize students with the most commonly encountered mechanisms of material degradation in industrial practice and methods that allow for extending or calculating the operational durability of machine and equipment components.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U05] is able to plant an experiment within the range of measuring the basic operating parameters of mechanical devices using a specialized equipment, interpret the results and reach the correct conclusions		Expanding knowledge about various research methods employed in laboratory testing of selected mechanical systems with references to engineering practice.		[SU3] Assessment of ability to use knowledge gained from the subject		
	[K6_W03] possesses and is able to practically apply the knowledge on the construction, properties and testing methods of construction materials		Developing practical skills in conducting assessments of the failure modes of utilized engineering materials with reference to mechanics and machine design.		[SW1] Assessment of factual knowledge		
Subject contents	1. Sudden Material Fracture. Mechanisms of brittle fracture and ductile tearing of metallic materials. Criteria for the sudden fracture of metals and alloys.2. Fatigue Fracture Mechanisms. Calculating the fatigue life for low-cycle and high-cycle fatigue using Basquin's and Coffin-Manson's laws. Determining the fatigue life for components with initial cracks of length a_0 .3. High-Temperature Oxidation Mechanisms in Dry Gases. Kinetics of metal and alloy oxidation. Oxidation according to linear and parabolic laws. Oxidation rate of metals and alloys.4. Creep Mechanisms of Materials. Relationship between creep rate and homologous temperature, stress, and grain size in metals and alloys.5. Electrochemical Corrosion Mechanism. Oxidation rate, cathodic and anodic reactions. Methods of corrosion prevention.6.Tribological Wear Mechanisms. Abrasive and adhesive wear. Methods to reduce tribological wear.7. Cavitation Erosion Mechanisms. Cavitation phenomenon. Effects of cavitation erosion. Cavitation erosion curves and methods to determine material resistance to cavitation wear.						
Prerequisites and co-requisites							
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	Passing Quiz. The quiz lasts for 45 minutes. There are five questions, each worth 10 points. The passing threshold is 25 points.		50.0%		100.0%		

Recommended reading	Basic literature	<p>1. Engineering Materials - Part 1. Properties and Applications. Michael F. Ashby ; David R.H. Jones. WN-T 1996. ISBN:83204193602.</p> <p>2. Engineering Materials - Part 2. Structure and Property Development, Material Selection. Michael F. Ashby ; David R.H. Jones. WN-T 1996.</p> <p>3. Handbook of environmental degradation of materials. M. Kutz - 2018</p>
	Supplementary literature	<p>1. Corrosion mechanisms in theory and practice. P. Marcus - 20112. Degradation of Engineering Materials Implications to Regenerative Medicine. Krzysztof J. Kurzydłowski, Małgorzata Lewandowska, Wojciech Świąszkowski, Małgorzata Lewandowska-Szumieł. 2007 https://doi.org/10.1002/masy.2007507013. Fracture mechanics: fundamentals and applications. T.L. Anderson - 2017</p>
	eResources addresses	<p>Podstawowe https://docer.pl/doc/vcevv1 - unlimited Uzupełniające Adresy na platformie eNauczanie:</p>
Example issues/ example questions/ tasks being completed	<p>1. Draw a Wöhler curve, i.e., the stress dependency, such as $\sigma = \sigma_{max} - \sigma_{min}$, as a function of the number of cycles N until sample failure in a semi-logarithmic or double-logarithmic system for the case where the mean stresses are zero MPa.</p> <p>2. Provide criteria for assessing sudden fracture.</p> <p>3. Explain the linear and power laws of metal oxidation in dry gases.</p> <p>4. Write the cathodic and anodic reactions for electrochemical corrosion of iron in oxygenated water.</p> <p>5. Explain the relationship between creep rate, temperature, and applied stresses.</p>	
Work placement	Not applicable	