NUMERICAL METHODS

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:	**Numerical Methods** (Metody numeryczne)			
Module type:	**obligatory**	**Semester: 2**	ECTS:**4**	Module ID:**FCS-00102**
No. of hrs in semester:	Lecture (L) - **15** Classes(C) - **0** Specialization workshop (SW) - **30** Project (P) - **0** Laboratory classes (LC) - **0** Seminar (S) - **0**			
Prerequisites	Linear Algebra (FCS-00030), Calculus (FCS-00002), Calculus 2 (FCS-00070), Programming Basics (FCS-00031),			

Aims and objectives:	Learning selected numerical methods for algebra. Learning selected numerical methods for mathematical analysis. Implementing selected algorithms in numerical methods for algebra. Implementing selected algorithms in numerical methods for mathematical analysis.		
Forms of teching activities::	lecture, specialization workshop,	Assessment:	Evaluation must be relevant to the intended learning outcomes: Lecture - test, special workshop - written in-class tests and reports on realized tasks.
Module content:	Lecture: Newton and Hermite interpolation. Splines. Mean-square approximation. Numerical methods to solve: nonlinear equations (bisection, secant and Newton methods), systems of linear equations (Gauss and Cholesky methods) and nonlinear equations (Newton method). Deriving matrix eigenvalues and eigenvectors. Numerical integration: definite and multiple integral computing (Gaussian and Newton-Cotes quadratures). Numerical methods for initial value and boundary value problem solving for ordinary differential equations (difference methods and the Runge-Kutta type methods). Examples of numerical methods applications. Special workshop: Newton and Hermite interpolation. Splines. Mean-square approximation. Numerical methods to solve: nonlinear equations (bisection, secant and Newton methods), systems of linear equations (Gauss and Cholesky methods) and nonlinear equations (Newton method). Deriving matrix eigenvalues and eigenvectors. Numerical integration: definite and multiple integral computing (Gaussian and Newton-Cotes quadratures). Numerical methods for initial value and boundary value problem solving for ordinary differential equations (difference methods and the Runge-Kutta type methods). Examples of numerical methods applications.		
Teaching methods:	programming, 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 chosen numerical methods of algebra	INF1_W01
LO2	knows chosen numerical methods of calculus	INF1_W01
LO3	knows how to implement algorithms realizing chosen numerical methods of algebra	INF1_U01
LO4	knows how to implement algorithms realizing chosen numerical methods of calculus	INF1_U01

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	test-lecture	L
LO2	test-lecture	L
LO3	work observation at special workshop, reports	Sw
LO4	work observation at special workshop, reports	Sw

Student's workload (in hours)	**1** - Attendance at lectures	None	15
	2 - Attendance at specialistic workshop	None	30
	3 - Preparation for passing the lecture	None	10
	4 - Preparation for specialistic workshop	None	15
	5 - Homework realization	None	30
		TOTAL:	**100**

Quantitative indicators	Student's workload - activities that require direct teacher participation: (1)+(2)	45	**ECTS** 1.8
	Student's workload connected with practical classes (4)+(2)+(5)	75	3.0

Basic references:	1. P. Tatjewski, Numerical methods, OW PW, 2014. 2. A. Bjorck, G. Dahlquist, Numerical methods, Courier Corporation, 2003. 3. U.M. Ascher, Ch. Greif, A First Course on Numerical Methods, SIAM, 2011.
Further reading	

	1. S.C. Chapra, R.P. Canale, Numerical methods for engineers, MCGraw-Hill, 2006. 2. A. Kharab, R.B. Guenther, An introduction to numerical methods: a MATLAB approach, CRC/Taylor & Francis, 2012. 3. R.Z. Morawski, A. Miękina, Solved Problems in Numerical Methods for Students of Electronics and Information Technology, OW PW, Warszawa, 2021.

Unit:	Department of Mathematics	Lecturer/ instructor	dr Krzysztof Piekarski
Date of issuing the programme:	30th March 2026	Author of the programme:	dr Krzysztof Piekarski

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