



## Subject card

Subject name and code	, PG_00056110						
Field of study	Mechatronics						
Date of commencement of studies	October 2021	Academic year of realisation of subject			2023/2024		
Education level	first-cycle studies	Subject group					
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	3	Language of instruction			Polish		
Semester of study	5	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Institute of Mechanics and Machine Design -> Faculty of Mechanical Engineering and Ship Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Rafał Hein				
	Teachers						
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						
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		0.0		0.0	30
Subject objectives	The aim of the course is to present the methods of modeling and solving differential equations.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_U02] is able to elaborate on specific mechatronic topics as well as topics from engineering and technical sciences and disciplines such as Mechanical Engineering, Automation, Electronics and Electrical Engineering	Student model mechanical and mechatronic systems using various methods of modelling. He can apply various methods of transition from the physical to the mathematical model and then solve the obtained ordinary and partial differential equations.			[SU1] Assessment of task fulfilment		
	[K6_W10] has a basic knowledge about development trends in terms of engineering and technical sciences and scientific disciplines: Mechanical Engineering, Automation, Electronics and Electrical Engineering, adequate for Mechatronics course	He knows the trends in the development of theoretical methods of modeling and analysis of mechanical and mechatronic systems.			[SW1] Assessment of factual knowledge		
	[K6_U05] is able to use properly chosen tools to compare design solutions of elements and mechatronics systems according to given application and economic criteria (e.g. power demand, speed, costs)	Student can program and use computer programs for modeling and analysis of mechanical and mechatronic systems.			[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools		
Subject contents	Introduction to modeling of dynamical systems. Basic notion and terms - physical model, mathematical model, numerical model. Ordinary differential equations in modeling and analysis of dynamic systems. Analytical and numerical methods of solving ordinary differential equations on computational examples. Partial differential equations in modeling and analysis of physical systems. Application of distributed transfer function method in analysis of mechatronic systems. Computational examples of applications analytical and numerical methods to solving partial differential equations. Finite difference method. Finite volume method. Finite element method.						
Prerequisites and co-requisites	Mathematics including linear algebra, matrix algebra, differential and integral calculus, linear ordinary and partial differential equations. Strength of materials including the theory of elasticity.						
Assessment methods and criteria	Subject passing criteria		Passing threshold		Percentage of the final grade		
	Laboratory		56.0%		50.0%		
	Lecture		56.0%		50.0%		

Recommended reading	Basic literature	<p>1. Rao S.S.: The finite element method in engineering, Elsevier 2005.</p> <p>2. Rakowski G., Kacprzyk Z.: Metoda elementów skończonych w mechanice konstrukcji, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2005.</p> <p>3. Gołębiowski L., Kulig T.S.: Metody numeryczne w technice, Oficyna Wydawnicza Politechniki Rzeszowskiej, Rzeszów 2012.</p> <p>4. Pietrzak J., Rakowski G., Wrześniowski K.: Macierzowa analiza konstrukcji, PWN 1989.</p> <p>5. Gawroński W. i inni: Metoda elementów skończonych w dynamice konstrukcji, Arkady, Warszawa 1984.</p> <p>6. Kruszewski J., Sawaik S., Wittbrodt E.: Metoda sztywnych elementów skończonych w dynamice konstrukcji, WNT 1999.</p>
	Supplementary literature	Zienkiewicz O.C, Taylor R.L., Zhu J.Z.: The Finite Element Method: Its Basis and Fundamentals, Elsevier 2013.
	eResources addresses	Adresy na platformie eNauczenie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	