DIFFERENTIAL AND DIFFERENCE EQUATIONS

Faculty of Computer Science				
Study programme:	**Computer Science**		Degree level:	**Engineer's degree full-time programme**
Specialization	**---**		Diploma path:	**2026/2027W - 2026/2027S**
Module name:	**Differential and Difference Equations** (Równania różniczkowe i różnicowe)			
Module type:	**obligatory**	**Semester: 2**	ECTS:**6**	Module ID:**FCS-00064**
No. of hrs in semester:	Lecture (L) - **45** Classes(C) - **30** Specialization workshop (SW) - **15** Project (P) - **0** Laboratory classes (LC) - **0** Seminar (S) - **0**			
Prerequisites	Linear Algebra (FCS-00030), Linear Algebra and Analytic Geometry 2 (FCS-00060), Calculus (FCS-00002), Calculus 2 (FCS-00070),			

Aims and objectives:	Getting students to learn ordinary differential equations and methods of solving them. Gaining ability to solve selected types of ordinary differential equations and systems. Getting students to learn methods of solving linear difference equations and systems and basic types of partial differential equations. Getting students to learn applications of differential and difference equations.		
Forms of teching activities::	lecture, classes, specialization workshop,	Assessment:	Evaluation must be relevant to the intended learning outcomes: Lectures: written and oral exam; Classes: 4-6 tests; Specialistic workshop: entry tests and reports
Module content:	Lectures: Differential equations of first order, field of directions, existence and uniqueness of solutions. Integrable types of equations of first order. Linear equations of higher orders, homogeneous and nonhomogeneous. Fundamental matrix, exponential matrix. Variation of constant method. Laplace transformation. Linear difference equations and systems. Selected types of partial differential equations. Applications of differential and difference equations. Classes: Differential equations of first order, field of directions, existence and uniqueness of solutions. Integrable types of equations of first order. Linear equations of higher orders, homogeneous and nonhomogeneous. Fundamental matrix, exponential matrix. Variation of constant method. Laplace transformation. Linear difference equations and systems. Applications of differential and difference equations. Specialistic workshop: Differential equations of first order, field of directions, existence and uniqueness of solutions. Integrable types of equations of first order. Linear equations of higher orders, homogeneous and nonhomogeneous. Fundamental matrix, exponential matrix. Laplace transformation. Linear difference equations and systems. Applications of differential and difference equations. Numerical methods of solving differential equations.		
Teaching methods:	subject exercises, programming, discussion related to the lecture, lecture problem, informative lecture,		

Learning outcomes

Symbol	Specify min. 4, max. 8 learning outcomes in the following order: knowledge – skills – competence. Each learning outcome must be verifiable	Reference to the programme learning outcomes of education
LO1	knows basic concepts related to differential and difference equations and their applications to modeling	
LO2	knows basic computational methods and theorems connected with differential equations	
LO3	is able to solve selected types of differential and difference equations, knows proper computational tools	
LO4	is able to apply differential and difference equations to modeling	

No. of learning outcome	Methods of assessing the learning outcome	Type of teaching activities (if more than one) during which the outcome is assessed
LO1	written and oral exam	L
LO2	written and oral exam	L
LO3	tests and entry tests	C, Sw
LO4	tests and entry tests	C, Sw

Student's workload (in hours)			
	1 - Attendance at lectures		45
	2 - Attendance at classes and specialistic workshop		45
	3 - Preparation to classes and specialistic workshop		15
	4 - Preparation of reports and homework		18
	5 - Attendance at consultations		5
	6 - Preparation to exam		10
	7 - Preparation to tests		10
	8 - Attendance at exam		2
		TOTAL:	**150**

Quantitative indicators			
	Student's workload - activities that require direct teacher participation: (5)+(2)+(8)+(1)	97	**ECTS** 3.9
	Student's workload connected with practical classes (3)+(2)+(7)+(4)	88	3.5

Basic references:	1. W.-C. Xie, Differential Equations for Engineers, Cambridge : Cambridge University Press, 2010. 2. B.R. Hunt, Differential equations with MATLAB : updated for MATLAB 7 and Simulink 6, Hoboken : Wiley J., 2005.

	3. C.R. Wylie, Differential equations, New York : McGraw-Hill, 1979. 4. S. Elaydi, An introduction to difference equations, New York : Springer, 2005.
Further reading	1. A.A. Šestakov, A course of higher mathematics : integral calculus, differential equations, vector analysis, Mir, Moscow 1990

Unit:	Department of Mathematics	Lecturer/ instructor	
Date of issuing the programme:	31st March 2026	Author of the programme:	prof. dr hab. inż. Zbigniew Bartosiewicz

L - lecture, C - classes, LC - laboratory classes, P-project, SW - specialization workshop, S - seminar