



## Subject card

Subject name and code	Modelling and Simulation of Systems, PG_00054281						
Field of study	Informatics						
Date of commencement of studies	February 2025		Academic year of realisation of subject		2025/2026		
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	2		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. Adam Lamęcki 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 puprose, the methods and techniques of mathematical modelling.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	Student creates software enabling modeling of phenomena and processes occurring in various types of devices and systems.	[SU1] Assessment of task fulfilment
	[K7_W03] knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	Student modifies and supplements the codes of programs simulating phenomena from various fields of industry and science.	[SW3] Assessment of knowledge contained in written work and projects
	[K7_U01] can apply mathematical knowledge to formulate and solve complex and non-typical problems related to the field of study by: - appropriate selection of source information and its critical analysis, synthesis, creative interpretation and presentation, - application of appropriate methods and tools	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
	[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 physical laws and phenomena in the field of kinematics, dynamics, mechanics, vibrations, waves and heat flow.	[SW1] Assessment of factual knowledge
Subject contents	<ul style="list-style-type: none"> <li>- differential equations as one of the basic tools of mathematical modeling</li> <li>- discrete methods of solving differential equations (Euler, finite differences, finite elements)</li> <li>- methods of function interpolation and approximation (including radial basis functions)</li> <li>- elements of stochastics- solving and interpreting of matrix eigenvalue problems</li> </ul>		

Prerequisites and co-requisites	<ul style="list-style-type: none"><li>- basic knowledge of the Matlab environment</li><li>- basics of differential and integral calculus</li><li>- elements of linear algebra</li><li>- the basics of physics</li></ul>											
Assessment methods and criteria	<table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>laboratory</td><td>50.0%</td><td>60.0%</td></tr><tr><td>test</td><td>50.0%</td><td>40.0%</td></tr></table>	Subject passing criteria	Passing threshold	Percentage of the final grade	laboratory	50.0%	60.0%	test	50.0%	40.0%		
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Recommended reading	<table><tr><td>Basic literature</td><td><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></td></tr><tr><td>Supplementary literature</td><td>McLaughlin, Michael P.: A Tutorial on Mathematical Modeling</td></tr><tr><td>eResources addresses</td><td>Adresy na platformie eNauczanie:</td></tr></table>	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 eNauczanie:					
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Example issues/ example questions/ tasks being completed	<p>The object moves along a straight line. Its speed is directly proportional to the square of the distance <math>s(t)</math> that it has already traveled. Which of the following equations describes this relation?(a) <math>s = k / s^2</math>. (b) <math>ds / dt = k / t^2</math>. (c) <math>ds / dt = kt^2</math>. (d) <math>ds / dt = ks^2</math>.</p>											
Work placement	Not applicable											

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