



Subject card

Subject name and code	Mechanical Integrity Standards for Data-Driven Digital Engineering, PG_00060238						
Field of study	Mechanical and Medical Engineering						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2023/2024		
Education level	second-cycle studies		Subject group				
Mode of study	Full-time studies		Mode of delivery		at the university		
Year of study	2		Language of instruction		English		
Semester of study	3		ECTS credits		1.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Zakład Mechaniki, Wytrzymałości i Sterowania Złożonych Obiektów Technicznych -> Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Jarosław Szwedowicz				
	Teachers		dr hab. inż. Jarosław Szwedowicz				
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		0.0		0.0	15
Subject objectives	The course explains the engineering practices for assessing the failure mechanisms of mechanical components, Stress-Life and Strain-Life methods, cycle-counting techniques in an understandable way. The explained knowledge-based models are related to needs for engine monitoring, which generates field data. These data are used for digital engineering solutions like digital twin (for component) or digital thread (for process). The course leverages fundamental knowledge for an integrated analytical and digital engineering solutions of interest of industry.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W08] He/she broad knowledge related to understand social, economic, legal, ecological and other outer techniques conditions of engineering activities in mechanical-medical engineering		Provides information on risks and costs in the implementation of projects based on digital engineering.		[SW2] Assessment of knowledge contained in presentation		
	[K7_W07] He/she in-depth knowledge related to engineering materials and technologies used in mechanical-medical engineering		Explains engineering practices for assessing failure mechanisms of mechanical components, Stress-Life and Strain-Life methods, fatigue cycle counting techniques in relation to digital engineering.		[SW2] Assessment of knowledge contained in presentation		
	[K7_W09] He/she in-depth knowledge related to diagnosis techniques and medical procedures in the scope of the field of study of mechanical-medical engineering		The field data from the monitored engine and its design data create a working domain of digital engineering, which is used for generating a digital twin of the operating machine.		[SW2] Assessment of knowledge contained in presentation		
	[K7_W06] He/she in-depth knowledge related to construct, design and build of mechanical devices and mechanical-medical devices		The course will remind basics of all operations with strains and stresses needed for Mohr's circles. Then, four well-known failure hypotheses are presented regarding the monotonic and cyclic material behavior.		[SW2] Assessment of knowledge contained in presentation		

Subject contents	To understand the general concept of the failure mechanisms of mechanical components, this course firstly reminds basics of all operations with strains and stresses needed for Mohrs circles. Then, four well-known failure hypotheses are presented in a comprehensive manner regarding the monotonic and cyclic material behaviour. For various design features of the mechanical component, differences between Stress-Life and Strain-Life methods are explained in an understandable way. Afterwards the cycle-counting techniques for fatigue assessments are discussed for creating the allowable reference data and operating limits of the machine. Finally, the most crucial physical parameters determining the strength degradation of the mechanical system are selected for the health monitoring, which generates field data. Both design and field data are reviewed for explaining the data-driven digital engineering and its needs for soft- and hard sensors. At the end, this course provides the general knowledge and explains differences between the classical mechanical and digital engineering that must be combined for the digital twin tool.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	A 45-min written exam	25.0%	100.0%
Recommended reading	Basic literature	The presentations given in Moodle, that will be explained in detail during lectures for making own notes and remarks.	
	Supplementary literature	N/A	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	Sample questions for the exam will be given at the end of each lecture, for self-study. Like, for example: What are physical quantities used for creating any Haigh diagram? Can a Haigh chart be used for plastic deformations (strains)?		
Work placement	Not applicable		