



## Subject card

Subject name and code	Modelling and Simulation of Electronic Systems, PG_00048098						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2026/2027		
Education level	first-cycle studies	Subject group			Optional subject group 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	4	Language of instruction			Polish		
Semester of study	7	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Metrology and Optoelectronics -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Michał Kowalewski				
	Teachers		dr inż. Michał Kowalewski				
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		2.0		18.0	50
Subject objectives	A course teaches students model building skills, that is representing some aspects of the real world by numbers or symbols which may be easily manipulated to facilitate the study of the dynamics of existing or hypothesized systems at a reduced cost.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_W33] Knows programming languages and equipment description languages, as well as methods for the synthesis of combinational and sequential circuits and programmable systems		Classifies methods of modeling electronic systems. Knows the rules of modeling in Simulink. Appreciates the importance of modeling and simulation as a tool in the design and analysis of electronic systems.			[SW1] Assessment of factual knowledge	
[K6_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 technical systems, devices and facilities typical for the field of studies, gained in the professional engineering environment		In Matlab and Simulink, student constructs and researches models of analogue-to-digital converters: successive approximation, integration, sigma-delta modulator. Investigates model of generator with automatic amplitude control loop, model of van der pole oscillator. Models nonlinear systems using piecewise-linear approximation.			[SU4] Assessment of ability to use methods and tools		
Subject contents	1. Introduction 2. Modelling of linear continuous circuits, topological formulation of algebraic network equations 3. Modeling of linear continuous systems: transfer function models and state-space approach 4. Modelling discrete time systems 5. Block diagram reduction and manipulation rules 6. Behavioural modelling in Matlab environment 7. Modelling of non-linear circuits by piecewise-linear method 8. Creation of hierarchical models, using the debugger and accelerator, creating masked blocks, interactive simulation, running a batch of simulations in Simulink 9. Libraries of standard Simulink blocks: linear, non-linear, discrete, sources, sinks 10. Libraries: mathematical operations, function and tables, signals and systems 11. Variable-step and fixed-step solvers of sets of ordinary differential equations 12. Practical examples: model of successive approximation ADC 13. Model of dual-slope integration ADC 14. Model of sigma-delta converter 15. Colloquium						
Prerequisites and co-requisites	No requirements						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Laboratory	50.0%	40.0%
	Midterm colloquiums	50.0%	60.0%
Recommended reading	Basic literature	1. Vlach J., Singhal K.: Computer methods for circuit analysis and design. New York, Van Nostrand Reinhold, 1994 2. Osowski S.: Modelowanie i symulacja układów i procesów dynamicznych. OWPW, 2007 3. Klee H.: Simulation of Dynamic Systems with MATLAB and Simulink. CRC Press, Boca Raton 2007. 4. Esfandiari R.S., Lu B.: Modeling and analysis of dynamic systems, CRC Press, Boca Raton 2010	
	Supplementary literature	No requirements	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	1. 7th order elliptical filter models. 2. Formulation of state equations for electronic systems. 3. Model building and dynamic system simulation in Matlab-Simulink environment 4. Examination of the analog-to-digital converter model. 5. Examination of numerical integration algorithms. 6. Selected models of electronic systems: a generator with automatic amplitude control, a / c converter with double integration, a sigma-delta modulator.		
Work placement	Not applicable		