GDAŃSK UNIVERSITY OF TECHNOLOGY

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	