Table of references of learning outcomes for the study programme to:

- universal characteristics of PQF level one, at level 6 for first-cycle students/at level 7 for second-cycle degree programmes, laid down in an annex to the Act on Integrated Qualifications System (Journal of Acts of 2020, item 226) – "Reference – symbol",

- characteristics of PQF level two, at level 6 for first-cycle students/at level 7 for second-cycle degree programmes, laid down in the regulation on level two characteristics at levels 6-8 of the Polish Qualifications Framework (Journal of Acts of 2018, item 2218) – "Reference – symbol I".

No.	Symbol of the learning outcome for the study programme	Learning outcomes	Reference-symbol I/III	Reference - symbol
1	*2*	*3*	*4*	*5*
Knowledge				
1	I1A_W01	Has knowledge of mathematics – covering mathematical analysis, algebra, discrete mathematics, logic and set theory, statistics and numerical methods – useful when formulating and solving simple tasks related to computer science.	I.P6S_WG.o	P6U_W
2	I1A_W02	Has knowledge of classical physics and basics of relativistic and quantum physics.	I.P6S_WG.o	P6U_W
3	I1A_W03	Has structured, theoretically founded knowledge of theory and models of information, data transmission, computer networks, network technologies, including wireless ones.	I.P6S_WG.o III.P6S_WG	P6U_W
4	I1A_W04	Has structured, theoretically founded general knowledge of architecture of computer systems, operating systems and embedded systems.	I.P6S_WG.o III.P6S_WG	P6S_W
5	I1A_W05	Has structured, theoretically founded detailed knowledge of computational models, algorithms and data structures used when designing IT solutions and strategy of designing algorithms and evaluation of computational complexity.	I.P6S_WG.o	P6U_W
6	I1A_W06	Knows basic models and techniques of artificial intelligence and their applications.	I.P6S_WG.o	P6U_W
7	I1A_W07	Has structured, theoretically founded knowledge of computer graphics and digital signal representation, their analysis and processing.	I.P6S_WG.o	P6U_W
8	I1A_W08	Has structured, theoretically founded detailed knowledge of programming languages and paradigms, object-oriented design and programming, use of components, architectural patterns, programming environments, tools and best practices.	I.P6S_WG.o III.P6S_WG	P6U_W

No.	Symbol of the learning outcome for the study programme	Learning outcomes	Reference-symbol I/III	Reference - symbol
1	*2*	*3*	*4*	*5*
9	I1A_W09	Has structured, theoretically founded detailed knowledge of databases, their design, optimization and use in the life cycle of IT projects.	I.P6S_WG.o III.P6S_WG	P6U_W
10	I1A_W10	Has structured, theoretically founded detailed knowledge of design and development of complex IT systems that cover business and hardware constraints and user expectations related to human-machine communication (UI/UX).	I.P6S_WG.o III.P6S_WG	P6U_W
11	I1A_W11	Has structured, theoretically founded detailed knowledge of software engineering, processes occurring in the life cycle of IT systems, analysis and formulation of functional and non-functional requirements of IT projects, methodology of software testing and deployment, ensuring efficiency and reliability of information systems.	I.P6S_WG.o III.P6S_WG	P6U_W
12	I1A_W12	Understands fundamental dilemmas of modern civilization, especially those related to the evolution of information technologies.	I.P6S_WK	P6U_W
13	I1A_W13	Has basic knowledge necessary to understand economic, legal, ethical and other constraints of engineering activity, including knowledge of industrial property, copyright and related rights.	I.P6S_WK III.P6S_WK	P6U_W
14	I1A_W14	Has basic knowledge of management and running a business activity, knows the rules of setting up and developing various forms of enterprise.	I.P6S_WK III.P6S_WK	P6U_W
Skills				
1	I1A_U01	Can acquire information from literature, databases and other sources, integrate them, interpret them and draw conclusions and formulate opinions.	I.P6S_UW.o III.P6S_UW.o	P6U_U
2	I1A_U02	Can use the acquired mathematical knowledge of process description, model design and algorithm creation to design IT systems and solve engineering tasks.	I.P6S_UW.o III.P6S_UW.o	P6U_U
3	I1A_U03	Can use the knowledge of mathematics and theoretical foundations of IT to analyse, evaluate and optimize hardware and software solutions.	I.P6S_UW.o III.P6S_UW.o	P6U_U
4	I1A_U04	Can plan and conduct experiments, including computer measurements and simulations, interpret the	I.P6S_UW.o III.P6S_UW.o	P6U_U

No.	Symbol of the learning outcome for the study programme	Learning outcomes	Reference-symbol I/III	Reference - symbol
1	*2*	*3*	*4*	*5*
		obtained results and draw conclusions.		
5	I1A_U05	Can use simulation and experimental methods, including prototyping, to formulate and solve IT tasks.	I.P6S_UW.o III.P6S_UW.o	P6U_U
6	I1A_U06	Can conduct a simple analysis of the behaviour of an IT system and evaluate existing IT solutions in terms of their quality and correctness.	I.P6S_UW.o III.P6S_UW.o	P6U_U
7	I1A_U07	Can design IT systems and solve engineering tasks related to hardware, system software and network technologies.	I.P6S_UW.o III.P6S_UW.o	P6U_U
8	I1A_U08	Can design and implement algorithms and can evaluate the computational complexity of algorithms and problems.	I.P6S_UW.o III.P6S_UW.o	P6U_U
9	I1A_U09	Can apply artificial intelligence models and techniques relevant to a given task.	I.P6S_UW.o III.P6S_UW.o	P6U_U
10	I1A_U10	Can program in various programming languages, for various programming and hardware platforms and use various IT techniques and tools.	I.P6S_UW.o III.P6S_UW.o	P6U_U
11	I1A_U11	Can use at least one of the most popular database management systems to store and analyse data.	I.P6S_UW.o III.P6S_UW.o	P6U_U
12	I1A_U12	Can design, implement and verify IT solutions, in particular multilayer, mobile, graphical applications, communicating with database management systems, using appropriately selected methods, techniques, tools and technologies.	I.P6S_UW.o III.P6S_UW.o	P6U_U
13	I1A_U13	Can develop software according to defined functional and non-functional requirements, test the obtained solution, implement and maintain it, using relevant methods, techniques, tools and technologies.	I.P6S_UW.o III.P6S_UW.o	P6U_U
14	I1A_U14	Can notice social, economic and legal aspects, and make an initial economic analysis of the proposed technical solutions and undertaken engineering activities, when formulating and solving IT tasks.	I.P6S_UW.o III.P6S_UW.o	P6U_U
15	I1A_U15	Can communicate and discuss in the professional environment and other environments, provide arguments and evaluate opinions in a professional way, using specialist terminology and various means	I.P6S_UK	P6U_U

No.	Symbol of the learning outcome for the study programme	Learning outcomes	Reference-symbol I/III	Reference - symbol
1	*2*	*3*	*4*	*5*
		of communication.		
16	I1A_U16	Uses a foreign language at a level allowing to communicate (B2 level of the Common European Framework of Reference), to read and understand texts and present a problem in the studied field.	I.P6S_UK	P6U_U
17	I1A_U17	Can plan and organize individual work and in an IT team and collaborate in interdisciplinary teams.	I.P6S_UO	P6U_U
18	I1A_U18	Can plan and execute further learning.	I.P6S_UU	P6U_U
Social competence				
1	I1A_K01	Is prepared to critically evaluate the acquired knowledge, its validity and usefulness.	P6S_KK	P6U_K
2	I1A_K02	Understands the importance of mathematics in the field of IT, recognizes the importance of knowledge as a key element when solving cognitive and practical problems and uses experts' opinions.	P6S_KK	P6U_K
3	I1A_K03	Understands economic, social and other non-technical aspects and results of engineering work, knows the value of interdisciplinary cooperation and is aware of the responsibility for the impact of IT systems on the social environment and public interest.	P6S_KO	P6U_K
4	I1A_K04	Is prepared to carry out projects of social, scientific, research, programming and deployment character.	P6S_KO	P6U_K
5	I1A_K05	Is prepared to think and act in an entrepreneurial way.	P6S_KO	P6U_K
6	I1A_K06	Understands the need for professional conduct, in particular care for the achievements and traditions of the profession and following the rules of professional ethics.	P6S_KR	P6U_K

2. Methods of verification and assessment of the learning outcomes achieved by the student during the whole education cycle *(include also internships if foreseen)*:

- Formative assessment during the semester – scoring assessment of tests, scoring assessment of tasks done in laboratories, scoring assessment of homework, including IT projects, scoring assessment of participation in tutorials;
- Summative assessment – grade for a written test or examination consisting of solving tasks or explaining issues posed in the form of questions;
- Assessment of outcomes achieved during a student internship – credit awarded by the dean for student

affairs or proxy for internships based on a student's report on the completed internship;

- Assessment of learning outcomes during the diploma award proceedings – grade for the diploma thesis, grade for the diploma examination.

The methods of verifying the achievement of learning outcomes used by teachers depend on the form of conducting classes. Detailed information on the methods of evaluation of learning outcomes is included in the Course Sheet.