



**Uchwała nr 2377
Senatu Uniwersytetu w Białymstoku
z dnia 27 marca 2019 r.**

***w sprawie ustalenia programów studiów
dla kierunku Computer Science,
obowiązujących od roku akademickiego 2019/2020***

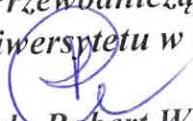
Na podstawie art. 28 ust. 1 pkt 11 ustawy z dnia 20 lipca 2018 r. *Prawo o szkolnictwie wyższym i nauce* (Dz. U. z 2018 r., poz. 1668 z późn. zm.) w związku z art. 268 ust. 2 ustawy z dnia 3 lipca 2018 r. *Przepisy wprowadzające ustawę – Prawo o szkolnictwie wyższym i nauce* (Dz. U. z 2018 r., poz. 1669 z późn. zm.) Senat Uniwersytetu w Białymstoku uchwała, co następuje:

§ 1

1. Senat Uniwersytetu w Białymstoku ustala, obowiązujące od roku akademickiego 2019/2020, programy studiów dla kierunku *Computer Science* na poziomie studiów pierwszego i drugiego stopnia o profilu ogólnoakademickim, prowadzonych w języku angielskim.
2. Programy studiów stanowią odpowiednio Załącznik nr 1 i nr 2 do niniejszej Uchwały.

§ 2

Uchwała wchodzi w życie z dniem podjęcia.

***Przewodniczący
Senatu Uniwersytetu w Białymstoku***

Prof. dr hab. Robert W. Ciborowski

LEARNING OUTCOMES
for the field of study **Computer science**
first degree study – general academic profile

Setting the field of study in discipline/scientific disciplines, which the learning outcomes refer to: *computer science, mathematics, linguistics, law, philosophy, culture and religion science, economics and finance*
Identification of the leading discipline: *computer science*

Description symbol of the second degree Polish Qualification Framework (PQF) in the scope of computer science	DESCRIPTION OF THE SECOND DEGREE PQF	Symbol of the field outcome	DESCRIPTION OF THE FIELD LEARNING OUTCOMES
P6S_WG	<p>KNOWLEDGE, a graduate is familiar with and understands:</p> <p>Scope and depth - completeness of the cognitive perspective and dependence</p> <p><i>to an advanced degree - selected facts, objects and phenomena and their methods and theories explaining complex relationships between them, constituting basic general knowledge in the field of scientific or artistic disciplines forming theoretical foundations and selected issues related to detailed knowledge - appropriate for the study program</i></p>	KA6_WG1	basic knowledge about logic, discrete mathematics, algebra and mathematical analysis
		KA6_WG2	basic knowledge about statistics and probabilistic methods
		KA6_WG3	the idea of algorithm and the rules of designing and analyzing algorithms
		KA6_WG4	basic techniques and methods of programming, programming paradigms and languages
		KA6_WG5	the rules of collecting and saving data
		KA6_WG6	basic methods of approximate and exact calculations, understands the significance of error analysis in numerical calculations
		KA6_WG7	possibilities to use software for numerical calculations
		KA6_WG8	methodologies and tools allowing to create software in local, distributed and internet environment
		KA6_WG9	methods of network communication as well as rules of network safety
		KA6_WG10	basic rules of operating systems functioning
		KA6_WG11	basic concepts of artificial intelligence, representation and processing knowledge, human-computer interaction
		KA6_WG12	foundations of software engineering
		KA6_WG13	basic methods of technology and elements of distributed systems architecture, fundamental assumptions

	KA6_WG14	of parallel and distributed programming, fundamental models of parallel and distributed calculations basic concepts of automata theory and mathematical linguistics
P6S_WK	KA6_WK1	basic knowledge referring to legal and ethical issues connected with computer science; fundamental rules of Occupational Safety and Health while using computer hardware
	KA6_WK2	selected dilemmas of modern civilization
SKILLS, a graduate can/is able to:		
	KA6_UW1	use algebra methods: follow simple reasoning inside theories of basic algebraic structures (groups, rings, fields); use matrices to solve problems
	KA6_UW2	use methods of mathematical analysis to solve problems: notion and properties of functions, sequences and series, limits and continuity of functions of one and several variables, integral and differential calculus of functions of one and several variables
	KA6_UW3	use statistical and probabilistic methods for data analysis
	KA6_UW4	use apparatus of mathematical logic to describe and verify facts, using inductive and deductive reasoning
	KA6_UW5	formulate and interpret computer science concepts using mathematical constructions and computational methods
	KA6_UW6	independently design algorithms realizing selected tasks, analyze the complexity of an algorithm
	KA6_UW7	choose an appropriate paradigm and programming language to solve tasks of a certain type
	KA6_UW8	independently implement algorithms using appropriate elements of a chosen programming language
	KA6_UW9	solve algebraic and analytical problems in a numerical way
P6S_UW	KA6_UW10	apply software for numerical calculations to solve problems, estimate an error of numerical calculations, implement known numerical algorithms in a chosen programming language

<p>KA6_UW11</p>	<p>design and optimize a database in accordance with a specification, efficiently search for required information in an existing database, implement a database in a selected system of databases</p>
<p>KA6_UW12</p>	<p>design a local area network, ensure safety while managing a local area network</p>
<p>KA6_UW13</p>	<p>take advantage of possibilities of different operating systems in computer systems realizing different functions</p>
<p>KA6_UW14</p>	<p>describe problems expressed in a natural language using the terminology of artificial intelligence</p>
<p>KA6_UW15</p>	<p>use design patterns, APIs and tools supporting the process of creating, testing and debugging software</p>
<p>KA6_UW16</p>	<p>use knowledge of the automata theory as well as formal languages to solve simple problems regarding human-computer interaction, artificial intelligence, formulating algorithms and designing simple information systems</p>
<p>KA6_UW17</p>	<p>create client-server type software</p>
<p>KA6_UW18</p>	<p>use technologies of creating software working in the Internet</p>
<p>KA6_UW19</p>	<p>use parallel calculations to increase the efficiency of algorithmic problem resolution, choose a suitable algorithm for a given model of parallel and distributed calculations</p>
<p>KA6_UW20</p>	<p>implement the resolution of a problem requiring interaction between processes in distributed environment employing available software</p>
<p>KA6_UW21</p>	<p>numerically model selected phenomena and simulate simple processes in a computational way, optimize numerical representations of phenomena and processes</p>
<p>KA6_UW22</p>	<p>use selected computation models</p>
<p>KA6_UK1</p>	<p>use the computer terminology in a foreign language</p>
<p>KA6_UK2</p>	<p>prepare a study of computer science concepts and present them</p>
<p>KA6_UK3</p>	<p>independently devise the resolution of an assigned information technology task which is a borderline case of theory and practice as well as present the resolution and conclusions</p>
<p>P6S_UK</p>	<p>Communicating - receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language</p> <p><i>communicate using specialized terminology</i></p> <p><i>take part in a debate - present and evaluate various opinions and positions and discuss them</i></p> <p><i>use a foreign language at B2 level of the Common European Framework of Reference for Languages</i></p>

P6S_UO	<p>Work organization - planning and teamwork</p> <p><i>plan and organize individual work and as part of the team</i></p> <p><i>cooperate with other people as part of team work (also of an interdisciplinary nature)</i></p>	KA6_UO1	work in a programming team to solve assigned problem comprehensively
P6S_UU	<p>Learning - planning one's own development and the development of others</p> <p><i>independently plan and implement own lifelong learning</i></p>	KA6_UO2	cooperate in a team completing collective tasks
P6S_KK	<p>Assessment - a critical approach</p> <p><i>critical assessment of own knowledge and received content</i></p> <p><i>recognition of the importance of knowledge in solving cognitive and practical problems and consulting experts in case of difficulties in solving a problem</i></p>	KA6_UU1	understand the need to improve their skills and qualifications, and monitor the development of technologies and IT tools
P6S_KO	<p>Responsibility - fulfilling social obligations and acting for the public interest</p> <p><i>fulfilling social obligations, co-organizing activities for the social environment</i></p> <p><i>initiating activities for the public interest</i></p>	KA6_KK1	careful determining priorities and the order of actions
P6S_KR	<p>Professional role - independence and development of the ethos</p> <p><i>thinking and acting in an entrepreneurial way</i></p> <p><i>responsible performance of professional roles, including:</i></p> <ul style="list-style-type: none"> - observing the rules of professional ethics and requirements from others, - care for the achievements and traditions of the profession 	KA6_KO1	showing the right attitude necessary to take up practical activity in the information society
P6S_KR	<p>Professional role - independence and development of the ethos</p> <p><i>thinking and acting in an entrepreneurial way</i></p> <p><i>responsible performance of professional roles, including:</i></p> <ul style="list-style-type: none"> - observing the rules of professional ethics and requirements from others, - care for the achievements and traditions of the profession 	KA6_KR1	understanding the need to obey ethical rules and legal regulations connected with the activity in the IT environment

Explanation of the symbols

P6S_WG – description symbol of the second degree PQF

P – practical profile
A – general academic profile
P6 or P7 – PQF level (6 – first degree study, 7 – second degree study and uniform master degree study)
S – specification typical of qualifications obtained in higher education
W – knowledge (descriptive category)
G – depth and extent
K – context
U – skills (descriptive category)
W – use of knowledge
K – communicating
O – work organization
U – learning
K – social competence (descriptive category)
K – critical evaluation
O – responsibility
R – professional role

KA6_WG1 – symbol of the field outcome

K – field learning outcomes
A – educational profile (A – general academic, P – practical)
6 – educational level (6 – first degree study, 7 – second degree study and uniform master degree study)
W – knowledge (descriptive category)
G – depth and extent
K – context
U – skills (descriptive category)
W – use of knowledge
K – communicating
O – work organization
U – learning
K – social competence (descriptive category)
K – critical evaluation
O – responsibility
R – professional role

STUDY PROGRAMME - Part A

I. GENERAL INFORMATION

1. Setting the field of studies in discipline/scientific disciplines, which the learning outcomes refer to: **computer science, mathematics, linguistics, law, philosophy, culture and religion science, economics and finance**

2. Name of the field of study: **Computer Science**

3. Level of education: **first degree studies**

4. Educational profile: **general academic**

5. Form of study: **full-time studies**

6. A number of semesters: **6**

7. Total number of ECTS points required to achieve the equivalent level of relevant qualifications: **183**

8. Total number of teaching hours: **2210**

9. Programme is effective from the academic year: **2019/2020**

10. Programme adopted at the meeting of Faculty Board on **13.02.2019**

II. EDUCATION MODULES

Modules (module code: MK_1 and name)	Field learning outcomes Knowledge Skills Social competence (symbols)	Teaching methods and verification	Courses/modules	a number of ECTS points per course/module	QUANTITATIVE INDICATORS - ECTS points included in courses:								
					that require direct participation of teachers or other people conducting the classes	in basic science specific for a given field of study, which learning outcomes for a given field, level and profile of education refer to	classes shaping practical skills/classes connected with scientific activity conducted at the university in discipline/disciplines, which the field of study is assigned to	in discipline of humanities or social sciences (min. 5 ECTS points) - for the fields from other discipline of science*	in a foreign language (language classes)	in apprenticeships	that are elective		
MK_1, Mathematical Analysis	KA6_WG1, KA6_UW2, KA6_UW4, KA6_UU1, KA6_KO1	Teaching methods: Lecture and exercise classes, discussion, presentation, problem solving, individual exercises. Assessment methods: exams (written and/or oral), tests, activity evaluation.	1. Review of Mathematics	3,0	1,0		3,0						
			2. Mathematical Analysis 1	4,0	2,0		2,0						
			3. Mathematical Analysis 2	6,0	2,0		2,0						
			4. Mathematical Analysis 3	3,0	2,0		2,0						
			5. Differential and Difference Methods	2,0	1,0		1,0						
total				18,0	8,0	0,0	10,0	0,0	0,0	0,0	0,0		

MK_2 Algebra	KA6_WG1, KA6_UW1, KA6_UW4, KA6_UU1, KA6_KK1	Teaching methods: lecture and exercise classes. Assesment methods: exams, tests, activity evaluation.	Linear Algebra with Analytical Geometry	6,0	2,0	0,0	1,0	0,0	0,0	0,0	0,0
				total	6,0	2,0	0,0	1,0	0,0	0,0	0,0
MK_3 Logic and Set Theory	KA6_WG1, KA6_UW4, KA6_UW5, KA6_UU1, KA6_KK1	Teaching methods: lecture and exercise classes Assesment methods: exams, tests, activity evaluation	Elements of Logic and Set Theory	6,0	3,0		3,0				
				total	6,0	3,0	0,0	3,0	0,0	0,0	0,0
MK_4 Design and Analysis of Algorithms	KA6_WG1, KA6_WG3, KA6_UW2, KA6_UW4, KA6_UW6, KA6_UW8, KA6_UU1	Teaching methods: lecture and exercise classes. Assesment methods: exams, tests, activity evaluation.	1. Discrete Mathematics 2. Algorithms and Data Structures	5,0	2,0	2,0	5,0				
				total	10,0	5,0	7,0	10,0	0,0	0,0	0,0
					5,0	3,0	5,0				

MK_5 Programming	KA6_WG1, KA6_WG3, KA6_WG4, KA6_WG5, KA6_WG6, KA6_WG7, KA6_UW6, KA6_UW7, KA6_UW8, KA6_UW9, KA6_UW10, KA6_UW15, KA6_UK1, KA6_UK3, KA6_UU1, KA6_KK1	Teaching methods: lecture, exercise classes and laboratory classes, homeworks. Assesment methods: exams (written and/or oral), tests, activity evaluation.	1. Introduction to Structured Programming	7,0	4,0	7,0	7,0	7,0	0,0	0,0	0,0	0,0
	2. Python Programming		4,0	2,0	4,0	4,0						
	3. Introduction to Object-Oriented Programming		5,0	3,0	5,0	5,0						
	4. Advanced Programming		5,0	3,0	5,0	5,0						
	total		21,0	12,0	21,0	21,0	0,0	0,0	0,0	0,0	0,0	0,0
MK_6 Programming Environments	KA6_WG1, KA6_WG3, KA6_WG4, KA6_WG5, KA6_WG10, KA6_WG11, KA6_UW6, KA6_UW7, KA6_UW8, KA6_UW15, KA6_UK3 KA6_UO2, KA6_UU1, KA6_KK1	Teaching methods: lecture and laboratory classes, discussion. Assesment methods: exams (written and/or oral) tests, activity evaluation.	1. Graphics and Human-Computer Communication	3,0	2,0	3,0	1,0					
	2. Graphical User Interface Programming		5,0	2,0	5,0	2,0						
	total		8,0	4,0	8,0	3,0	0,0	0,0	0,0	0,0	0,0	

Databases and Applications MK_10	KA6_WG4, KA6_WG5, KA6_WG8, KA6_WG9, KA6_UW8, KA6_UW11, KA6_UW17, KA6_UW18, KA6_UK1, KA6_UO2, KA6_UU1, KA6_KR1, KA6_KO1	Teaching methods: lecture, laboratory and project classes, individual and group work. Assesment methods: exams (written and/or oral), tests, activity evaluation.	1. Databases	5,0	3,0	5,0	5,0	9,0	0,0	0,0	0,0
			2. Internet Programming	4,0	3,0	4,0	4,0	9,0	0,0	0,0	0,0
			total	9,0	6,0	9,0	9,0	6,0	0,0	0,0	0,0
Software Engineering MK_11	KA6_WG4, KA6_WG5, KA6_WG8, KA6_WG12, KA6_UW6, KA6_UW7, KA6_UW8, KA6_UW11, KA6_UW15, KA6_UW17, KA6_UK2, KA6_UO1, KA6_UK3, KA6_UO2, KA6_UU1, KA6_KO1	Teaching methods: lecture and laboratory classes, group work on a project, problem solving method, discussion, presentation. Assesment methods: exams (written and/or oral), tests, activity evaluation, project documentation evaluation.	1. Software Engineering 1	2,0	1,0	2,0	2,0	2,0	2,0	2,0	2,0
			2. Software Engineering 2	4,0	2,0	4,0	4,0	4,0	4,0	4,0	4,0
			3. Team Project	5,0	1,0	5,0	5,0	1,0	5,0	5,0	5,0
			total	11,0	4,0	11,0	11,0	6,0	0,0	0,0	0,0

<p>Elective Courses</p> <p>MK_21</p>	<p>KA6_WG11, KA6_UW4, KA6_KK1</p> <p>Teaching methods: lecture and laboratory classes, group work.</p> <p>Assesment methods: exams, tests presentation and report evaluation.</p>	<p>Knowledge Representation and Processing:</p> <ol style="list-style-type: none"> 1. Constructive Methods in Computer Science 2. Functional Programming 3. Logic Programming 4. LaTeX Typesetting System <p><i>A student chooses one of the above subjects or optional subjects with analogous learning outcomes and ECTS points from the offer approved by the Council responsible for the course of study</i></p>	4,0	2,0	4,0	4,0	4,0	4,0		4,0
<p>KA6_WG1, KA6_UW2, KA6_KO1</p>		<p>Modelling and Simulation:</p> <ol style="list-style-type: none"> 1. Computer Modelling and Simulation Methods 2. Optimization Methods 3. Computer Statistics <p><i>A student chooses one of the above subjects or optional subjects with analogous learning outcomes and ECTS points from the offer approved by the Council responsible for the course of study</i></p>	4,0	2,0	4,0	4,0	4,0	4,0		4,0
<p>KA6_WG4, KA6_WG11, KA6_UO1, KA6_UK3, KA6_UO2, KA6_UU1, KA6_KO1</p>		<p>Applied Computer Science:</p> <ol style="list-style-type: none"> 1. Bioinformatics 2. Digital Image Processing 3. Computer Methods in Technology 4. Machine Translation in Grammatical Framework 5. Graphics Cards Programming <p><i>A student chooses one of the above subjects or optional subjects with analogous learning outcomes and ECTS points from the offer approved by the Council responsible for the course of study</i></p>	4,0	2,0	4,0	4,0	4,0	4,0		4,0
			24,0	12,0	24,0	24,0	24,0	0,0	0,0	24,0

KA6_WG5, KA6_WG9, KA6_WG10, KA6_WK1, KA6_UW11, KA6_UW12, KA6_UW13, KA6_UW17, KA6_UK1, KA6_UK2, KA6_UO1, KA6_UO2, KA6_UU1, KA6_KR1, KA6_KO1	Apprenticeships MK_22	KA6_WG5, KA6_WG9, KA6_WG10, KA6_WK1, KA6_UW11, KA6_UW12, KA6_UW13, KA6_UW17, KA6_UK1, KA6_UK2, KA6_UO1, KA6_UO2, KA6_UU1, KA6_KR1, KA6_KO1	Apprenticeships	Teaching methods: presentations and demonstrations, practical exercises, group workshops. Assessment methods: employer and supervisor evaluation, practice register evaluation.	Apprenticeships	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0	4,0						
total											4,0	4,0	0,0	0,0	0,0	0,0	4,0	4,0	4,0	
TOTAL NUMBER OF ECTS points for ALL MODULES											183,0	95,0	123,0	109,0	5,0	12,0	4,0	4,0	4,0	57,0

* refers to the fields that are not assigned to the disciplines of humanities or social sciences

III PROPORTIONAL INDICATORS (percentage)

1. Percentage share of ECTS points for the classes that require direct participation of teachers or other people conducting classes:	51,91%
2. Percentage share of ECTS points earned for elective modules (min. 30%):	31,15%
3. Percentage share of ECTS points earned for the classes conducted in a foreign language (in a total number of ECTS points envisaged by the study programme):	100,00%
4. Percentage share of ECTS points earned for the modules of classes shaping practical skills for practical educational profiles (above 50%):	not applicable
5. Percentage share of ECTS points earned for the modules of classes connected with scientific activity conducted at the university in discipline/disciplines, to which the field of study is assigned for general academic profile (above 50%):	59,56%

6. Percentage shares of individual (all) discipline of science, which the study programme refers to:	computer science	69,67%
	mathematics	20,49%
	linguistics	6,56%
	law	0,55%
	philosophy	0,55%
	culture and religion science	1,09%
	economics and finance	1,09%

IV. CONDITIONS OF GRADUATION AND CONFERRED PROFESSIONAL TITLE

Graduating with the Bachelor's Degree professional title requires completing all obligatory courses in the study programme, preparing a dissertation and passing a diploma examination.

STUDY PROGRAMME – Part B

1. *Name of the field of study:* **Computer Science**
2. *Level of education:* **first degree studies**
3. *Educational profile:* **general academic**

MODULES' PROGRAMME CONTENT

MK_1 Mathematical Analysis:

MK_1/1 Review of Mathematics: Systematize math knowledge acquired in secondary school. Bridge the gap between the „school math knowledge” and math knowledge required for academic level mathematics.

MK_1/2 Mathematical Analysis 1: Mathematical logic - elements, elements of set theory. Relations, functions and their properties. Numerical sequences, properties, limits. Numerical series, their properties and convergence.

MK_1/3 Mathematical Analysis 2: Limit of one variable function. Actions on functions and their boundaries. Asymptote functions. Continuity of function. Derivative of the function of one variable and its properties. Derivative of the inverse and composite function. Differential of a function. Extrema of functions of one variable. L'Hospital's rule. Derivatives of higher orders. Taylor series. Power series. Sequences and series functions. Antiderivative indefinite integral. Integration of rational, irrational and trigonometric functions. The Riemann integral. Improper integral.

MK_1/4 Mathematical Analysis 3: Topological properties, metric space. Function of several variables, domain, limits, graphs of two variable functions. Partial derivatives. Symmetry of second derivatives. Directional derivative, gradient. Implicit differentiation. Second partial derivative test. Jacobian. Polar coordinate system. Double, triple integral over a normal domain and its applications.

MK_1/5 Differential and Difference Methods: Types of ordinary differential equations, methods of solving differential equations, certain applications of first-order differential equations, difference equations.

MK_2 Algebra:

Linear Algebra with Analytical Geometry: Fundamental algebraic structures: groups, rings and fields; the complex number field; the polynomial ring over an arbitrary ring; formulation of problems in matrix-vector terms and operations on matrices (the inverse of matrices, the rank of matrices); solving systems of linear equations using different methods; checking linear independence and determination a base of vector space; using notions of analytic geometry.

MK_3 Logic and Set Theory:

Elements of Logic and Set Theory: Expressing thoughts formally and correctly, reasoning using logical tools. Fundamental notions and methods necessary to understand more advanced mathematical theories. Formally constructing and modelling mathematical objects on set-theoretical grounds.

MK_4 Design and Analysis of Algorithms:

MK_4/1 Discrete Mathematics: Induction and recursion, the basics of combinatorics, basic techniques of counting, the basics of graph theory, the basics of number theory.

MK_4/2 Algorithms and Data Structures: Basic data structures (lists, stacks, queues, hash tables, trees, graphs), algorithms (graph algorithms, pattern matching in strings) and different methods of their design (“divide and conquer”, dynamic programming, greedy methods) and also estimation of their complexity.

MK_5 Programming:

MK_5/1 Introduction to Structured Programming: Information processing in computer (representation of information, information processing on machine-level and high-level languages). Programming in C.

MK_5/2 Python Programming: Python Environment. Programming paradigms (structural, object-oriented, functional) in the context of Python. Elements of network programming. The designing and implementation of programs using selected packages and modules. The course includes elements of processing and analysis of big data sets.

MK_5/3 Introduction to Object-Oriented Programming: Familiarize the students with the basic concepts and techniques of object-oriented programming on the example of C++. Practice the most important object-oriented techniques. Teach design, implementation and analysis of programs in the object-oriented paradigm.

MK_5/4 Advanced Programming: Introduction to the Java language. Object oriented programming: inheritance, polymorphism. Exceptions – defining and using. Generic programming: parametrized types, collections, comparators, iterators, algorithms. Graphical user interfaces. Event programming.

MK_6 Programming Environments:

MK_6/1 Graphics and Human-Computer Communication: Programming in a graphical environment. Analysis of the human-computer interaction on the example of 2D games programming. Digital image representation and processing: intensity transformations, blending, filtering, enhancement by histogram modification, geometric transformations. The basics of 3D modelling.

MK_6/2 Graphical User Interface Programming: Basic mechanisms of programming in the Windows operating system. Functionality of the Windows API, Windows Forms library

contained in the .NET Framework and WPF engine to create user interfaces. General principles of designing a graphical user interface with regard to ergonomics and analysis of the needs of potential users.

MK_7 Technical Aspects of Informatics:

MK_7/1 Computer System Architecture: Digital technology and digital systems, Machine representation of data and execution of arithmetic operations, Computer organization on the level of assembler, Organization and storage systems architecture, Interfaces and communication, organization of the CPU, Multiprocessing and alternative architectures

MK_7/2 Operating Systems: Basic use, configuration and administration of various operating systems. Solving basic problems concerning a multitasking operating system environment and using all its resources, i.e. CPU, memory, disks.

MK_7/3 Network Technologies: Construction and operation of computer networks. OSI and TCP / IP - the protocols and features, IP addressing, routing, switching, Wide Area Networks (WAN), Virtual Private Networks (VPN).

MK_8 Professional and legal issues in informatics:

MK_8/1 Health, Safety and Ergonomics: General principles of safety and ergonomics with a special focus on health and safety regulations for computer workstation and ergonomic principles in the design of the computer workstation.

MK_8/2 Intellectual Property Rights: Copyrights and related rights; observance of intellectual property including the computer programs.

MK_9 Numerical Methods:

Computational Methods: Calculation of errors of arithmetic operations. Interpolation and approximation methods. Numerical integration (quadratures with fixed nodes, Gauss quadratures). Approximated solving of systems of linear equations. Solving of nonlinear equations with one unknown.

MK_10 Databases and Applications:

MK_10/1 Databases: Introduction. Relational model. Relational algebra. SQL language. Designing relational databases. Normalization. Normal forms. Conceptual design. Entity relationship diagram. Logical design. Physical design. Basic file structures. Indexes. Transactions. Concurrency. Optimization.

MK_10/2 Internet Programming: Basic Internet programming techniques, languages, tools and standards.

MK_11 Software engineering:

MK_11/1 Software Engineering 1: The typical software lifecycle phases, principles of systems design by the object method, software development tools, software requirements specification,

testing rules of software and software configuration management, project planning and software development process management.

MK_11/2 Software Engineering 2: The rules of development of complex systems with particular consideration of implementation as phase. The four main programming paradigms (imperative, functional, object-oriented and logic) as a fundamental style of computer programming, as well the basic software design patterns will be discussed.

MK_11/3 Team Project: Creating simple applications in a small team. Choosing a suitable model of creating an application. Dividing tasks for each person in a group. Creating a work plan. Documenting and testing applications.

MK_12 Probabilistic Methods and Statistics:

Probability methods and statistics: Random variable, The probability of discrete and continuous, Probability distributions, Expected values, Variance, Standard deviation, Stochastic processes, Sampling, The problem of estimation, Testing statistical hypotheses, Correlation and regression, Computer methods of statistics.

MK_13 Humanities and Social Courses:

MK_13/1 Humanities Course: Students choose one humanities course from a list approved by the Faculty Board

MK_13/2 Economy Course: Students choose one economy course from a list approved by the Faculty Board

MK_13/3 Computer and Information Ethics: The genesis of computer and information ethics. Intellectual property. Privacy and anonymity. Professional responsibility of computer scientists, codes of conduct for computer professionals, and computer crimes.

MK_14 Artificial intelligence:

Artificial Intelligence: Rough sets. Fuzzy sets. Artificial neural networks. Classification and clustering algorithms. Search methods. Evolutionary algorithms. Practical part: Application selected classification/clustering algorithms to data sets and reporting on the results.

MK_15 Parallel and Distributed Programming:

Parallel and Distributed Programming: Characteristics of parallel and distributed programming. Architectures of computers. Models and algorithms of calculations. Programming with shared memory, OpenMP interface. Programming with message-passing, MPI library. GPGPU graphics cards programming elements.

MK_16 Theoretical Foundations of Informatics:

Introduction to the Theory of Automata and Formal Languages: Basic issues: the language and grammar, regular grammars, context-free grammars, context-sensitive grammars, finite

automata, pushdown automata, Turing machines, non-determinism, Chomsky hierarchy, characterization of the problems due to the undecidability and complexity.

MK_17 Seminar:

MK_17/1 Seminar 1: Presentation of students' research results achieved during preparation of their diploma theses, improvement of skills of communicative transfer of knowledge, presentation of issues from the list of exam topics. The range of presentation topics corresponds to the topics of prepared theses.

MK_17/1 Seminar 2: Presentation of students' research results achieved during preparation of their diploma theses, improvement of skills of communicative transfer of knowledge, presentation of issues from the list of exam topics. The range of presentation topics corresponds to the topics of prepared theses.

MK_18 Diploma preparation:

MK_18/1 Diploma Preparation Class 1: Directing the student to develop and write a thesis. Description justifying the purpose of the thesis, the description of the current state of knowledge related to the topic of work, searching for information in the literature, also in foreign languages, planning, conducting and critical assessment of experiments, presentation of research results of independent own work. Contents are selected subject to ongoing theses.

MK_18/2 Diploma Preparation Class 2: Directing the student to develop and write a thesis. Description justifying the purpose of the thesis, the description of the current state of knowledge related to the topic of work, searching for information in the literature, also in foreign languages, planning, conducting and critical assessment of experiments, presentation of research results of independent own work. Contents are selected subject to ongoing theses.

MK_19 Physical Education:

Physical Education: Safety precautions for physical education classes, the rules of use of the sports facility. Learning the basic technical and tactical elements. Educating students to care for their physical condition and supporting the development of social competence in group cooperation.

MK_20 Foreign Languages:

MK_20/1 English: Everyday use of foreign language (travel, mass media and other means of communication, global issues, education), understanding and applying IT terminology (electronic devices, IT data security, communication systems, computer engineering, development of information techniques).

MK_20/2 Russian: Everyday use of foreign language (travel, mass media and other means of communication, global issues, education), understanding and applying IT terminology (electronic devices, IT data security, communication systems, computer engineering, development of information techniques).

MK_20/3 German: Everyday use of foreign language (travel, mass media and other means of communication, global issues, education), understanding and applying IT terminology (electronic devices, IT data security, communication systems, computer engineering, development of information techniques).

MK_20/4 Polish: Everyday use of foreign language (travel, mass media and other means of communication, global issues, education), understanding and applying IT terminology (electronic devices, IT data security, communication systems, computer engineering, development of information techniques).

MK_21 Elective Courses:

MK_21A Advanced Programming Methods; to choose among:

MK_21A/1 Component Programming: Design multilayer component-based applications implemented on J2EE platform. Architecture of J2EE application. Model-View-Controller (MVC) design pattern. Enterprise JavaBeans (EJB). Types of EJB components. Java database connectivity interface (JDBC). Servlets in J2EE application. Session management. Security issues.

MK_21A/2 .NET Programming: To provide foundations and characteristics of .NET platform and its derivatives. Implementation of programs for .NET using WPF engine.

MK_21A/3 Design Patterns: Genesis of design patterns. Uses of design patterns and examples of their use in practice. Recognize the applicability of design patterns in the projects. Correct design and implementation of projects using design patterns on the example of Java.

MK_21A/4 Matlab Programming: Matlab Environment. The designing and implementation of programs using embedded Matlab function and selected Matlab toolboxes, in particularly to solve 'Big Data' problems. Parallel computing.

MK_21A/5 Internet Frameworks: The essence and purpose of web frameworks. Overview of the most popular frameworks and online libraries.

MK_21B Diagnostic and Control Systems; to choose among:

MK_21B/1 LabVIEW Programming: The basics of graphical programming in LabVIEW. Creating simple programs in G language. Operating and modifying selected applications in the LabVIEW environment. Creating applications which can control selected electronic devices. Creating data acquisition applications and data visualization applications.

MK_21B/2 Computer Measurement Systems: Configuration and structure of measurement system. Measurement interfaces. Digital-to-analogue and analogue-to-digital converters. Signal processing. ELVIS II + educational platform. Programming elements in LabVIEW. Virtual and wireless measurement systems.

MK_21B/3 Digital Signal Processing: Different methods of signal analysis and practical signal analysis in MATLAB (application of digital signal processing methods for artificially generated signals and biomedical signals ECG and EEG).

MK_21B/4 Medical Informatics: Various methods of signal and image analysis, computer systems and software at different levels of health care, telemedicine and medicine on the Internet and the possibility of practical applications.

MK_21C Knowledge Representation and Processing; to choose among:

MK_21C/1 Constructive Methods in Computer Science: The basics of the Mizar proof verification system to enable verification of various reasoning examples.

MK_21C/2 Functional Programming: Introduction to lambda calculus, acquaintance with functional programming paradigm, acquaintance with selected functional language.

MK_21C/3 Logic Programming: Introduction to logic programming paradigm, acquaintance with Prolog.

MK_21C/4 LaTeX Typesetting System: Various document classes. Fonts. Environments. Tables. Graphics. Definitions and redefinitions. Mathematical mode. Various indexes. Creating of classes and packages. Dynamic presentations.

MK_21D Modelling and Simulation; to choose among:

MK_21D/1 Computer modelling and simulation methods: The modelling phases and the methods of creating models of selected systems and their analysis using computer simulation. Creating mathematical models of systems, creating computer models using selected programming environments and conducting computer simulation of the systems' performance.

MK_21D/2 Optimization Methods: The formulation of the goal function with constraints and without constraints. The necessary and sufficient conditions of extremum. Searching extremum of goal function by numerical methods. Gradient methods. Nonlinear optimization with constraints. Square programming. Simplex method for linear optimization.

MK_21D/3 Computer Statistics: The purpose of the course is to give the student a good overview of statistical techniques that have been developed during the last years due to increasing computer capacity. Using the statistical software R.

MK_21E Applied Computer Science; to choose among:

MK_21E/1 Bioinformatics: Introduction to molecular biology. Bimolecular sequence analysis. Biological databases. Introduction to structural bioinformatics. Introduction to R and Python and their applications in bioinformatics. Biopython and Bioconductor libraries. Implementation of bioinformatics workflows in R and Python.

MK_21E/2 Digital Image Processing: Acquisition of digital images – equipment, sampling, quantization, colour representation. Methods of digital image processing: arithmetic operations, image enhancement, noise removal, edge detection, thresholding and morphological methods.

Analysis of digital images: segmentation, background generation, foreground object detection, labelling and shape coefficients. Image processing in the frequency domain, the 2D Fourier Transform. Vision systems: standards, equipment and acceleration methods.

MK_21E/3 Computer Methods in Technology: Basic concepts of computer modelling and simulation. Analysis of mathematical models. Boundary problems. Finite Difference Method (FDM). Boundary element method (BEM). Finite element method (FEM). Parametric integral equation system (PIES) as a computer method for 2D and 3D problems.

MK_21E/4 Machine Translation in Grammatical Framework: The possibilities of machine translation based on grammatical analysis with examples of its applications.

MK_21E/5 Graphics Cards Programming: Practical applications of massively parallel graphic cards for scientific computations. Programming model for massively parallel processors. Applications in machine learning algorithms.

MK_22 Apprenticeships:

Apprenticeships: Configuration of computer equipment, work on different operating systems (eg. Windows, Linux). Understanding the infrastructure of computer networks of the enterprise as well as its data protection, processing and archiving programs. Knowledge of the basic principles of teamwork, working together on projects in the enterprise software development teams.

LEARNING OUTCOMES
for the field of study Computer science
second degree study – general academic profile

Setting the field of study in discipline/scientific disciplines, which the learning outcomes refer to: *computer science, mathematics, linguistics, law, culture and religion science, economics and finance*
Identification of the leading discipline: *computer science*

Description symbol of the second degree Polish Qualification Framework (PQF) in the scope of computer science	DESCRIPTION OF THE SECOND DEGREE PQF	Symbol of the field outcome	DESCRIPTION OF THE FIELD LEARNING OUTCOMES
<p>P7S_WG</p>	<p style="text-align: center;">KNOWLEDGE, a graduate is familiar with and understands:</p> <p>Scope and depth - completeness of the cognitive perspective and dependence</p> <p><i>to an extended degree - selected facts, objects and phenomena as well as their methods and theories explaining the complex relationships between them, providing advanced general knowledge in the field of scientific or artistic disciplines that form theoretical foundations, structured and theoretically founded knowledge covering key issues and selected issues in the advanced field detailed knowledge - appropriate for the study program</i></p> <p><i>main development tendencies of scientific or artistic disciplines to which the field of study is assigned - in the case of general academic studies</i></p>	KA7_WG1	broadened and deepened knowledge about analyzing advanced algorithms and data structures
		KA7_WG2	basic knowledge of analytical and algebraic methods in IT applications
		KA7_WG3	basic knowledge about modeling and analysis of information systems architecture, as well as creating models and analyzing their quality
		KA7_WG4	basic knowledge of modeling and simulation using models of imprecision or uncertainty and the practical application of these models
		KA7_WG5	ordered and in-depth theoretical knowledge in the field of designing and programming relational databases
		KA7_WG6	basic knowledge in the field of contemporary expert systems and their applications
		KA7_WG7	deepened and structured knowledge in the field of security of digital data and information systems, including in the context of the functioning of computer networks
		KA7_WG8	basic knowledge about algorithms for massive parallel computations with the use of modern numerical methods and their implementation on multiprocessor, multi-core machines and graphics cards

		KA7_WG9 KA7_WG10	structured theoretical knowledge of information techniques and technologies used in various fields structured theoretical knowledge about methods of designing and programming applications used in various fields
P7S_WK	<p>Context - conditions, effects</p> <p><i>fundamental dilemmas of modern civilization</i></p> <p><i>economic, legal, ethical and other conditions of various types of activities related to the awarded qualification, including basic concepts and principles in the field of protection of industrial property and copyright</i></p> <p><i>basic principles of creating and developing various forms of entrepreneurship</i></p>	KA7_WK1 KA7_WK2 KA7_WK3	knowledge about development trends and new achievements in the field of computer science basic knowledge in the field of managing and managing teams implementing IT projects fundamental dilemmas of modern civilization
SKILLS, a graduate can/is able to:			
P7S_UW	<p>The use of knowledge - problems to be solved and tasks performed</p> <p><i>use acquired knowledge - formulate and solve complex and unusual problems and perform innovatively tasks in unpredictable by:</i></p> <ul style="list-style-type: none"> - <i>proper selection of sources and information from them, evaluation, critical analysis, synthesis, creative interpretation and presentation of this information</i> - <i>selection and application of appropriate methods and tools, including advanced information and communication techniques</i> - <i>adapting existing or developing new methods and tools</i> - <i>formulating and testing hypotheses related to simple research problems</i> 	KA7_UW1 KA7_UW2 KA7_UW3 KA7_UW4 KA7_UW5 KA7_UW6 KA7_UW7 KA7_UW8 KA7_UW9 KA7_UW10 KA7_UW11 KA7_UW12	construct models in a selected area of computer science and use their realization in the implementation environment, analyzing the characteristics of information systems apply basic models of imprecision or uncertainty and model practical issues using these models implement advanced dynamic data structures and advanced algorithms implement known algebra and analysis methods and make their appropriate modification depending on the applications program databases using SQL extensions plan an expert system which solves specific problems and implement it apply models and classes of information systems security as well as methods of user identification and authentication implement massive parallel processing algorithms, including in a graphic card environment use the methods and mathematical models learned, modify them if necessary, for analyzing and designing applications assess and compare design solutions and the process of programming applications using various information technologies, due to the set utility or economic criteria design and implement software for selected computer science applications use the software appropriate for selected computer science applications

		KA7_UW13	configure devices appropriate for selected computer science applications
		KA7_UW14	propose improvements to existing algorithms and applications used in various fields
		KA7_UW15	assess the suitability and the possibility of using new developments in the field of computer science
P7S_UK	<p>Communicating - receiving and creating statements, disseminating knowledge in the scientific community and using a foreign language</p> <p><i>communicate on specialist topics with diverse groups of recipients</i></p> <p><i>lead a debate</i></p> <p><i>use a foreign language at B2+ level of the Common European Framework of Reference for Languages and specialist terminology</i></p>	KA7_UK1	use a foreign language at the B2 + level with specialist terminology appropriate for computer science, allowing to express ideas, in written and oral form, on general subjects and those related to computer science
		KA7_UK2	prepare and present a presentation about a project task, research project or a selected computer science subject, leading a discussion about this presentation
		KA7_UK3	use a foreign language well enough to read and understand professional literature and communicate, including professional topics
		KA7_UK4	develop the detailed documentation of a project or research task, results of an experiment, prepare a study discussing these results
P7S_UO	<p>Work organization - planning and teamwork</p> <p><i>manage the team's work</i></p> <p><i>interact with other people as part of team work and take a leading role in teams</i></p>	KA7_UO1	manage teams implementing computer science projects
		KA7_UO2	collaborate in a team implementing joint projects
		KA7_UO3	develop an IT project, its documentation, and manage the team
P7S_UU	<p>Learning - planning one's own development and the development of others</p> <p><i>plan and implement own lifelong learning and guide others in this area</i></p>	KA7_UO4	act and think in a creative and innovative way
		KA7_UU1	acquire information from various sources (literature, websites, databases, etc.), integrate it and make its interpretation and critical assessment, draw conclusions, formulate and fully justify opinions
		KA7_UU2	understand the need for continuous training and self-education
		KA7_UU3	carefully identify the priorities and order of activities
SOCIAL COMPETENCE, a graduate is prepared for:			
P7S_KK	<p>Assessment - a critical approach</p> <p><i>critical assessment of own knowledge and received content</i></p> <p><i>recognition of the importance of knowledge in solving cognitive and practical problems and consulting experts in case of difficulties in solving a problem</i></p>	KA7_KK1	understanding the limitations of own knowledge and the need for further education, including the acquisition of non-domain knowledge
P7S_KO	<p>Responsibility - fulfilling social obligations and acting for the public interest</p>	KA7_KO1	initiating activities necessary to take up practical activity for the development of the information society

	<p><i>fulfilling social obligations, inspiring and organizing activities for the social environment</i></p> <p><i>initiating activities for the public interest</i></p> <p><i>thinking and acting in an entrepreneurial way</i></p>		
<p>P7S_KR</p>	<p>Professional role - independence and development of the ethos</p> <p><i>responsible performance of professional roles, taking into account changing social needs, including:</i></p> <ul style="list-style-type: none"> - <i>developing the profession,</i> - <i>maintaining the ethos of the profession,</i> - <i>adherence to and development of professional ethics and actions to comply with these principles</i> 	<p>KA7_KRI</p> <p>KA7_KR2</p>	<p>systematic familiarization with the latest trends in the development of information technologies through scientific and popular science magazines and websites</p> <p>appreciating the importance of intellectual honesty in own and other people's activities and the need of adherence to the principles of professional ethics</p>

Explanation of the symbols

P6S_WG – description symbol of the second degree PQF

<p>P – practical profile</p>	
<p>A – general academic profile</p>	
<p>P6 or P7 – PQF level (6 – first degree study, 7 – second degree study and uniform master degree study)</p>	
<p>S – specification typical of qualifications obtained in higher education</p>	
<p>W – knowledge (descriptive category)</p>	
<p>G – depth and extent</p>	
<p>K – context</p>	
<p>U – skills (descriptive category)</p>	
<p>W – use of knowledge</p>	
<p>K – communicating</p>	
<p>O – work organization</p>	
<p>U – learning</p>	
<p>K – social competence (descriptive category)</p>	
<p>K – critical evaluation</p>	
<p>O – responsibility</p>	
<p>R – professional role</p>	

KA6_WG1 – symbol of the field outcome

<p>K – field learning outcomes</p>	
<p>A – educational profile (A – general academic, P – practical)</p>	
<p>6 – educational level (6 – first degree study, 7 – second degree study and uniform master degree study)</p>	
<p>W – knowledge (descriptive category)</p>	
<p>G – depth and extent</p>	
<p>K – context</p>	
<p>U – skills (descriptive category)</p>	
<p>W – use of knowledge</p>	
<p>K – communicating</p>	
<p>O – work organization</p>	
<p>U – learning</p>	
<p>K – social competence (descriptive category)</p>	
<p>K – critical evaluation</p>	
<p>O – responsibility</p>	
<p>R – professional role</p>	

STUDY PROGRAMME - Part A

I GENERAL INFORMATION

1. Setting the field of studies in discipline/scientific disciplines, which the learning outcomes refer to: computer science, mathematics, linguistics, law, culture and religion science, economics and finance
2. Name of the field of study: **Computer Science**
3. Specializations offered: **Internet and Mobile Technologies**
4. Level of education: **second degree studies**
5. Educational profile: **general academic**
6. Form of study: **full-time studies**
7. A number of semesters: **4**
8. Total number of ECTS points required to achieve the equivalent level of relevant qualifications: **122**
9. Total number of teaching hours: **1080**
10. Programme accepted at the meeting of Faculty Council on 13.02.2019, effective from the academic year: 2019/2020

II. Education modules

		<i>QUANTITATIVE INDICATORS - ECTS POINTS INCLUDED IN COURSES:</i>									
Modules (module code: MK_1 and module name)	<i>Field learning outcomes</i>	<i>Teaching methods and verification</i>	<i>Courses/modules</i>	a number of ECTS points per course/module	that require direct participation of teachers or other people conducting the classes	in basic science specific for a given field of study, which learning outcomes for a given field, level and profile of education refer to	classes shaping practical skills/classes connected with scientific activity conducted at the university in discipline/disciplines, which the field of study is assigned to	in discipline of humanities or social sciences (min. 5 ECTS points) - for the fields from other discipline of science*	in a foreign language (language classes)	in apprenticeships	that are elective
MK_1, Modelling and Analysis of IT Systems	KA7_WG3, KA7_WG5, KA7_UU1, KA7_UK4, KA7_UW1, KA7_UO3, KA7_UO4, KA7_UO2, KA7_UU2	Teaching methods: lecture, laboratory and project classes. Verification: exams (written and/or oral), projects evaluation, activity evaluation.	Modelling and Analysis of IT Systems	4,0	3,0	4,0	0,0	0,0	0,0	0,0	0,0
total				4,0	3,0	4,0	0,0	0,0	0,0	0,0	0,0

MK_2 Advanced Databases	KA7_WG5, KA7_WG10, KA7_UU1, KA7_UW5, KA7_UO4, KA7_UO2, KA7_UU2	Teaching methods: lecture and laboratory classes, multimedia presentations, individual work, consultations. Verification: exams, tests, projects evaluation, activity evaluation.	Advanced Databases	4,0	2,0	4,0	4,0	4,0	0,0	0,0	0,0	0,0	0,0
MK_3 Analytic methods in Computer Science	KA7_WG2, KA7_UW4, KA7_KR1	Teaching methods: lecture and laboratory classes, exercises, consultations. Verification: exams (written and/or oral), tests, activity evaluation.	1. Analytical Methods in Computer Science 2. Analytical Geometry in Computer Graphics <i>The student chooses one of the above courses or another course from the list of elective courses with the same learning effects and ECTS scores, each proposed subject is approved by the Council responsible for the course of study on the basis of its full description according to the pattern existing on the UwB. The course can be run in a foreign language.</i>	4,0	2,0	2,0	2,0	2,0	0,0	0,0	0,0	0,0	4,0
MK_4 Global Optimization	KA7_WG9, KA7_WK1, KA7_UW1, KA7_UW9, KA7_UW11, KA7_UW12, KA7_UO4, KA7_UO2	Teaching methods: lecture and laboratory classes, multimedia presentations. Verification: exams (written and/or oral), projects evaluation, problems solving, activity evaluation.	Global Optimization	4,0	2,0	4,0	4,0	4,0	0,0	0,0	0,0	0,0	0,0
			total	4,0	2,0	4,0	4,0	4,0	0,0	0,0	0,0	0,0	0,0
			total	4,0	2,0	2,0	2,0	2,0	0,0	0,0	0,0	0,0	4,0
			total	4,0	2,0	4,0	4,0	4,0	0,0	0,0	0,0	0,0	0,0

Advanced Object-Oriented Programming MK ₁₅	KA7_WG9, KA7_WG10, KA7_UW3, KA7_UW11, KA7_UO2	Teaching methods: lecture and project classes, consultations Verification: exams (written and/or oral), projects evaluation, problems solving, activity evaluation.	1. Advanced Object-Oriented Programming in C++ 2. Advanced Object-Oriented Programming in Java <i>Student chooses one of the above courses or another course from the list of elective courses with the same learning effects and ECTS scores, each proposed subject is approved by the Council responsible for the course of study on the basis of its full description according to the pattern existing on the Uwb. The course can be run in a foreign language.</i>	4,0	2,0	4,0	4,0	4,0	4,0	0,0	0,0	4,0
			total	4,0	2,0	4,0	4,0	4,0	4,0	0,0	0,0	4,0
Multimedia Techniques MK ₆	KA7_WG9, KA7_WG10, KA7_WK1, KA7_UU1, KA7_UW11, KA7_UW12, KA7_UW13, KA7_UO4, KA7_UU2, KA7_KR1	Teaching methods: traditional methods: lecture, presentation, demonstration, activating methods: classical exercises, simulation exercises, discussion, case study. Verification: exams (written and/or oral), paper, report, problems solving, activity evaluation.	Multimedia Techniques	4,0	2,0	4,0	4,0	4,0	4,0	0,0	0,0	0,0
Projects of Web Application MK ₇	KA7_WG10, KA7_WK1, KA7_UW11, KA7_UW12, KA7_UW14, KA7_UW15, KA7_KR1	Teaching methods: lecture, presentation, project classes that require creation of prototype and testing its functionality Verification: exams (written and/or oral), projects evaluation, activity evaluation.	Internet Applications Design	4,0	2,0	4,0	4,0	4,0	4,0	0,0	0,0	0,0
			total	4,0	2,0	4,0	4,0	4,0	4,0	0,0	0,0	0,0

KA7_WG2, KA7_WG9, KA7_WG10, KA7_WK1, KA7_UU1, KA7_UW4, KA7_UW15, KA7_UO4, KA7_UO2, KA7_UU2, KA7_KR1	Algebraic Methods in Computer Science MK_8,	Teaching methods: lecture, exercises, project as homework. Verification: exams (written and/or oral), projects evaluation, tests, activity evaluation.	Algebraic Methods in Computer Science	4,0	2,0	2,0	2,0	2,0	2,0	0,0	0,0	0,0	0,0
total													
KA7_WG4, KA7_UW2, KA7_UO4, KA7_UU2, KA7_KR1	Introduction to Fuzzy Modelling and Analysis MK_9,	Teaching methods: lecture, laboratory classes, consultations. Verification: exams (written and/or oral), tests, activity evaluation.	Introduction to Fuzzy Modelling and Analysis	4,0	2,0	4,0	4,0	4,0	4,0	0,0	0,0	0,0	0,0
total													
KA7_WG6, KA7_WK1, KA7_UW6, KA7_UW15, KA7_UO4	Expert Systems MK_10,	Teaching methods: lecture, laboratory classes, presentation, discussion. Verification: exams (written and/or oral), project evaluation, problems solving, activity evaluation.	Expert Systems	3,0	2,0	3,0	3,0	3,0	3,0	0,0	0,0	0,0	0,0
total													
KA7_WG8, KA7_WG9, KA7_WK1, KA7_UW8, KA7_UW11, KA7_UW12, KA7_UW13, KA7_UW14, KA7_UW15, KA7_UO4, KA7_UU2, KA7_KR1	Massive Parallel Computing MK_11,	Teaching methods: lecture, laboratory classes, consultations. Verification: exams (written and/or oral), problems solving, activity evaluation.	Massive Parallel Computing	4,0	2,0	4,0	4,0	4,0	4,0	0,0	0,0	0,0	0,0
total													

MK_12 XML Technologies in Programming	KA7_WG10, KA7_WK1, KA7_UW11, KA7_UW15, KA7_UU2	Teaching methods: lecture, laboratory classes, discussion, presentation, case study. Verification: exams (written and/or oral), tests, evaluation of laboratory work, activity evaluation.	XML Technologies in Programming	4,0	2,0	4,0	4,0	4,0	4,0	0,0	0,0	0,0
				total	4,0	2,0	4,0	4,0	4,0	0,0	0,0	0,0
MK_13, Multimedia Systems	KA7_WG10, KA7_WK1, KA7_UW11, KA7_UW12, KA7_UW15, KA7_UO4, KA7_UU2	Teaching methods: lecture, laboratory classes, presentation, discussion. Verification: exams (written and/or oral), evaluation of created system, problems solving, activity evaluation.	1. Adaptive Internet Multimedia Systems 2. Intelligent Multimedia Teaching systems <i>Student chooses one of the above courses or another course from the list of elective courses with the same learning effects and ECTS scores, each proposed subject is approved by the Council responsible for the course of study on the basis of its full description according to the pattern existing on the UwB. The course can be run in a foreign language.</i>	4,0	2,0	4,0	4,0	4,0	4,0	0,0	0,0	4,0
				total	4,0	2,0	4,0	4,0	4,0	0,0	0,0	0,0
MK_14, E-learning Systems	KA7_WG9, KA7_WG10, KA7_WK1, KA7_UW11, KA7_UW15, KA7_UO4, KA7_UU2	Teaching methods: lecture, presentation, discussion, project classes, case study. Verification: exams, evaluation of created e-learning course, problems solving, activity evaluation.	E-learning Systems	3,0	2,0	3,0	3,0	3,0	3,0	0,0	0,0	0,0
				total	3,0	2,0	3,0	3,0	3,0	0,0	0,0	0,0

MK_15, Mobile Technologies	KA7_WG9, KA7_WK1, KA7_UW12, KA7_UW13, KA7_UO4, KA7_UU2, KA7_KR1	Teaching methods: lecture, laboratory classes. Verification: exams (written and/or oral), report, activity evaluation.	Mobile Technologies	3.0	2.0	3.0	3.0	3.0	0.0	0.0	0.0
total											
MK_16, Security of Data and IT Systems	KA7_WG7, KA7_UW7, KA7_UW10, KA7_UW12, KA7_KR1	Teaching methods: lecture, laboratory classes, consultation. Verification: exams, tests, activity evaluation.	Security of Data and IT Systems	4.0	2.0	4.0	2.0	4.0	0.0	0.0	0.0
MK_17, Advanced Algorithms and Data Structures	KA7_WG1, KA7_UU1, KA7_UK4, KA7_UW3, KA7_UO4, KA7_UU2	Teaching methods: lecture, laboratory classes, case study. Verification: exams, paper, problems solving, activity evaluation.	Advanced Algorithms and Data Structures	4.0	2.0	4.0	4.0	2.0	0.0	0.0	0.0
total											
MK_18, Internet Data Analysis	KA7_WK1, KA7_UW11, KA7_UW12, KA7_UW15, KA7_UO4, KA7_UU2, KA7_UU3, KA7_KR1, KA7_KR2	Teaching methods: lecture, laboratory classes, presentation, discussion, case study. Verification: exams, tests, problems solving, activity evaluation.	Internet Data Analysis	3.0	2.0	3.0	4.0	3.0	0.0	0.0	0.0
total											
MK_19, Internet Frameworks	KA7_WG10, KA7_WK1, KA7_UW11, KA7_UW15, KA7_UO4	Teaching methods: lecture, individual laboratory classes, presentation, discussion, project classes, consultations. Verification: exams (written and/or oral), project evaluation, evaluation of laboratory work, activity evaluation.	Internet Frameworks	4.0	2.0	4.0	4.0	4.0	0.0	0.0	0.0
total											

MK_24	Intellectual Property Rights	KA7_KR2	Teaching methods: lecture, discussion. Verification: exams (written and/or oral).	Intellectual Property Rights	1,0	1,0	0,0	0,0	0,0	0,0	0,0	0,0
				total	1,0	1,0	0,0	0,0	0,0	0,0	0,0	0,0
MK_25	Foreign language	KA7_UK1, KA7_UK2, KA7_UK3, KA7_UK4, KA7_UU1, KA7_UU2, KA7_KR1	Teaching methods: exercises, consultations, work on literature, solving homework tasks, discussion in problem groups. Practical exercises for all language skills: speaking, writing, reading, listening. Verification: exams (written and/or oral), tests, project evaluation, papers, activity evaluation, self-evaluation of learning outcomes.	1. English 2. Russian 3. German 4. Polish (only for foreign students) <i>Student choose one of the above courses</i>	2,0	1,0					2,0	2,0
				English for IT Professionals	2,0	1,0					2,0	2,0
				total	4,0	2,0	0,0	0,0	0,0	0,0	4,0	2,0
MK_26	M.Sc. Diploma Seminar	KA7_UK1, KA7_UU1, KA7_UK2, KA7_UK3, KA7_UU2, KA7_UU3, KA7_KR1, KA7_KK1	Teaching methods: seminar classes, presentations, papers. Verification: presentation of assumptions and achieved results of thesis, evaluation of degree of thesis preparation, activity evaluation.	1. M. Sc. Diploma Seminar 1 2. M. Sc. Diploma Seminar 2 <i>Student attends both seminars. Thematic seminars - student chooses the subject from the list proposed by the labs / departments.</i>	6,0	4,0	6,0				3,0	6,0
				total	6,0	4,0	6,0	0,0	0,0	0,0	3,0	6,0
MK_27	M.Sc. Diploma Preparation Class	KA7_UU1, KA7_UK4, KA7_UO2, KA7_KR1	Teaching methods: presentations, consultations, own work. Verification: presentation of assumptions and achieved results of thesis, evaluation of degree of thesis preparation, activity evaluation.	1. M. Sc. Diploma Preparation Class 1 2. M. Sc. Diploma Preparation Class 2 <i>Student attends both workshops. Student chooses the master thesis supervisor</i>	22,0	7,0	22,0				0,0	22,0
				total	22,0	7,0	22,0	0,0	0,0	0,0	0,0	22,0
				TOTAL NUMBER OF ECTS points for ALL MODULES	122,0	62,0	108,0	72,0	5,0	7,0	0,0	47,0

* refers to the fields that are not assigned to the disciplines of humanities or social sciences

III PROPORTIONAL INDICATORS (percentage)

1. Percentage share of ECTS points for the classes that require direct participation of teachers or other people conducting classes:		50,82%
2. Percentage share of ECTS points earned for elective modules (min. 30%).		38,52%
3. Percentage share of ECTS points earned for the classes conducted in a foreign language (in a total number of ECTS points envisaged by the study programme):		100,00%
4. Percentage share of ECTS points earned for the modules of classes shaping practical skills for practical educational profiles (above 50%):		not applicable
5. Percentage share of ECTS points earned for the modules of classes connected with scientific activity conducted at the university in discipline/disciplines, to which the field of study is assigned for general academic profile (above 50%):		59,02%
6. Percentage shares of individual (all) discipline of science, which the study programme refers to:	computer science	88,52%
	mathematics	3,28%
	linguistics	3,28%
	law	0,82%
	culture and religion science	1,64%
	economics and finance	2,46%

IV CONDITIONS OF GRADUATION AND CONFERRED PROFESSIONAL TITLE

Graduating with the Master's Degree professional title requires completing all obligatory courses in the study programme, preparing a dissertation (master's) and passing a diploma examination (master's).

STUDY PROGRAMME - Part B

1. *Name of the field of study:* **Computer Science**
2. *Level of education:* **second degree studies**
3. *Educational profile:* **general academic**
4. *Specialization:* **Internet and Mobile Technologies**

Programme accepted at the meeting of Faculty Council on 13.02.2019, effective from the academic year: 2019/2020

MODULES' PROGRAMME CONTENT

MK_1 Modelling and Analysis of IT Systems:

Modelling and Analysis of IT Systems: Business and object-oriented modelling methods of IT systems. UML modelling of IT system requirements, statics and dynamics. Principles of choice UML diagrams and recording of connections between their elements. Realisation of selected UML constructions in object-oriented programming languages.

MK_2 Advanced Databases:

Advanced Databases: Introduction to PL/SQL. Language rules. Data types. Blocks. Variables and their scope. Conditional instructions. Loops. SQL in PL/SQL. Records. Cursors. Collections. Exceptions. Creating and using procedures, functions and packages. Triggers. Dynamic SQL: NDS and DBMS_SQL. Introduction to PL/SQL objects.

MK_3 Analytic Methods in Computer Science:

MK_3/1 Analytical methods in computer science: Analytical methods in computer science: Linear space, projective space. Distance, non-Euclidean geometry. Length, volume. Pseudorandom number generators. Monte-Carlo simulations convergence. Probabilistic measures, generating functions, Fourier transform. Classes supported by CAS.

MK_3/2 Analytical geometry in computer graphics: Finite dimensional linear spaces, linear transformations. Spherical geometry - complex numbers - quaternions. Projective space, cross-ratio, distances. Bernstein polynomials approximation. Examples in: PostScript (Ghostscript), gnuplot (supported by CAS).

MK_4 Global Optimization:

Global Optimization: Genetic algorithm. Travelling salesman problem. Evolution strategies. Randomized algorithm of „lonely seeker“; simulated annealing; tabu-search; ant colony optimization algorithm; particle swarm optimization; artificial immune systems; clonal selection; applications of evolutionary algorithms.

MK_5 Advanced Object-Oriented Programming:

MK_5/1 Advanced Object-Oriented Programming in C++: Advanced methods of object-oriented programming, STL.

MK_5/2: Advanced Object-Oriented Programming in Java: a Reminder to the Object-Oriented paradigm. Reflection. Annotations - using existing and creating new ones. Creating client / server applications using RMI technology. Using code written in other languages - JNI.

MK_6 Multimedia Techniques:

Multimedia Techniques: Multimedia as the form of communicating – applications of multimedia. Multimedia devices. Internet transmission of the image and sound in the real time – videoconferences. Compression of multimedia data. Entropy. Redundancy. Lossy compression – JPEG standard, MPEG Video, MPEG Audio. Lossless compression – Huffman method, structure of Huffman tree. Dictionary methods (LZ). Coding systems of the graphics, audio, video – formats. Digital recording and processing of sound and sequence of video. Computer animations, „video capturing“. Multimedia applications, tutorials.

MK_7 Projects of Web Application:

Internet Applications Design: Website design based on Internet standards. Web usability. User-oriented design. Recommendations for the design of individual parts of the website: homepage, forms, links, etc. Web page navigation design. Advertising and web usability, typography, formatting and web usability, color and web usability. Web usability testing tools. Designing useful error handling. Designing forms. Methods and objectives of prototyping. Examples of mock-ups, prototypes and personae. Prototyping tools. Testing the usability and functionality of web pages. Design for different target groups (including disabled people). Designing multi-lingual pages. Designing applications for mobile devices.

MK_8 Algebraic Methods in Computer Science:

Algebraic methods in computer science: Selected algebraic methods needed in the field of computer science, especially in coding theory and cryptography. Basic algebraic structures and theorems in algebra used in cryptographic algorithms

MK_9 Introduction to Fuzzy Modelling and Analysis:

Introduction to Fuzzy Modelling and Analysis: Fuzzy sets. Fuzziness and randomness. Types of membership functions of fuzzy sets. Arithmetic operations on fuzzy numbers. Extension principle. Basic fuzzy models. Fuzzy neural models. Fuzzy control using fuzzy models.

MK_10 Expert Systems:

Expert Systems: Architecture of an expert system (ES). Applications of ES. Methods of knowledge representation in ES. Methods of acquisition of knowledge to ES. Methods of the inference. Influence of the uncertainty on functioning system based on the knowledge. Hybrid systems. Characteristics of programming languages for creating ES.

MK_11 Massive Parallel Computing:

Massive parallel computing: Programming algorithms methods in massive parallel computing. Parallel computing using graphic cards in CUDA environment. Architecture of parallel computer systems. Numerical libraries. Parallel algorithms for solving systems of linear equations. Monte-Carlo calculations and simulations. Multidimensional numerical integrations.

MK_12 XML Technologies in Programming:

XML Technologies in Programming: Description of XML language. Syntactical and structural correctness of XML document. DTD. XML Schema. Supplementing languages XML. Presentation of content in XML - cascading stylesheets. Examples of XML applications. Transformations of XML documents and paths in transformations - XSLT and XPath. Object model of XML document. Syntactic analysis.

MK_13 Multimedia Systems:

MK_13/1 Adaptive Internet Multimedia Systems: The idea and structure of the system adapting itself to the needs of user. Individualization of the needs of a learner. Styles of learning and their classifications. Strategies of teaching and their computer representations. Selection of the strategy of teaching to the learning style. Tools for creating adaptive systems.

MK_13/2 Intelligent Multimedia Teaching systems: The idea and structure of the intelligent systems. Individualization of the needs of a learner. Styles of learning and their classifications. Strategies of teaching and their computer representations. Selection of the strategy of teaching to the learning style. Tools for creating intelligent systems.

MK_14 E-learning Systems: E-learning Systems: Architecture and models of e-learning systems. Stages of constructing the course. Principles of preparation of teaching materials. Communication and information flow in e-learning. E-learning platforms. Testing knowledge in e-learning. Tools that allow remote experiments.

MK_15 Mobile Technologies:

Mobile Technologies: Positioning and navigation of mobile users. Global positioning systems. Cellular systems. Wireless communication systems. Complex mobile processing problems. Wireless Local Area Networks. Mobile SDKs in various operating systems. Configuration and securing of wireless networks.

MK_16 Security of Data and IT Systems:

Security of Data and IT Systems: Data security digital systems and threats to information systems in the context of confidentiality, integrity and availability of information. Basics of cryptography. Theoretical and practical issues regarding data security in the context of the functioning of computer networks.

MK_17 Advanced Algorithms and Data Structures:

Advanced Algorithms and Data Structures. Advanced graph algorithms: all-pairs shortest paths, flow networks. String matching algorithms. Advanced data structures. Approximation algorithms. Parallel algorithms.

MK_18 Internet Data Analysis:

Internet Data Analysis: Types of data. Review of qualitative analyses. Analysis of quantitative data. Tests. Analysis of competitiveness. Analyses of flow of users. New forms of analyses: social portals, mobile services and video contents. Software supporting internet data analysis.

MK_19 Internet Frameworks:

Internet Frameworks: Introduction to internet frameworks. Network templates - Smarty and PHPTAL. Architectural design pattern MVC. Object-Relational Mapping ORM. Review of the most popular internet frameworks.

MK_20 Mobile Applications Programming:

Mobile Applications Programming: Mobile operating systems, responsive web design in mobile applications, native mobile applications, and hybrid mobile applications. Features of mobile operating systems. Mobile networks, wireless LAN, NFC, Bluetooth, accelerometer, touch screen. Responsive mobile web applications address the mobile aspects of HTML5, CSS3, JavaScript, libraries, and front-end frameworks such as jQuery, jQuery Mobile, AngularJS, Bootstrap, Semantic UI. Native mobile applications include APIs for operating systems such as Android, iOS, and Windows Phone. Hybrid mobile applications complement the above content with the PhoneGap and Apache Cordova frameworks.

MK_21 Network Programming:

Network Programming: Implementing client-server types of applications in popular programming languages. Methods of implementing web services using selected tools and technologies. The working and configuration of a J2EE application server, e.g. Apache Tomcat. Programming Java servlets and Java Server Pages. Communication in heterogeneous networks using the SOAP standard. Definition and description of network services in the WSDL format. Practical application of main network programming technologies.

MK_22 Management of IT Projects:

Management of IT Projects: life cycle, success rate and project plan. Task assignments and selection of team members. Management of: user requirements, risk and budget. Project schedule development. Tracking progress, Earned Value method. Documentation. Testing. Implementation of project. End user training. Warranty and Maintenance.

MK_23 Humanities and Social Sciences Courses:

MK_23/1 Course to choose from humanities: Student chooses one of the courses from the list of humanities approved by the Faculty Council on the basis of its full description according to the pattern existing on the University of Bialystok.

MK_23/2 Course to choose from social sciences: The student chooses one of the courses from the list of social sciences courses approved by the Faculty Council on the basis of its full description according to the pattern existing on the University of Bialystok.

MK_24 Intellectual Property Rights: Protection intellectual property: those - basic concepts and problems. Protection of the secret. Protection of the artistic work. Protection of inventions. Protection from a creative and legal point of view of works of students. Copyright in digital technologies. Administering the intellectual property in the college and the enterprise. Comprehending the technology transfer.

MK_25 Foreign language:

MK_25/1 English: Every day use of foreign language (travel, mass media and other means of communication, global issues, education), understanding and applying IT terminology (electronic devices, IT data security, communication systems, computer engineering, development of information techniques).

MK_25/2 Russian: Every day use of foreign language (travel, mass media and other means of communication, global issues, education), understanding and applying IT terminology (electronic devices, IT data security, communication systems, computer engineering, development of information techniques).

MK_25/3 German: Every day use of foreign language (travel, mass media and other means of communication, global issues, education), understanding and applying IT terminology (electronic devices, IT data security, communication systems, computer engineering, development of information techniques).

MK_25/4 Polish: Every day use of foreign language (travel, mass media and other means of communication, global issues, education), understanding and applying IT terminology (electronic devices, IT data security, communication systems, computer engineering, development of information techniques).

MK_25/5 English for IT Professionals: The use of a foreign language in work by IT professionals, the ability to understand and use advanced IT terminology (computer networks, operating systems, electronic devices, data and computer systems security, communication systems, computer engineering, development of information technology).

MK_26 M.Sc. Diploma Seminar:

MK_26/1 M.Sc. Diploma Seminar 1: Students give talks related to the seminar topics and their master theses. They present their research results and elaborated possible examination questions. The seminar topics are adequate to the topics of students' master theses.

MK_26/2 M.Sc. Diploma Seminar 2: Students give talks related to the seminar topics and their master theses. They present their research results and elaborated possible examination questions. The seminar topics are adequate to the topics of students' master theses.

MK_27 M. Sc. Diploma Preparation Class:

MK_27/1 M. Sc. Diploma Preparation Class 1: Directing the student to develop and write a thesis. Description justifying the purpose of the thesis, the description of the current state of knowledge related to the topic of work, searching for information in the literature, also in foreign languages, planning, conducting and critical assessment of experiments, presentation of research results of independent own work. Contents are selected subject to ongoing theses.

MK_27/2 M. Sc. Diploma Preparation Class 2: Directing the student to develop and write a thesis. Description justifying the purpose of the thesis, the description of the current state of knowledge related to the topic of work, searching for information in the literature, also in foreign languages, planning, conducting and critical assessment of experiments, presentation of research results of independent own work. Contents are selected subject to ongoing theses.

Item	MODULE NAME/COURSE NAME	USOS course code	ECTS	exam after the semester	credit after the semester	Number of classes												1 year									
																		1 sem.		2 sem.		3 sem.		4 sem.			
						N TOTAL	LECTURES	CLASSES	TUTORIALS	LABORATORIES	LABORATORIES - PROJECT	FOREIGN LANGUAGE COURSES	SEMINARS / PROSEMINARS	FIELD CLASSES	LECTURES	CLT/LF/SaP/FC	ECTS	LECTURES	CLT/LF/SaP/FC	ECTS	LECTURES	CLT/LF/SaP/FC	ECTS				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
MODULE 12 XML Technologies in Programming																											
1	XML Technologies in Programming	0600-IS2-1TXWP#a	4		2	45	15			30								15	30	4							
	TOTAL		4			45	15			30								15	30	4							
MODULE 13 Multimedia System																											
1	Elective Course 1 ¹⁾		4		2	30	15			15								15	15	4							
	TOTAL		4			30	15			15								15	15	4							
MODULE 14 E-learning Systems																											
1	E-learning Systems	0600-IS2-1SZE#a	3	2		30	15			15								15	15	3							
	TOTAL		3			30	15			15								15	15	3							
MODULE 15 Mobile Technologies																											
1	Mobile Technologies	0600-IS2-1TMO#a	3		2	30	15			15								15	15	3							
	TOTAL		3			30	15			15								15	15	3							
MODULE 16 Security of Data and IT Systems																											
1	Security of Data and IT Systems	0600-IS2-2BDS#a	4	3		45	15			30								15	30	4							
	TOTAL		4			45	15			30								15	30	4							
MODULE 17 Advanced Algorithms and Data Structures																											
1	Advanced Algorithms and Data Structures	0600-IS2-2ZASD#a	4	3		45	30			15								30	15	4							
	TOTAL		4			45	30			15								30	15	4							
MODULE 18 Internet Data Analysis																											
1	Internet Data Analysis	0600-IS2-2ADI#a	3	3		30	15			15								15	15	3							
	TOTAL		3			30	15			15								15	15	3							
MODULE 19 Internet Frameworks:																											
1	Internet Frameworks	0600-IS2-2PFI#a	4	3		45	15			30								15	30	4							
	TOTAL		4			45	15			30								15	30	4							
MODULE 20 Mobile Applications Programming																											
1	Mobile Applications Programming	0600-IS2-2PAM#a	4	3		45	15			15	15							15	30	4							
	TOTAL		4			45	15			15	15							15	30	4							
MODULE 21 Network Programming																											
1	Network Programming	0600-IS2-2PSS#a	4	3		45	15			30								15	30	4							
	TOTAL		4			45	15			30								15	30	4							
MODULE 22 Management of IT Projects																											
1	Management of IT Projects	0600-IS2-2ZPI#a	4	4		30	15			15								15	15	4							
	TOTAL		4			30	15			15								15	15	4							
MODULE 23 Humanities and Social Sciences Courses*																											
1	Course to choose from humanities		2	3		10	10																				
2	Course to choose from social sciences		3	4		25	10			15																	
	TOTAL		5			35	20			15																	
MODULE 24 Intellectual Property Rights																											
1	Intellectual Property Rights	0600-IS2-1OWI#a	1	1		10	10											10		1							
	TOTAL		1			10	10											10		1							

Item	MODULE NAME/COURSE NAME	USCS course code	ECTS	exam after the semester	credit after the semester	Number of classes											I year										
						IN TOTAL	LECTURES	CLASSES	TUTORIALS	LABORATORIES	LABORATORIES - PROJECT	FOREIGN LANGUAGE COURSES	SEMINARS / PROSEMINARS	FIELD CLASSES	1 sem.	2 sem.	3 sem.	4 sem.									
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	
MODULE 25 Foreign language																											
1	Foreign language		2		1	30					30	30			2												
2	English for IT Professionals	0600-IS2-1JA1T	2		2	30					30	30			2												
	TOTAL		4			60					60	60			2												
MODULE 26 M.Sc. Diploma Seminar																											
1	M.Sc. Diploma Seminar 1	0600-IS2-2SM1#a	3		3	30						30										30	3				
2	M.Sc. Diploma Seminar 2	0600-IS2-2SM2#a	3		4	30						30													30	3	
	TOTAL		6			60						60										30	3		30	3	
MODULE 27 M. Sc. Diploma Preparation Class																											
1	M. Sc. Diploma Preparation Class 1	0600-IS2-2PM1#a	2		3	15			15														15	2			
2	M. Sc. Diploma Preparation Class 2	0600-IS2-2PM2#a	20		4	45			45																45	20	
	TOTAL		22			60			60														15	2		45	20
IN TOTAL						1080	390	60	435	75	60	60	115	195	31	135	195	31	115	195	30	25	105	30			

no. of exams/cred.

1	8	2	7	4	5	1	3
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* course realized within the faculty's offer

1) List of courses at the study programme - Part A