Course Syllabus

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/person responsible	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 knows the basic concepts of numerical analysis and optimization methods	K_W03
W_02	The student knows selected numerical methods in the field of interpolation, approximation, solving systems of linear equations, numerical integration, solving non-linear equations, linear programming	K_W03, K_W06
W_03	Student - understands the importance of numerical analysis methods and optimization methods to solve practical problems	K_W03, K_W06
SKILLS		
U_01	The student is able to apply the basic concepts of numerical analysis and optimization methods	K_U04, K_U07
U_02	The student is able to use selected methods of numerical analysis and optimization methods	K_U08, K_U11, K_U20, K_U22
U_03	The student is able to implement selected algorithms of numerical analysis and optimization methods	K_U07, K_U08, K_U11, K_U20, K_U22, K_U17
SOCIAL COMPETENCIES		
K_01	The student sees the necessity of using numerical methods and optimization methods in various fields of science	K_K01
K_02	The student has the need for lifelong learning and the ability to motivate other people to expand their qualifications	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
W_3	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_3	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
K_02	Laboratory classes	Presentation Exam / Oral test, Test	Internship journal Internship report, Test

VI. Grading criteria, weighting factors

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

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

Written exam - for people who have passed the exercises.

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, 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