Course Syllabus
Course from study programme for the cycle: 2022/2023

I. General Information

Course name	Algorithms of numerical analysis
Programme	Informatics
Level of studies (BA, BSc, MA, MSc, long-cycle MA)	BA
Form of studies (full-time, part-time)	full-time
Discipline	Informatics, Mathematics
Language of instruction	english

Course coordinator	dr Małgorzata Nowak-Kępczyk

Type of class *(use only the types mentioned below)*	Number of teaching hours	Semester	ECTS Points
lecture	15	II	3
tutorial			
classes			
laboratory classes	15	II	
workshops			
seminar			
introductory seminar			
foreign language classes			
practical placement			
field work			
diploma laboratory			
translation classes			
study visit			

Course pre-requisites	1. Knowledge of the subjects of primary and specialized education covered by the study program: Introduction to differential and integral calculus, Linear algebra with analytical geometry, Introduction to computer science, Fundamentals of algorithmics and programming 2. Programming skills

II. Course Objectives

C1 - Getting to know the methods of numerical analysis and the basics of optimization methods and their applications to solve computational problems
C2 - Acquiring the ability to write and implement numerical analysis algorithms
C3 - Getting acquainted with the methods of approximate calculations for solving tasks for which exact solutions are difficult to find or impossible to determine analytically

III. Course learning outcomes with reference to programme learning outcomes

Symbol	Description of course learning outcome	Reference to programme learning outcome
KNOWLEDGE		
W_01	The student is familiar with the selected algorithms and examples of their practical implementation	K_W03
W_02	The student has general knowledge of theoretical computer science, algorithms designing and programming, operating systems, computer networks, software engineering, data bases, artificial intelligence and computer graphics	K_W06
SKILLS		
U_01	The student is able to apply the basic concepts of numerical analysis and optimization methods	K_U04
U_02	The student can analyze algorithms and programs written in an imperative language of programming from the point of view of their correctness and computational complexity. He or she can present and justify the results of the analysis	K_U07
U_03	The student can develop and record simple algorithms which solve problems from various areas of sciences	K_U08
U_04	The student can apply the principles of creating of structured and object-oriented programming	K_U11
U_05	The student can work on his/her own and in a team, understands the need of systematic work over long-term projects. The student can appropriately choose priorities within a given IT project.	K_U17
U_06	The student is able to implement selected numerical methods in practice	K_U20
U_07	The student can use acquired knowledge about mathematics to describe processes, create models, write algorithms and other activities in informatics	K_U22
SOCIAL COMPETENCIES		
K_01	Is ready to assess the level of his or her knowledge and skills. The student can conduct a critical evaluation of the received information.	K_K01

IV. Course Content

1. Horner's diagram. Polynomial interpolation. Lagrange interpolation formula. Newton's interpolation formula.
2. Methods for solving systems of linear equations. Gauss elimination method. Matrix decomposition methods based on Gaussian elimination. Cholesky decomposition method A = LL * of positively defined matrices.
3. Approximation. Least squares method. Chebyshev systems
4. Numerical integration. Interpolation quadratures. Newton-Cotes quadratures.
5. Methods of solving nonlinear equations and their systems. The bisection method. Secant method, regula falsi method. Newton's method. Newton's multidimensional method.

V. Didactic methods used and forms of assessment of learning outcomes

Symbol	Didactic methods *(choose from the list)*	Forms of assessment *(choose from the list)*	Documentation type *(choose from the list)*
KNOWLEDGE			

W_01	Problem lecture	Test, project	Test filled print, project print
W_02	Problem lecture	Exam/Test/Project	Test filled print, project print
		SKILLS	
U_01	Laboratory classes	Presentation Exam / Oral test, Test	Internship journal Internship report, Test
U_02	Laboratory classes	Presentation Exam / Oral test, Test	Internship journal Internship report, Test
U_03	Laboratory classes	Presentation Exam / Oral test, Test	Internship journal Internship report, Test
U_04	Laboratory classes	Presentation Exam / Oral test, Test	Internship journal Internship report, Test
U_05	Laboratory classes	Presentation Exam / Oral test, Test	Internship journal Internship report, Test
U_06	Laboratory classes	Presentation Exam / Oral test, Test	Internship journal Internship report, Test
U_07	Laboratory classes	Presentation Exam / Oral test, Test	Internship journal Internship report, Test
		SOCIAL COMPETENCIES	
K_01	Laboratory classes	Presentation Exam / Oral test, Test	Internship journal Internship report, Test

VI. Grading criteria, weighting factors

Passing classes - 2 tests on the 6th and 12th classes,

The test may be moved to another date after agreeing with the students.

Written exam - for people who have passed the classes.

The student may be released from the written part of the examination on the basis of the result obtained in the tests. Detailed conditions of the release are given to students with each edition of the course.

Detailed rules of assessment are given to students with each edition of the subject.

VII. Student workload

Form of activity	Number of hours
Number of contact hours (with the teacher)	**90**
Number of hours of individual student work	**50**

VIII. Literature

Basic literature
1. Aho A. V., Ullman I. D., Data Structures and Algorithms, 1983. 2. Kincaid D., Cheney W., Numerical analysis, 2006. 4. Stoer J., Introduction to numerical methods,, 1979. 5. T.H. Cormen, C.E. Leiserson, R.L. Rivest, C. Stein, Introduction to algorithms/ Wprowadzenie do algorytmów. Nowe wydanie. PWN, Warszawa 2018.
Additional literature
1. Björck A., Dahlquist G., Numerical methods. 1983. 2. Ralston A., Introduction to numerical analysis, 1993. 3. Stożek E., Metody numeryczne w zadaniach. Wyd. Uniwersytetu Łódzkiego, Łódź, 1994. 4. Straszecka E., Laboratorium metod numerycznych, Wyd. Politechniki Śląskiej, Gliwice, 2002. 5. Wąsowski J., Ćwiczenia laboratoryjne z metod numerycznych. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2002