PROGRAMME OF STUDY FOR FIRST-CYCLE PROGRAMME – COMPUTER SCIENCE for the 2021/2022 enrolment

1. **FACULTY OF TECHNICAL SCIENCES**

2. **FIELD OF STUDY:** COMPUTER SCIENCE

3. **FORM OF STUDY:** FULL-TIME STUDIES

4. **PROFESSIONAL TITLE GRANTED TO GRADUATES:** INŻYNIER (B.Eng)

5. **EDUCATIONAL PROFILE:** PRACTICAL

6. **ASSIGNMENT TO THE AREAS OF SCIENCE:** ENGINEERING AND TECHNICAL SCIENCES

7. **ASSIGNMENT TO SCIENTIFIC DISCIPLINES (in accordance with ECTS points) ALONG WITH THE INDICATION OF THE LEADING DISCIPLINE (min. 50% ECTS points):**

Scientific disciplines	ECTS points	
	number	%
Technical informatics and telecommunications – *leading discipline*	210	100

Table 1. Summary indicators characterising the programme of study

No.	INDICATOR	VALUE
1.	Total number of semesters and ECTS credits required for graduation	**7 / 210**
2.	Total number of teaching hours	**2336**
3.	Total number of ECTS points which the student obtains in classes with the direct participation of academic teachers or other persons who have classes	**112**
4.	Total number of ECTS points which the student obtains in practical skills classes *(more than 50% ECTS points required for the graduation)*	**184**
5.	Number of ECTS points which the student obtains in classes in humanities or social sciences *(at least 5 ECTS points – for fields of study assigned to the disciplines within the areas of science other than humanities or social sciences respectively)*	**5**
6.	Number of ECTS points which the student obtains in elective subjects *(at least 30% ECTS points required for the graduation)*	**66**
7.	Total number of ECTS points which the student obtains in professional internships	**36**
8.	Professional internships (hours)	**960**
9.	In the case of full-time first-cycle studies and unitary master's studies, the number of hours of physical education classes	**60**
10.	Total number of hours of classes conducted using distance learning methods and techniques	**150**

Terms and forms of professional internships are determined by the Internship Programme.

THE CONCEPT AND GOALS OF EDUCATION

Studies in the field of Computer Science last 7 semesters. They are full-time studies and the graduate obtains a professional title of B.Eng (inżynier). The first-cycle programme in Computer Science is fully compatible with the mission and development strategy of PSW.

The education takes place at the level of the first-cycle programme, practical profile. Within the first-cycle programme it is possible to adjust one's own educational profile by electing optional subjects. The students have a free choice of a major, which seems to be of the greatest practical value. The Department of Computer Science in a modern manner educates IT engineers in strategic majors, key for the development of the economy and the state. According to the report evaluating the research in the demand of the economy for higher education graduates of programmes in mathematical, natural and technical sciences, it is Computer Science that enjoys the greatest popularity in the job market.

The following majors are on offer in the field of Computer Science:
- Software Engineering and Mobile Technologies,
- Internet Technologies and Computer Graphics,
- Computer Networks and Cyber Security,
- Robotics and Artificial Intelligence.

The first-cycle programme in Computer Science gives students in-depth knowledge in modern technologies and the skills of creating and administering IT systems as well as social competences which facilitate operating in the IT market. After finishing studies, the graduate will have:

- **knowledge**, including the following:
- the latest trends in the development of this discipline,
- ways of obtaining information (from the literature, databases and other sources available in English or any other language), of analysing the data obtained, drawing conclusions and forming opinions,
- issues in mathematics, physics, automatics, electronics, electrotechnics, signal analysis and processing etc., required to formulate and solve engineering tasks,
- applying the latest IT technologies,
- basics of programming and programming methodology, algorithmic techniques and efficient data structures required to write computer applications,
- databases, computer networks and computer architecture and organisation, network technologies, including computer network architecture, security and construction of network applications,
- multimedia techniques, computer graphics techniques,
- determinants of engineering activities and basic rules of occupational health and safety in the field of Computer Science, intellectual property protection and patent law, principles of the creation and development of forms of individual entrepreneurship;

- **skills**, including the following:
- administering computer systems and networks; designing computer networks, using Windows, Linux and Unix system platforms,
- C and C++, C#, Java, PHP, HTML programming, using algorithms and data structures to design programs,

- using the programming environment, including Eclipse, Microsoft Visual Studio, Android Studio,
- applying modern technologies to design Internet services and applications, i.e. PHP, JavaScript, ASP.NET,
- administering and managing database systems, i.e. Oracle, MySQL, designing databases,
- designing and constructing IT systems, networks, applications in graphic and database environments, applying appropriate techniques, methods and tools in accordance with the specification,
- recognising, while developing engineering projects, their non-technical aspects, including environmental, economic and legal ones,
- communicating IT issues in plain language,
- communicating in English at B2 level of the Common European Framework of Reference for Languages by the Council of Europe;

- **social competence** including the following:
- understanding the need to develop their knowledge and practical skills related to the changes in IT, the graduate is aware of the possibilities of continuous training and raising professional, personal and social competences,
- readiness to responsible teamwork, including the ability to comply with the principles of teamwork, taking responsibility for jointly performed tasks,
- readiness to the responsible performance of a professional role – as a representative of the IT profession – including the compliance with the rules of professional ethics, reliability, impartiality, professionalism and an ethical approach,
- being aware of the significance of and understanding non-technical aspects and effects of the activities of an IT engineer,
- ability to act in an entrepreneurial way.

The student may choose the following majors:
- SOFTWARE ENGINEERING AND MOBILE TECHNOLOGIES – the main fields of education within this major are: software designing, creating and testing, programming in graphic environments, creating applications for mobile devices, integration of mobile applications with IT systems, and microcontroller programming;
- INTERNET TECHNOLOGIES AND COMPUTER GRAPHICS – the major focuses on the Internet, web programming, multimedia technologies, computer graphics and image analysis and processing;
- COMPUTER NETWORKS AND CYBERSECURITY – education within this major involves: computer network design, construction, configuration and management, operating system administration, and ensuring the safe functioning of IT systems through anticipating, preventing, and reacting to threats;
- ROBOTICS AND ARTIFICIAL INTELLIGENCE – within this major, education is focused on: neural networks and artificial intelligence, robot programming, image processing and object recognition, robotic control systems – programmable microcontrollers.

The development of information techniques and commonly spreading globalisation are the factors which cause the growth of interest and impact of IT studies. A growing demand for IT graduates is

due to the continuous modernisation of industry, computerisation of the infrastructure of state offices and the use of computers as work tools at home.

The graduate of the field of Computer Science is prepared for work in IT companies which construct, implement and maintain IT tools and systems and in other firms and companies which use such tools and systems.

After the analysis of second-cycle programmes (master's degree studies) at renowned universities, the scope of material has been selected so that the graduates can continue their studies and obtain a master's degree.

LEARNING OUTCOMES FOR THE FIELD OF COMPUTER SCIENCE, FIRST-CYCLE PROGRAMME, PRACTICAL PROFILE

Table of a field learning outcome references to the 6-th descriptors of the levels in the Polish Qualifications Framework				
		Reference to the 6-th descriptors of the levels in the Polish Qualifications Framework		
		Symbol of the first-stage universal descriptors of the levels in the Polish Qualifications Framework[1] Symbol of the second-stage descriptors in the Polish Qualifications Framework[1]	Symbol of the second-stage in the Polish Qualifications Framework[2]	
Symbol of a field learning outcome	Field learning outcomes		code of the component of the description of the Polish Qualifications Framework	code of the component of the description of the Polish Qualifications Framework - related to engineering competences
KNOWLEDGE				
K_W01	has knowledge of mathematics, including logic and set theory, algebra, mathematical analysis, probabilistic methods, statistics and numerical methods – useful in formulating and solving simple IT related tasks	P6U_W	P6S_WG	P6S_WG
K_W02	has knowledge of physics, including mechanics, thermodynamics, optics, electricity and magnetism, nuclear physics and solid-state physics, including the knowledge required to understand basic physical phenomena in electronic components and systems and in their environment	P6U_W	P6S_WG	P6S_WG
K_W03	has basic knowledge of systems of automatics, electronics, electrotechnics, in particular related to designing electrical and electronic systems and electronic measuring	P6U_W	P6S_WG	P6S_WG
K_W04	has knowledge of signal analysis and processing, in particular related to signal coding, information processing and has knowledge on the structure and operation of the DSP processes	P6U_W	P6S_WG	P6S_WG
K_W05	knows basic software methods, techniques, tools, and apparatus and equipment used in solving simple engineering tasks related to IT systems	P6U_W	P6S_WG	P6S_WG

K_W06	has knowledge of basics of IT and computer system architecture, including the knowledge on the construction of computers, systems and operations of binary logic, simple algorithm design and security in IT systems	P6U_W	P6S_WG	P6S_WG
K_W07	has structured theoretical knowledge of algorithms and basics of programming, required to create simple programs based on efficient algorithms	P6U_W	P6S_WG	P6S_WG
K_W08	has structured, theoretically founded knowledge related to the basics of programming and programming methodology	P6U_W	P6S_WG	P6S_WG
K_W09	has structured, theoretically founded general knowledge related to operation systems, their structure and components	P6U_W	P6S_WG	P6S_WG
K_W10	has structured, theoretically founded knowledge on databases, in particular the knowledge related to the techniques of database creation, optimisation, selected languages and database systems	P6U_W	P6S_WG	P6S_WG
K_W11	has structured, theoretically founded general knowledge on wired and wireless computer networks, in particular network topology, transmission protocols and devices, and network metrology and installation	P6U_W	P6S_WG	P6S_WG
K_W12	has basic knowledge of computer architecture and organisation, including multiprocessor systems, required to design computer systems, industrial systems and for parallel information processing	P6U_W	P6S_WG	P6S_WG
K_W13	has advanced knowledge on the implementation of efficient algorithms, algorithmic techniques and their application in practical computational problems	P6U_W	P6S_WG	P6S_WG
K_W14	knows and understands the principles of programming in higher-level object-oriented languages, the use of key instructions, designing and using classes and objects, creating window and multi-threaded programs, knows mechanisms of creating user interfaces; has knowledge on program creating in C++, C#, Java languages with the use of additional libraries	P6U_W	P6S_WG	P6S_WG
K_W15	has detailed knowledge related to structures, technologies and languages of database programming	P6U_W	P6S_WG	P6S_WG
K_W16	has detailed knowledge related to the techniques of PLC and microcontroller programming based on high- and low-level languages	P6U_W	P6S_WG	P6S_WG
K_W17	has advanced knowledge related to the administration of web servers (PHP), their constituent factors and CMS	P6U_W	P6S_WG	P6S_WG
K_W18	has detailed knowledge on network design (including mobile and ICT wireless networks), device configuration and network security as well as network operating systems	P6U_W	P6S_WG	P6S_WG
K_W19	has advanced knowledge related to multimedia techniques, techniques of 2D and 3D computer graphics, in particular 2D and 3D design in selected programming environments, preparation of graphics for websites, film production and postproduction	P6U_W	P6S_WG	P6S_WG
K_W20	is familiar with the current state and latest development trends in IT	P6U_W	P6S_WG P6S_WK	P6S_WG P6S_WK
K_W21	has basic knowledge on the cycle of life of IT devices and systems	P6U_W	P6S_WG P6S_WK	P6S_WG P6S_WK
K_W22	has basic knowledge required to understand other non-technical aspects of engineering activity, knows basic	P6U_W	P6S_WG	P6S_WG

	rules of occupational health and safety in the field of Computer Science			
K_W23	has elementary knowledge on management, including quality and business management	P6U_W	P6S_WG P6S_WK	P6S_WG P6S_WK
K_W24	has elementary knowledge on intellectual property protection and patent law	P6U_W	P6S_WG P6S_WK	P6S_WG P6S_WK
K_W25	knows general rules of the creation and development of forms of individual entrepreneurship	P6U_W	P6S_WK	P6S_WK
K_W26	has knowledge on network technologies, including the architecture of computer networks, basic communication protocols, security and construction of network applications (e.g. TCP/IP, routing, client-server model, cryptographic protocols, types of network attacks, defence mechanisms)	P6U_W	P6S_WG	P6S_WG
K_W27	has the knowledge of acts of internal law, applied in everyday activity of a unit / entity in which the student serves their internship (e.g. organisational regulations, organisation structure, rules of occupational health and safety, classified information management)	P6U_W	P6S_WG P6S_WK	P6S_WG P6S_WK
K_W28	has knowledge on the place of the entity in which the student serves their internship in the sector / market, knows the specifics of the closer and further environment of the entity	P6U_W	P6S_WG P6S_WK	P6S_WG P6S_WK
SKILLS				
K_U01	is able to obtain information from the literature, databases and other sources; is able to integrate the information obtained, interpret it and draw conclusions as well as formulate and justify opinions	P6U_U	P6S_UW	P6S_UW
K_U02	is able to work individually and in a team; is able to assess the time required to implement the task commissioned, is able to develop and implement the work schedule to ensure that deadlines are met	P6U_U	P6S_UW P6S_UO	P6S_UW P6S_UO
K_U03	is able to develop documentation on the implementation of an engineering task and to prepare a text containing the discussion of the results of the implementation of this task	P6U_U	P6S_UW P6S_UK	P6S_UW P6S_UK
K_U04	is able to prepare and present a short presentation on the results of the implementation of an engineering task	P6U_U	P6S_UW P6S_UK	P6S_UW P6S_UK
K_U05	speaks English sufficiently to communicate and comprehend the professional literature, data sheets, instruction manuals, documentation of IT devices and tools and similar documents	P6U_U	P6S_UW P6S_UK	
K_U06	has the ability of self-learning, e.g. to improve professional competence	P6U_U	P6S_UW	P6S_UW
K_U07	is able to apply introduced mathematical methods and models as well as computer simulations in the analysis and assessment of the operation of analogue and digital electronic systems, in the analysis of signal and simple signal processing systems, applying appropriate hardware and software techniques; is able to interpret the results obtained and draw conclusions	P6U_U	P6S_UW	P6S_UW
K_U08	is able to design, implement, maintain various data repositories, in particular relational databases of	P6U_U	P6S_UW	P6S_UW

	selected providers; manages the access; manipulates the data and their structure by means of the query language in interactive mode through systems of database management and in embedded mode in created utility applications			
K_U09	is able to compare projects, including programming tasks due to the given utility and economic criteria (intuitiveness of use, speed of operation, cost, etc.)	P6U_U	P6S_UW	P6S_UW
K_U10	is able to use appropriate programming environments, simulators and computer aided design tools for the simulation, design and verification of electronic components and systems as well as simple electronic systems	P6U_U	P6S_UW	P6S_UW
K_U11	is able to plan and conduct the simulation and extraction of basic parameters characterising microprocessor and computer systems	P6U_U	P6S_UW	P6S_UW
K_U12	is able to design, implement and apply efficient algorithmic techniques, choose appropriate AI methods for specific practical computational problems, build neural networks for specific problems, create expert systems using fuzzy logic; is able to present the results obtained in the graphic and numeral form, interpret them and draw appropriate conclusions	P6U_U	P6S_UW	P6S_UW
K_U13	is able to create desktop and Internet software components, also multimedia, and complete utility applications in the selected programming environment, also with the use of ready-made software components and templates in accordance with the architectural model	P6U_U	P6S_UW	P6S_UW
K_U14	is able to critically analyse the manner of functioning and select the process of testing of software components, algorithms, databases, computer networks, designed graphic interfaces	P6U_U	P6S_UW	P6S_UW
K_U15	is able to formulate a specification of simple IT systems at the level of functions implemented and with the use of hardware description languages	P6U_U	P6S_UW	P6S_UW
K_U16	is able to design IT systems, networks, devices of IT process control, taking into account utility and economic criteria with the use of appropriate techniques, methods and tools	P6U_U	P6S_UW P6S_UK	P6S_UW P6S_UK
K_U17	is able to use data sheets and application notes in order to select the appropriate components of systems and circuits designed	P6U_U	P6S_UW	P6S_UW
K_U18	is able to design a simple computer system in accordance with the given specification and initially assess its cost; is able to implement, run and test it	P6U_U	P6S_UW P6S_UO	P6S_UW P6S_UO
K_U19	is able to assess the initial costs, plan and manage the implementation of IT projects at the basic level	P6U_U	P6S_UW	P6S_UW
K_U20	is able to build, run and test a computer system adjusted to the requirements earlier specified	P6U_U	P6S_UW	P6S_UW
K_U21	is able to configure communication devices in local wired and wireless telecommunication networks	P6U_U	P6S_UW	P6S_UW
K_U22	is able to program and design in known graphic environments	P6U_U	P6S_UW	P6S_UW
K_U23	is able to build, run and test a network, database and web server, from specified components, based on the known network operating systems	P6U_U	P6S_UW	P6S_UW

K_U24	applies the rules of occupational health and safety	P6U_U	P6S_UU P6S_UW	P6S_UU P6S_UW
K_U25	is able to assess the usefulness of methods and tools used for solving simple engineering tasks typical of IT and select and apply appropriate methods and tools	P6U_U	P6S_UW	P6S_UW
K_U26	is able, while formulating and solving IT component and system design tasks, to recognise their non-technical aspects, including environmental, economic and legal ones	P6U_U	P6S_UW P6S_UK	P6S_UW P6S_UK
K_U27	is able to program simple embedded systems; improve the reliability of the embedded system with the use of documentation required	P6U_U	P6S_UW	P6S_UW
K_U28	prepares a negotiation plan, anticipates the actions of the co-negotiator; provides appropriate conditions for negotiations and mediation; solves problems arising during negotiations and mediation	P6U_U	P6S_UO	P6S_UO
K_U29	is able to design, configure and administer a simple network, is able to configure, secure and share basic network services, has the ability to detect and diagnose problems appearing in the network and to solve them	P6U_U	P6S_UW	P6S_UW
K_U30	is able to discuss IT issues in plain language	P6U_U	P6S_UO	P6S_UO
K_U31	is able to collaborate with the members of the working team in the entity in which the student serves an internship, while performing professional activities, even of a complex nature	P6U_U	P6S_UU P6S_UO	
K_U32	is able to plan their own work in the entity in which the student serves their internship and achieve the intended goals, even in the conditions which are not fully predictable	P6U_U	P6S_UU P6S_UO	P6S_UU P6S_UO
K_U33	is able to solve tasks/ problems appearing in the working environment, also in the conditions which are not fully predictable	P6U_U	P6S_UU	
K_U34	is able to obtain data, create information and apply the acquired knowledge in practical activities in the entity in which the student serves their internship, with the use of critical analysis and synthesis of this information	P6U_U	P6S_UU P6S_UW	P6S_UU P6S_UW
K_U35	is able to critically assess the efficiency of their own actions performed during the internship, using appropriate methods and tools for this purpose	P6U_U	P6S_UW	P6S_UW
SOCIAL COMPETENCE				
K_K01	understands the need of and knows the possibilities of continuous education (second- and third-cycle programmes, postgraduate studies and courses), of raising professional, personal and social competences	P6U_K	P6S_KK P6S_KR	
K_K02	is aware of the significance of and understands the non-technical aspects and effects of the activity of an IT engineer, including its impact on the environment and related responsibility for the decisions taken	P6U_K	P6S_KO P6S_KR	
K_K03	is aware of the significance of professional behaviour, compliance with rules of professional ethics and respect for the diversity of viewpoints and cultures	P6U_K	P6S_KO P6S_KR	
K_K04	is aware of the responsibility for their own work and readiness to comply with the rules of teamwork and raising responsibility for the jointly performed tasks	P6U_K	P6S_KO P6S_KR	
K_K05	is able to think and act in an entrepreneurial manner	P6U_K	P6S_KO	

K_K06	identifies problems related to negotiations and mediation; solves problems appearing during negotiations and mediation; ensures the self-esteem of the participants of negotiations and mediation; is sensitive to the psychological and material needs of the participants of negotiations and mediation; is open to justified suggestions from the participants of negotiations and mediation	P6U_K	P6S_KO	
K_K07	is aware of the social role of the graduate of a technical university, in particular understands the need to formulate and convey information and opinions on IT achievements and other aspects of the activity of an IT engineer to society – e.g. through mass media; undertakes to convey such information and opinions in plain language	P6U_K	P6S_KR	
K_K08	is able to communicate with laymen and specialists in a given field, clearly and transparently communicates messages to team members and potential clients	P6U_K	P6S_KO P6S_KR	
K_K09	can predict consequences of actions undertaken related to the goals set by the entity in which the student serves their internship, thinks and acts in an entrepreneurial manner	P6U_K	P6S_KO	
K_K10	undertakes actions for new solutions, problems, cognitive and practical processes appearing in the entity in which the student serves their internship and is able to present them in the employer's environment	P6U_K	P6S_KK P6S_KR	
K_K11	acts in a responsible and ethical way during the internship, taking care of the achievements and traditions of the profession	P6U_K	P6S_KO P6S_KR	
K_K12	during the internship takes action for personal and professional development	P6U_K	P6S_KR	

Reference to first-stage universal descriptors at level 6 In accordance with the appendix to the Act of 22 December 2015 on the Integrated Qualifications System (Journal of Laws 2020, item 226)		codes
Knowledge outcomes: the student knows and understands:	At an advanced level – facts, theories, methods and complex relations between them. Various, complex conditions of the activity undertaken.	P6U_W
Skills outcomes: the student is able to:	Innovatively perform tasks and solve complex and untypical problems in changed and not fully predictable conditions. Independently plan their own lifelong learning. Communicate with the surroundings, justify their position.	P6U_U
Competence outcomes: the student is ready to:	Cultivate and disseminate models of proper conduct in the working environment and outside it. Independently take decisions, critically evaluate their own actions, the actions of teams which they manage and organisations in which they participate, take responsibility for the effects of these actions.	P6U_K

The descriptions used are presented beneath – in accordance with the Regulation of the Minister of Science and Higher Education of 14 November 2018 on the second-stage descriptors of learning outcomes for the qualifications at levels 6-8 of the Polish Qualifications Framework (Journal of Laws 2018 item 2218).

P6S_WG	the second-stage descriptor of learning outcomes for the qualifications at level 6 of the Polish Qualifications Framework in the field of knowledge: scope and depth – completeness of the cognitive perspective and dependence.
P6S_WK	the second-stage descriptor of learning outcomes for the qualifications at level 6 of the Polish Qualifications Framework in the field of knowledge: context – conditions, effects.
P6S_UW	the second-stage descriptor of learning outcomes for the qualifications at level 6 of the Polish Qualifications Framework in the field of skills: the use of knowledge – solved problems and performed

	tasks.
P6S_UK	the second-stage descriptor of learning outcomes for the qualifications at level 6 of the Polish Qualifications Framework in the field of skills: communicating – utterance receiving and forming , knowledge dissemination in the academic environment and use of a foreign language.
P6S_UO	the second-stage descriptor of learning outcomes for the qualifications at level 6 of the Polish Qualifications Framework in the field of skills: work organisation – planning and teamwork.
P6S_UU	the second-stage descriptor of learning outcomes for the qualifications at level 6 of the Polish Qualifications Framework in the field of skills: learning – planning one's own development and the development of other people.
P6S_KK	the second-stage descriptor of learning outcomes for the qualifications at level 6 of the Polish Qualifications Framework in the field of social competence: assessment – critical approach.
P6S_KO	the second-stage descriptor of learning outcomes for the qualifications at level 6 of the Polish Qualifications Framework in the field of social competence: responsibility – fulfilling social obligations and acting for the public interest.
P6S_KR	the second-stage descriptor of learning outcomes for the qualifications at level 6 of the Polish Qualifications Framework in the field of social competence: professional role – independence and development of the ethos.

WAYS OF THE VERIFICATION OF LEARNING OUTCOMES ACHIEVED BY THE STUDENT DURING THE WHOLE CYCLE OF EDUCATION

The teacher determines detailed learning outcomes and a form of their verification, and next puts them in the syllabus. The achievement of all learning outcomes determined for particular classes means the implementation of the assumed concept of education in the conducted field. The verification and assessment of learning outcomes achieved by the student during the whole cycle of education takes place through:

1) assessment of the student's current preparation for classes, participation in classes;
2) assignments (tests, papers, presentations, projects);
3) examinations (oral, written examination etc.);
4) student internships (in accordance with the internship regulations);
5) diploma process (in accordance with the study regulations);
6) study of the graduates' professional careers – through obtaining feedback on the acquired knowledge, skills and social competence and their usefulness in the job market;
7) study of employers' opinions – giving opinions by employers/stakeholders on the programmes of study, including the assumed learning outcomes and methods of their verification.

Forms and methods of class management and the criteria of the grade and its components are determined in the syllabus.