GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Theory of mechatronic systems, PG_00057023						
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 Mechanics and Mechatronics -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Rafał Hein				
	Teachers		dr hab. inż. Rafał Hein				
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						
	Teoria systemów mechatronicznych_2021_2022 - Moodle ID: 23251 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=23251						
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	To acquaint students with the fundamentals theory of mechatronic systems analysis and design. Explanation of the basic concepts used in the theory of mechatronic systems including among others synergy, emergence, holism. Presentation, characterization and comparison of reductionist and holistic paradigms in modeling, designing, analyzing and creating a real mechatronic system.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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 the directions of development of technical sciences, in particular in the fields of mechanics, automation and robotics, control, electronics and computer science.	[SW1] Assessment of factual knowledge
[K7_U04] is able to utilise known methods and mathematical models, as well as computer simulations for analysis and evaluation of non-stationary continuous and discrete mechatronic systems and processes	Student can apply signal processing methods for the analysis and investigation of stationary and non-stationary mechatronic systems. He designs passive and active analog filters to eliminate interference, aliasing, various kinds of parasitic effects and to reduce back-interaction between cooperating elements of the mechatronic system. Student models, analyzes and investigates mechatronic systems consisting of subsystems of various physical nature.	[SU1] Assessment of task fulfilment
[K7_U08] is able identifiy and forumlate tasks specification in terms of design of non-stationary mechatronic systems and processes, including non-standard problems and taking into consideration its non-technical aspects	Student can plan subsequent stages of the modeling, design and construction process of a real mechatronic system, including non-stationary one.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
[K7_W02] has organised, general, supported by the theory knowledge in terms of systems theory and techniques, mechatronic design, mechatronic systems and exploitation of mechatronic devices	Student knows the basic concepts used in the theory of mechatronic systems. He applies a holistic and reductionist approach to the design, analysis, modeling and investigation of mechatronic systems.	[SW1] Assessment of factual knowledge
[K7_W07] has basic knowledge on lifecycle of devices, objects and technical systems	Is aware of the periodic durability of mechatronic devices and systems.	[SW1] Assessment of factual knowledge

Subject contents

Lecture. System. System structure and classification. System engineering. System operation analysis and modeling problems. Mechatronic system. Mathematical model of a mechatronic system. Modeling of systems of various physical nature. Identification methods in the frequency domain - Fourier transform of signals. Analog filtration. Digital filtration. Expert systems. Fuzzy systems, fuzzy signals, rules of inference, areas of application. Fuzzy control.

Laboratory. Spectral analysis of signals. Modeling and investigation of analog and digital filters. Modeling of complex mechatronic systems of varied physical nature.

Prerequisites and co-requisites

Fundamentals of control systems, Control theory, Mathematics, including: linear algebra, differential and integral calculus.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Lecture	50.0%	50.0%
Laboratory	50.0%	50.0%

Recommended reading	Basic literature	1 Morrison F.: Sztuka Modelowania Układów Dynamicznych, Wydawnictwo Naukowo Techniczne, Warszawa, 1996, 2. Zieliński T. P.: Cyfrowe przetwarzanie sygnałów, Wydawnictwa Komunikacji i Łączności (WKŁ), Warszawa 2009 3. Izydorczyk J., Płonka G., Tyma G.: Teoria sygnałów, Helion, 2006 4. Lyons R. G.: Wprowadzenie do cyfrowego przetwarzanie sygnałów, Wydawnictwa Komunikacji i Łączności (WKŁ), Warszawa 2000 5. Izydorczyk J., Konopacki J.: Filtry analogowe i cyfrowe, Wydawnictwo Pracowni Komputerowej Jacka Skalmierskiego, 2003 6. Piegat A.: Modelowanie i Sterowanie Rozmyte, Wyd. EXIT, Warszawa 1999.
	Supplementary literature	1.Gutenbaum J.: Modele Matematyczne Systemów, Wyd. Omnitech, Warszawa, 1992, 2.Hall A. D.: Podstawy Techniki Systemów, PWN Warszawa, 1968,
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	