



## Subject card

Subject name and code	Modelling and Simulation of Systems, PG_00055359						
Field of study	Informatics						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2024/2025		
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	2	Language of instruction			English		
Semester of study	3	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Algorithms and Systems Modelling -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Piotr Kowalczyk					
	Teachers	dr hab. inż. Piotr Kowalczyk					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	0.0	0.0	45
	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	45		10.0		20.0	75
Subject objectives	Students learned the purpose, the methods and techniques of mathematical modelling.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U09] can carry out a critical analysis of the functioning of existing technical solutions and assess these solutions, as well as apply experience related to the maintenance of advanced technical systems, devices and facilities typical for the field of studies, gained in the professional engineering environment	Student is able to determine the applicability conditions of various modeling techniques. In particular, the convergence conditions of the method and its accuracy.	[SU3] Assessment of ability to use knowledge gained from the subject
	[K7_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret obtained results and draw conclusions	Understands the principles of the model, can detect errors, analyse and interpret the results obtained.	[SU2] Assessment of ability to analyse information
	[K7_U41] can select methods of modelling and analysis of information systems and applications using selected elements of theoretical computer science and modern programming tools	Student is able to choose or create an appropriate mathematical model of the problem under consideration and associate appropriate numerical tools with it.	[SU2] Assessment of ability to analyse information
	[K7_W02] Knows and understands, to an increased extent, selected laws of physics and physical phenomena, as well as methods and theories explaining the complex relationships between them, constituting advanced general knowledge in the field of technical sciences related to the field of study	Student knows and understands the laws and physical phenomena in the field of kinematics, dynamics, mechanics, vibrations, waves and heat flow.	[SW1] Assessment of factual knowledge
[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by:n-appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation,n-application of appropriate methods and toolsn	Student selects and evaluates the effectiveness of the method of modeling and simulation of systems: - uses discrete methods for solving ordinary and partial differential equations (differences and finite elements) - solves and interprets the matrix eigenvalue problems - uses appropriate methods of function interpolation and approximation (including multi variables functions)	[SU1] Assessment of task fulfilment	
Subject contents	- differential equations as one of the basic tools of mathematical modeling- discrete methods of solving differential equations (Euler, finite differences, finite elements)- methods of function interpolation and approximation (including radial basis functions)- elements of stochastics- solving and interpreting of matrix eigenvalue problems		
Prerequisites and co-requisites	- basic knowledge of the Matlab environment- basics of differential and integral calculus- elements of linear algebra- the basics of physics		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	exam test	50.0%	40.0%
	laboratory	50.0%	60.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. R. Wieczorkowski, R. Zieliński: "Komputerowe generatory liczb losowych", WNT, Warszawa 1997.</li> <li>2. D.E. Knuth: "Sztuka Programowania", t. 2: „Algorytmy seminumeryczne", WNT, Warszawa 2002.</li> <li>3. P. Billingsley: "Prawdopodobieństwo i miara", PWN, Warszawa 1987.</li> <li>4. J. Muszyński, A.D. Myszkis: "Równania różniczkowe zwyczajne", PWN, Warszawa 1984.</li> <li>5. R.J. Wilson: "Wprowadzenie do teorii grafów", PWN, Warszawa 1998.</li> </ol>	

	Supplementary literature	McLaughlin, Michael P.: A Tutorial on Mathematical Modeling
	eResources addresses	Adresy na platformie eNauczenie:
Example issues/ example questions/ tasks being completed	The object moves along a straight line. Its speed is directly proportional to the square of the distance $s(t)$ that it has already traveled. Which of the following equations describes this relationship? (a) $s = k / s^2$ . (b) $ds / dt = k / t^2$ . (c) $ds / dt = kt^2$ . (d) $ds / dt = ks^2$ .	
Work placement	Not applicable	