



## Study programme

<b>Organizational unit:</b>	Faculty of Information and Communication Technology
<b>Field of study:</b>	Applied Computer Science
<b>Level of study:</b>	first degree engineering
<b>Form of study:</b>	full-time studies
<b>Education cycle:</b>	2025/2026

# Table of contents

Field of study characteristics	3
Learning outcomes	6
Detailed information on ECTS points	9
Organization of studies	10
Study plan	12
Syllabuses	20

# Field of study characteristics

## Basic information

Organizational unit:	Faculty of Information and Communication Technology
Field of study:	Applied Computer Science
Study level:	first degree engineering
Study form:	full-time studies
Education profile:	general academic profile
Language of study:	English
Valid from the education cycle:	2025/2026
Number of semesters:	7
Number of semesters in the English version of the programme:	7
Total number of hours of classes:	2655
Total number of hours of classes in the English version of the programme:	2655
Total number of ECTS points required to complete a given level of study:	210
Professional title awarded to graduates:	inżynier

## Fields of science and scientific disciplines

### Scientific disciplines to which the field of study is assigned:

Field engineering and technical sciences

### Assigning the major to the fields and disciplines to which the learning outcomes relate:

Discipline	Percentage
Technical computing and telecommunications	100%

Main discipline: Technical computing and telecommunications

## Description of the field, profile of the graduate and possibilities of continuing studies

The Applied Computer Science major trains, on a seven-semester bachelor's degree program in Polish or English, computer engineers with extensive knowledge and skills. Graduates of the Applied Computer Science major have professional qualifications in:

- Architecture and organization of computers and programming of low-level devices, which are, among other things, elements of the Internet of Things,
- Programming languages, algorithms and data structures, programming paradigms, techniques for efficient programming and advanced programming methods and tools,
- Databases, their design and business data modeling and analysis,
- Software design and programming project management,
- Computer networks, systems administration and cyber security,
- Artificial intelligence and distributed systems, including cloud programming,
- Web, mobile and multimedia applications.

Graduates also have knowledge of basic sciences including various departments of higher mathematics and physics, which are necessary for solving engineering problems and useful for eventual continuation in second-level studies. An important addition to the education of a computer engineer is knowledge of the fundamentals of entrepreneurship and the social and professional problems of computer science. In addition, the graduate is proficient in English to the extent that he can speak freely, including in written form, on topics related to his work. A major role in the training of computer engineers is also attached to soft skills, such as the ability to present, for example, the results of one's own work, and the ability to work in a team. The latter is shaped in the course of numerous team projects, in particular while working on a Team Engineering Project (ZPI), which is the equivalent of an engineering thesis. As part of the ZPI, students complete complex IT projects in groups for real business clients as well.

Completion of the bachelor's degree program is certified by a diploma in computer engineering in the discipline of Technical Informatics and Telecommunications, which allows students to continue their education in a second degree program and/or postgraduate studies.

## Currentness of the study programme

### Concept and goals of education

The concept of education in the field of Applied Computer Science, undergraduate studies, is pragmatic in nature and is expressed through the following goals:

1. Preparing students for their profession: imparting knowledge and learning practical skills in as many different fields of computer science as possible.
2. Development of soft skills, such as teamwork, problem-solving ability, creativity, ability to self-present and present the results of their own work, etc.
3. Formation of the need for self-education in the field of continuing education (upskilling).
4. Formation of a flexible approach and the ability to adapt to changes in the professional environment requiring retraining (reskilling).
5. Use of modern teaching models, methods and techniques in the didactic process, flexibility and adaptability in applying them to specific situations.
6. Increase the share of classes conducted in cooperation with business representatives.

The degree program is designed to maximize students' hands-on experience through laboratory classes, group projects and professional internships. Great emphasis is placed on developing teamwork and communication skills, which is crucial in a professional environment.

Incorporating the latest trends and technologies into the curriculum is designed not only to impart up-to-date knowledge, but also to inspire students to expand their skills on their own and acquire new knowledge as technology evolves. Collaborating with business allows students to gain experience and establish professional contacts, could facilitate their later entry into the job market.

### Information regarding the inclusion of socio-economic needs in the study programme and the compliance of the major learning outcomes with these needs

The study program takes into account the socio-economic needs expressed in the studies of the current situation on the labor market in the IT industry and the prospects for its development:

- Salary and Trends in the IT Industry Report, 2024 edition; <https://pl.grafton.com/pl/raport-wynagrodzen-i-trendow-w-it-2024>,
- IT market in Poland: challenges and prospects for development until 2030; <https://www.raportbranzyyt.pl/>,
- IT Community Survey Report 2024; <https://bulldogjob.pl/it-report>,
- IT industry - trends and challenges in 2024 (13.12.2023); <https://cmt-advisory.pl/publikacje/branza-it-trendy-oraz-wyzwania/>,
- Future trends in the IT industry (04.10.2023); <https://cmt-advisory.pl/publikacje/branza-it-trendy-oraz-wyzwania/>,
- IT industry in Poland in 2024 - trends and predictions; <https://obserwatorgospodarczy.pl/2024/04/23/branza-it-w-polsce-w-roku-2024-trendy-i-przewidywania/>,
- State of the IT industry. Ew0rk Group survey results; <https://www.isbtech.pl/2024/03/stan-branzyyt-wyniki-badania-ework-group/>,
- What will be most important in the IT industry in the future. There is the latest research; <https://www.rp.pl/biznes/art38398331-co-w-przyszlosci-bedzie-najwazniejsze-w-branzyyt-sa-najnowsze-badania>.

In addition, the program is consulted with members of the Social Council of the Department of Computer Science and Telecommunications. The assumed learning outcomes correspond to current and prospective socio-economic needs resulting from the analysis of research results and the needs reported by employers in the Lower Silesia region.

## **Other important factors determining the validity of the study programme**

The validity of the study program is guaranteed by:

- Accreditation by the Polish Accreditation Commission,
- Systematic updating of the taught content taking into account the latest scientific research results in the discipline of technical informatics and telecommunications,
- Adaptation of the subject matter of practical classes to current technological developments,
- Providing students with access to modern laboratories, equipment and the latest software,
- Emphasis on students' acquisition of soft skills, such as the ability to work in a group, present their own results or debate and participate in discussions, which is in line with employers' expectations,
- Education and improvement of teaching staff.

## **The connection of the programme with the University's mission and its development strategy**

The direction is in line with the mission and strategy of Wrocław University of Technology for 2023-30. In particular, it fits into the priority research area: 1. "Information Technology, Data Science and Artificial Intelligence," which includes, but is not limited to: computer science, algorithmics and software engineering, artificial intelligence and machine learning, human-computer interaction, data analysis and visualization methods, classification and prediction, natural language processing, data storage and transmission engineering, information processing and privacy, cyber security and cryptography, computer and mobile networks, Internet of Things, virtualization, augmented and virtual reality, multimedia techniques, and medical informatics. [Strategy of Wrocław University of Technology 2023-2030, p. 17, Priority Research Areas, [https://pwr.edu.pl/fcp/LGBUKOQtTKIQhbx08SikTUhZeUTgtCgg9ACFDC0RGS3xSFVZpCFghUHcKVigEQUw/1/public/2023/docs/strategia\\_\\_pwr\\_2023\\_22-06-23.pdf](https://pwr.edu.pl/fcp/LGBUKOQtTKIQhbx08SikTUhZeUTgtCgg9ACFDC0RGS3xSFVZpCFghUHcKVigEQUw/1/public/2023/docs/strategia__pwr_2023_22-06-23.pdf)].

# Learning outcomes

Code	Description of the directional learning outcome	Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework	Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework, enabling the acquisition of engineering competences
<b>Knowledge</b>			
K1_IST_W01	Has general knowledge in the field of selected branches of mathematics: mathematical analysis, linear algebra and analytic geometry, mathematical logic, discrete mathematics, probability theory, and mathematical statistics, that form the theoretical foundations necessary to solve IT engineering problems	P6U_W, P6S_WG	
K1_IST_W02	Has advanced knowledge in selected branches of physics	P6U_W, P6S_WG	
K1_IST_W03	Knows and understands simple and complex data structures, algorithms, and programming constructs and can implement them in various programming languages	P6U_W, P6S_WG	P6S_WG_INŻ
K_IST_W04	Knows programming paradigms and languages using these paradigms	P6U_W, P6S_WG	
K1_IST_W05	Has detailed knowledge of software lifecycle models and their processes as well as methodologies, good practices, notation, and support tools for software development	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W06	Has knowledge in the field of computer structure, organization, and architecture	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W07	Has advanced knowledge about programming various types of applications, e.g., mobile, web, database, or distributed	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W08	Has knowledge of the construction, operation and administration of operating systems	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W09	Has knowledge of computer networks, their architectures, and the operation of selected network devices and Internet of Things (IoT) devices	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W10	Has knowledge in the field of IT systems security	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W11	Has knowledge of modeling processes of different nature and knows the methods and techniques used in decision support systems	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W12	Knows and understands the architecture of database systems and the basic methods and tools for collecting, processing, and retrieving information, as well as extracting knowledge from data	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W13	Has systematic knowledge in the field of artificial intelligence, in particular methods of representing and processing knowledge	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W14	Has detailed knowledge of software and database design	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W15	Has advanced knowledge in multimedia	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W16	Is familiar with typical technologies and programming tools for software developments	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W17	Has structured knowledge of IT project management	P6U_W, P6S_WG	P6S_WG_INŻ
K1_IST_W18	Is familiar with current development trends in computer science	P6U_W, P6S_WG	

<b>Code</b>	<b>Description of the directional learning outcome</b>	<b>Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework</b>	<b>Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework, enabling the acquisition of engineering competences</b>
K1_IST_W19	Has knowledge of managing the business activities; knows the principles of creating and running various sorts of individual entrepreneurship	P6U_W, P6S_WK	P6S_WK_INŻ
K1_IST_W20	Has knowledge in the field of protection of intellectual property and patent law	P6U_W, P6S_WK	
K1_IST_W21	Has the knowledge of the humanities that is necessary to understand the social and philosophical conditions of engineering activities	P6U_W, P6S_WK	
K1_IST_W22	He knows and understands the fundamental problems of modern civilization	P6U_W, P6S_WK	
<b>Skills</b>			
K1_IST_U01	Is able to construct and implement algorithms using advanced algorithmic strategies and simple or complex data structures	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U02	Can select and evaluate the relevance of a programming paradigm to a problem and build an application using that paradigm	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U03	Is able to describe requirements and design - using modeling language - selected software components, database schema and plan how the solution will be verified.	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U04	Is able to implement, according the design, software and database for simple, typical applications and to verify the correctness of the solution	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U05	Can design and build simple logic circuits	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U06	Is able to apply an indicated analytical method and plan and carry out a simple engineering experiment or computer simulation; is able to carry out measurements and analyze their results, especially for selected IT system components	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U07	Can configure basic devices and network software of computer networks	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U08	Can apply the indicated security techniques for a given IT system	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U09	Is able to develop and execute a schedule of work to produce a simple IT system, as well as preliminarily estimate the cost and time required for the project	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U10	Can formulate and solve complex and unusual problems and perform tasks under conditions that are not fully predictable	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U11	Has the ability to program applications of various types, such as mobile, web, and database	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U12	Is able to design and produce a multimedia product, using properly selected methods, techniques and tools	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U13	Can apply selected technologies and programming tools in practice	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U14	Has practical skills related to the administration of selected systems	P6U_U, P6S_UW	P6S_UW_INŻ
K1_IST_U15	Can describe and make a critical analysis of how existing IT solutions work and evaluate these solutions	P6U_U, P6S_UW	P6S_UW_INŻ

Code	Description of the directional learning outcome	Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework	Characteristics for qualifications at level 6 or 7 of the Polish Qualifications Framework, enabling the acquisition of engineering competences
K1_IST_U16	Can acquire information from literature, databases and other sources, including in English, among others, for the purposes of self-education and improvement of professional competence, is able to integrate obtained information, interpret it, draw conclusions, formulate and justify opinions	P6U_U, P6S_UW	
K1_IST_U17	Can develop documentation on the implementation of an engineering task, prepare a text containing a discussion of the results of the implementation of the task and give a short presentation on this topic, using advanced information and communication techniques	P6U_U, P6S_UW	
K1_IST_U18	Is able to communicate using specialized terminology; take part in discussions, present and evaluate different opinions and stands	P6U_U, P6S_UK	
K1_IST_U20	Is able to plan and organize work - individually and as part of a team	P6U_U, P6S_UO	
K1_IST_U21	Is able to collaborate with others in team ventures	P6U_U, P6S_UO	
K1_IST_U22	Has the ability to self-educate, among other things, to improve professional competence	P6U_U, P6S_UU	
K1_IST_U23	Has the necessary background to work in a business environment and knows the safety rules for the job position he holds	P6U_U, P6S_UW, P6S_UK, P6S_UO	P6S_UW_INŻ
K1_IST_U19	Is able to apply his or her knowledge to the solution of problems in selected areas of higher mathematics, physics, and technical computer science.	P6U_U, P6S_UW	
<b>Social competence</b>			
K1_IST_K01	Is ready to critically evaluate the knowledge he possesses and the content he receives	P6U_K, P6S_KK	
K1_IST_K02	Is aware of the importance of knowledge in solving cognitive and practical problems, and recognizes the need to consult experts when faced with difficulties in solving problems independently	P6U_K, P6S_KK	
K1_IST_K03	Adheres to professional ethics and demands it of others; is ready to take on responsible professional roles	P6U_K, P6S_KR	
K1_IST_K04	Is able to think and act in an entrepreneurial manner, is ready to take action on behalf of the social environment	P6U_K, P6S_KO	
<b>Language and physical education outcomes</b>			
SJO_S1_U01	Be able to use a foreign language at ESCJ level B2	P6S_UK	
SWF_S1_U01	Is aware of the importance of systematic physical activity for physical and mental health		

# Detailed information on ECTS points

Applied Computer Science

<b>Name</b>	<b>Value</b>
Total ECTS	210
Total number of hours of classes	2655
Number of ECTS points assigned to classes related to scientific activities conducted at the university in the discipline or disciplines to which the field of study is assigned (DN)	122/210 (58.1%)
Number of ECTS points allocated to classes developing practical skills (including laboratory, project) (P)	97.8
The number of ECTS points that a student will receive by completing classes that require the direct participation of academic teachers or other persons conducting classes and students (BU)	110.1
Percentage of ECTS for elective courses	67/210 (31.9%)
The number of ECTS points that a student will receive by completing classes in the humanities or social sciences appropriate for a given field of study	6
The number of contact hours that a student will receive by taking physical education classes	60
The number of ECTS points that a student will receive by completing classes in basic sciences (mathematics, physics/chemistry)	40

# Organization of studies

## Implementation of the study programme

### Allowable ECTS deficit

Semester	Allowable deficit of ECTS points after a semester
Semester 1	10 ECTS
Semester 2	10 ECTS
Semester 3	8 ECTS
Semester 4	8 ECTS
Semester 5	8 ECTS
Semester 6	0 ECTS
Semester 7	0 ECTS

### Detailed requirements

#### Subjects and groups of classes to be passed by the end of the 3rd semester:

Computer System Organization, Structural and Object oriented Programming, Structural and Object oriented Programming (L),

#### Subjects and groups of classes to be passed by the end of the 5th semester:

Physics I A (W), Physics I A (C), Logic for IT Specialists, Linear Algebra with Analytic Geometry, Mathematical Analysis I, Basic physics laboratory (L), Physics 2 B, Discrete Mathematics, Mathematical Analysis II, Theory of Probabilistic and Statistics, Lectorate 1.1, Sports 1, Basics of Software Engineering (L), Basics of Software Engineering, Block of elective courses M1 - one selected subject, Block of elective courses M2 - one selected subject, Block of elective courses M3 - one selected subject, Block of elective courses M4 - one selected subject,

#### Subjects and groups of classes to be passed by the end of the 6th semester:

Data Structures and Algorithms (L), Data Structures and Algorithms, Computer Architecture (L), Computer Architecture (W), Operating Systems (L), Operating Systems (W), Basics of entrepreneurship (W), Computer Networks, Effective Programming Techniques, Programming paradigms, Data Bases (L), Data Bases, Systems Analysis and Decision Support Methods (L), Systems Analysis and Decision Support Methods, Introduction to IoT (W), Introduction to IoT (L), Lectorate 1.2, Sports 2, Presentation Techniques (S), Cybersecurity (L), Cybersecurity (W), Script Languages, Software Engineering (P), Software Engineering (W), Artificial Intelligence (L), Artificial Intelligence (W), Business Data Modelling and Analysis (L), Business Data Modelling and Analysis (W), Block of elective courses M5 - one selected subject, Block of elective courses M6 - one selected subject, Block of elective courses M7 - one selected subject, Block of elective courses M8 - one selected subject,

#### Subjects and groups of classes to be passed by the end of the 7th semester:

IT Social and Professional Problems (W), Team Project, Block of elective courses M9 - one selected subject, Internship.

## Methods of verifying the intended learning outcomes

Activity form	Methods of verifying the intended learning outcomes
Seminar	Multimedia presentations conducted and prepared individually or in groups; case study analysis, class participation, paper
Classes	Credit - oral, written; short test, input task, evaluation of the sub-tasks; practical exam, model, essay, paper
Project	Project preparation, project implementation, project documentation, case study analysis, model

<b>Activity form</b>	<b>Methods of verifying the intended learning outcomes</b>
Internship	Internship report, internship journal, confirmation of internship program completion
Laboratory	Preparation of laboratory reports; oral statements, class participation; short test, input task, evaluation of the sub-tasks
Lecture	Exam - oral, written, credit, test - oral, written

## **Description of the process leading to achieving learning outcomes**

The process leading to the attainment of the assumed major learning outcomes includes active participation in classes organized at the university: lectures, exercises, laboratories, projects and seminars, as well as self-studies that allow consolidation, completion and expansion of knowledge. If necessary, the student can benefit from individual consultations. Learning outcomes in the area of skills are further developed during the mandatory student internship.

## **Internships**

The purpose of the internship is:

- To become familiar with the operation of an IT company or IT department.
- To gain knowledge of the design, programming, testing or implementation of professional IT solutions and practical administration of systems (indicate the connection with at least one course of direction).
- Implementation of an assigned, simple IT task using and improving the practical skills and social competencies acquired so far, with particular emphasis on teamwork.

The work placement for the Applied Computer Science major should last 4 weeks. Students complete the internship as specified in the study programme, during the summer holidays after the end of the 6th semester.

Detailed rules for the conduct and completion of student work placements at the Faculty of Information Technology and Telecommunications are published on the Faculty's website.

## **Diploma exam**

The diploma exam is held according to the rules stated in the Study Regulations of the Wrocław University of Technology. The scope of the diploma exam is updated annually and made available to students no later than the end of the 6th semester of study on the website of the Department of Computer Science and Telecommunications.

# Study plan

Applied Computer Science

## Semester 1

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Computer System Organization	Lecture: 30 Classes: 30	Graded credit	3	Obligatory
Structural and Object Oriented Programming (L)	Laboratory: 30	Graded credit	2	Obligatory
Structural and Object Oriented Programming	Lecture: 30 Classes: 30	Graded credit	3	Obligatory
Logic for IT Specialists	Lecture: 30 Classes: 30	Graded credit	5	Obligatory
Physics 1A	Lecture: 30 Classes: 15	Lecture: Exam Classes: Graded credit	Lecture: 3 Classes: 2	Obligatory
Mathematical Analysis 1	Lecture: 30 Classes: 30	Lecture: Exam Classes: Graded credit	Lecture: 4 Classes: 4	Obligatory
Linear Algebra and Analitic Geometry	Lecture: 30 Classes: 30	Exam	4	Obligatory
<b>Sum</b>	<b>375</b>		<b>30</b>	

## Semester 2

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
Computer Architecture	Lecture: 30 Laboratory: 30	Lecture: Graded credit Laboratory: Graded credit	Lecture: 2 Laboratory: 2	Obligatory
Operating Systems	Lecture: 30 Laboratory: 30	Lecture: Graded credit Laboratory: Graded credit	Lecture: 2 Laboratory: 2	Obligatory

<b>Subject</b>	<b>Number of hours</b>	<b>Form of verification</b>	<b>ECTS points</b>	<b>Mandatoriness</b>
Data Structures and Algorithms	Lecture: 30 Classes: 15	Exam	4	Obligatory
Data Structures and Algorithms (L)	Laboratory: 30	Graded credit	2	Obligatory
Physics 2 B	Lecture: 30	Exam	2	Obligatory
Basic Physics Laboratory	Laboratory: 15	Graded credit	2	Obligatory
Discrete Mathematics	Lecture: 30 Classes: 30	Graded credit	5	Obligatory
Mathematical Analysis 2	Lecture: 30 Classes: 30	Exam	7	Obligatory
<b>Sum</b>	<b>360</b>		<b>30</b>	

### Semester 3

<b>Subject</b>	<b>Number of hours</b>	<b>Form of verification</b>	<b>ECTS points</b>	<b>Mandatoriness</b>
Basics of Entrepreneurship	Lecture: 30	Graded credit	2	Obligatory
Computer Networks	Lecture: 30 Laboratory: 30 Seminar: 15	Exam	7	Obligatory
Effective Programming Techniques	Lecture: 15 Laboratory: 30	Graded credit	4	Obligatory
Programming Paradigms	Lecture: 30 Classes: 15 Laboratory: 30	Exam	7	Obligatory
Theory of Probability and Statistics	Lecture: 30 Classes: 30 Laboratory: 15	Exam	7	Obligatory
Foreign Language 1.1	Classes: 60	Graded credit	3	Obligatory group
The student chooses classes from the offer of the Department of Foreign Languages				
Foreign Language 1.1	Classes: 60	Graded credit	3	Elective

<b>Subject</b>	<b>Number of hours</b>	<b>Form of verification</b>	<b>ECTS points</b>	<b>Mandatoriness</b>
Sport activities	Classes: 30	Graded credit	-	Obligatory group
The student chooses classes from the offer of the Study of Physical Education and Sports				
Sport activities 1	Classes: 30	Graded credit	-	Elective
<b>Sum</b>	<b>390</b>		<b>30</b>	

## Semester 4

<b>Subject</b>	<b>Number of hours</b>	<b>Form of verification</b>	<b>ECTS points</b>	<b>Mandatoriness</b>
Systems Analysis and Decision Support Methods	Lecture: 30 Classes: 15	Exam	5	Obligatory
Systems Analysis and Decision Support Methods (L)	Laboratory: 15	Graded credit	1	Obligatory
Script Languages	Lecture: 30 Laboratory: 30	Exam	5	Obligatory
Databases	Lecture: 30 Classes: 15	Exam	5	Obligatory
Databases (L)	Laboratory: 30	Graded credit	2	Obligatory
Basics of Software Engineering (L)	Laboratory: 15	Graded credit	1	Obligatory
Basics of Software Engineering	Lecture: 15 Classes: 30	Graded credit	3	Obligatory
Foreign Language 1.2	Classes: 60	Graded credit	3	Obligatory group
The student chooses classes from the offer of the Department of Foreign Languages				
Foreign Language 1.2	Classes: 60	Graded credit	3	Elective
Sport activities	Classes: 30	Graded credit	-	Obligatory group
The student chooses classes from the offer of the Study of Physical Education and Sports				
Sport activities 2	Classes: 30	Graded credit	-	Elective

<b>Subject</b>	<b>Number of hours</b>	<b>Form of verification</b>	<b>ECTS points</b>	<b>Mandatoriness</b>
Elective Module M1 - Systems Administration	Lecture: 30 Laboratory: 30	Graded credit	5	Obligatory group
The student chooses one subject from the M1 Elective Subjects Module				
Linux Server Administration	Lecture: 30 Laboratory: 30	Graded credit	5	Elective
Managing IT Infrastructure	Lecture: 30 Laboratory: 30	Graded credit	5	Elective
Routing and Switching in Computer Networks	Lecture: 30 Laboratory: 30	Graded credit	5	Elective
<b>Sum</b>	<b>405</b>		<b>30</b>	

## Semester 5

<b>Subject</b>	<b>Number of hours</b>	<b>Form of verification</b>	<b>ECTS points</b>	<b>Mandatoriness</b>
Presentation Techniques	Seminar: 30	Graded credit	2	Obligatory
Cybersecurity	Lecture: 30 Laboratory: 30	Lecture: Exam Laboratory: Graded credit	Lecture: 3 Laboratory: 2	Obligatory
Introduction to IoT	Lecture: 30 Laboratory: 30	Lecture: Exam Laboratory: Graded credit	Lecture: 3 Laboratory: 2	Obligatory
Software Engineering	Lecture: 30 Project: 30	Lecture: Exam Project: Graded credit	Lecture: 3 Project: 3	Obligatory
Elective Module M2 - Web Technologies	Lecture: 30 Laboratory: 30	Graded credit	4	Obligatory group
The student chooses one subject from the M2 Elective Subjects Module				
Web Systems Programming	Lecture: 30 Laboratory: 30	Graded credit	4	Elective
Developing Web Applications with .NET	Lecture: 30 Laboratory: 30	Graded credit	4	Elective

<b>Subject</b>	<b>Number of hours</b>	<b>Form of verification</b>	<b>ECTS points</b>	<b>Mandatoriness</b>
Elective Module M3 - Database Design	Lecture: 15 Project: 30	Graded credit	4	Obligatory group
The student chooses one subject from the M3 Elective Subjects Module				
Database Programming	Lecture: 15 Project: 30	Graded credit	4	Elective
Database Design	Lecture: 15 Project: 30	Graded credit	4	Elective
Elective Module M4 - Mobile Applications	Lecture: 30 Laboratory: 30	Graded credit	4	Obligatory group
The student chooses one subject from the M4 Elective Subjects Module				
Mobile Applications for Android Platform	Lecture: 30 Laboratory: 30	Graded credit	4	Elective
Mobile Applications for iOS Platform	Lecture: 30 Laboratory: 30	Graded credit	4	Elective
<b>Sum</b>	<b>375</b>		<b>30</b>	

## Semester 6

<b>Subject</b>	<b>Number of hours</b>	<b>Form of verification</b>	<b>ECTS points</b>	<b>Mandatoriness</b>
Artificial Intelligence	Lecture: 30 Laboratory: 30	Lecture: Exam Laboratory: Graded credit	Lecture: 2 Laboratory: 2	Obligatory
Business Data Modelling and Analysis	Lecture: 30 Laboratory: 30	Lecture: Exam Laboratory: Graded credit	Lecture: 2 Laboratory: 2	Obligatory
Internship	Internship: 150	Graded credit	6	Obligatory
Elective Module M5 - Fundamentals of Project Management	Lecture: 15 Laboratory: 30 Seminar: 15	Graded credit	4	Obligatory group
The student chooses one subject from the M5 Elective Subjects Module				

<b>Subject</b>	<b>Number of hours</b>	<b>Form of verification</b>	<b>ECTS points</b>	<b>Mandatoriness</b>
Introduction to IT Project Management	Lecture: 15 Laboratory: 30 Seminar: 15	Graded credit	4	Elective
Support for IT Project Management	Lecture: 15 Laboratory: 30 Seminar: 15	Graded credit	4	Elective
Elective Module M6 - Distributed Systems	Lecture: 30 Laboratory: 30	Graded credit	4	Obligatory group
The student chooses one subject from the M6 Elective Subjects Module				
Distributed Computer Systems	Lecture: 30 Laboratory: 30	Graded credit	4	Elective
Cloud Programming	Lecture: 30 Laboratory: 30	Graded credit	4	Elective
Elective Module M7 - Programming Technologies and Tools	Lecture: 30 Laboratory: 30	Graded credit	4	Obligatory group
The student chooses one subject from the M7 Elective Subjects Module				
Game Programming	Lecture: 30 Laboratory: 30	Graded credit	4	Elective
Advanced Web Technologies	Lecture: 30 Laboratory: 30	Graded credit	4	Elective
Elective Module M8 - Multimedia	Lecture: 30 Laboratory: 30	Graded credit	4	Obligatory group
The student chooses one subject from the M8 Elective Subjects Module				
Computer Graphics	Lecture: 30 Laboratory: 30	Graded credit	4	Elective
Programming Multimedia Applications	Lecture: 30 Laboratory: 30	Graded credit	4	Elective
Digital Media Processing Techniques	Lecture: 30 Laboratory: 30	Graded credit	4	Elective
<b>Sum</b>	<b>510</b>		<b>30</b>	

## Semester 7

Subject	Number of hours	Form of verification	ECTS points	Mandatoriness
IT Social and Professional Problems	Lecture: 30	Graded credit	2	Obligatory
Team Project	Project: 120 Seminar: 15	Graded credit	22	Elective
Elective Module M9 - Development Trends in Computer Science	Lecture: 30 Laboratory: 45	Graded credit	6	Obligatory group
The student chooses one subject from the M9 Elective Subjects Module				
Data Science	Lecture: 30 Laboratory: 45	Graded credit	6	Elective
Neural Networks	Lecture: 30 Laboratory: 45	Graded credit	6	Elective
Metaheuristics in Problems Solving	Lecture: 30 Laboratory: 45	Graded credit	6	Elective
Human-Computer Interaction	Lecture: 30 Laboratory: 45	Graded credit	6	Elective
<b>Sum</b>	<b>240</b>		<b>30</b>	

# Syllabuses



## Computer System Organization Educational subject description sheet

### Basic information

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.11PP.03143.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Subjects of basic education

<b>Semester</b> Semester 1	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 3.0
	<b>Activities and hours</b> Lecture: 30 Classes: 30	

### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	A student knows ways of representing numbers in fixed-point systems, methods of number conversion and ways of implementing arithmetic operations.	K1_IST_W06
PEU_W02	A student knows how to minimize logical functions	K1_IST_W06
PEU_W03	A student knows basic combinational and sequential circuits,	K1_IST_W06
<b>In terms of skills</b>		
PEU_U01	The student is able to minimize logical functions and draw a diagram of a digital system implementing this function	K1_IST_U05
PEU_U02	The student can solve tasks using binary code.	K1_IST_U19

## Program content ensuring learning outcomes

- Knowledge of ways of representing fixed-point numbers and the basics of arithmetic for these numbers.
- Understanding methods for simplifying Boolean expressions.
- Knowledge of simple combinational and sequential circuits.
- Acquiring basic knowledge in the field of designing simple digital circuits.

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	30
Preparaton for classes	15
<b>Student workload</b>	<b>Hours</b> 75



Structural and Object Oriented Programming (L)  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.11TI.03144.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Information Technologies
<b>Education profile</b> general academic profile	

<b>Semester</b> Semester 1	<b>Activities, hours, ECTS and examination</b> • Laboratory: 30 h, 2 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of skills</b>		
PEU_U01	Knows how to explain and use object-oriented programming techniques in the applications developed.	K1_IST_U01, K1_IST_U02
PEU_U02	Can construct code that models a given problem using a class hierarchy	K1_IST_U01, K1_IST_U02
PEU_U03	Is able to implement algorithms in JAVA	K1_IST_U02
PEU_U04	Knows the basics of structured and Object Oriented Programming	K1_IST_U01

**Program content ensuring learning outcomes**

- Overview of the object-oriented approach and its significance in programming.
- Support for object-oriented programming in modern programming languages.
- Key applications and motivations for using the object-oriented paradigm.

- Basics of syntax in a selected object-oriented programming language.
- The class as a representation of a concept from the problem domain: class properties, declaring data fields and methods, controlling access to data and operations.
- Creating, destroying, and copying objects.
- The paradigm of object-oriented programming.
- Inheritance as a means of reusing code.
- Support for abstraction, interface classes, virtual functions, and polymorphism.
- The relationship between inheritance and information encapsulation.
- Error handling using exceptions.
- Solving common design problems with design patterns.

### Calculation of ECTS points

Activity form	Activity hours
Laboratory	30
Preparaton for classes	10
Preparation of a project	10
<b>Student workload</b>	<b>Hours</b> 50



Structural and Object Oriented Programming  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.11TI.03145.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Information Technologies

<b>Semester</b> Semester 1	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 3.0
	<b>Activities and hours</b> Lecture: 30 Classes: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Is familiar with the philosophy of the object-oriented approach	K1_IST_W03, K_IST_W04
PEU_W02	Is familiar with the object-oriented approach as a way of understanding the surrounding reality	K1_IST_W03, K_IST_W04
PEU_W03	Knows the basics of engineering and object-oriented programming methodologies	K1_IST_W03, K_IST_W04
<b>In terms of skills</b>		
PEU_U01	Can justify and apply object-oriented techniques to programs.	K1_IST_U01, K1_IST_U02
PEU_U02	Can construct and use relationships between objects based on polymorphism	K1_IST_U01, K1_IST_U02

## Program content ensuring learning outcomes

- An overview of the object-oriented approach and its importance in programming.
- Support for object-oriented programming in modern programming languages.
- Key applications and reasons for using the object-oriented paradigm.
- Basic syntax principles of the selected object-oriented programming language.
- Class as a representation of a concept in a problem domain: properties of classes, declaration of data fields and methods, control of access to data and operations.
- Creation, destruction and copying of objects.
- Object-oriented programming paradigm.
- Inheritance as a way to reuse code.
- Abstraction support, interface classes, virtual functions and polymorphism.
- The relationship between inheritance and information encapsulation.
- Error handling using exceptions. Solving repetitive design problems using design patterns.

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	30
Preparation for classes	5
Self-study of class topics	5
Preparation of a project	5
<b>Student workload</b>	<b>Hours</b> 75



Logic for IT Specialists  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.11PK.03146.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 1	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 5.0
	<b>Activities and hours</b> Lecture: 30 Classes: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Students know and understand the concept of a set and operations on sets, the concept of relations and functions	K1_IST_W01
PEU_W02	Students know and understand the concept of logical syntax and semantics of propositional logic and predicate calculus, and selected proving systems.	K1_IST_W01
PEU_W03	Students know and understand the concept of mathematical induction and structural definition of recursive sets and functions, graphs and methods of their representation.	K1_IST_W01
<b>In terms of skills</b>		

PEU_U01	Students can apply propositional and predicate calculi	K1_IST_U19
PEU_U02	Students can conduct a proofs by mathematical and structural induction	K1_IST_U19
PEU_U03	Students can use language of set theory interpreting problems in different areas of mathematics and science	K1_IST_U19

### Program content ensuring learning outcomes

The course covers the basic competency levels in logic and set theory, as well as the chosen basic methods used in these areas that are in use in different areas of IT.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	30
Self-study of class topics	20
Preparaton for classes	30
Preparation for an exam/credit	11
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 125



## Physics 1A

Educational subject description sheet

### Basic information

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.11PF.02372.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Subjects of basic education - physics
<b>Education profile</b> general academic profile	

<b>Semester</b> Semester 1	<b>Activities, hours, ECTS and examination</b> <ul style="list-style-type: none"><li>• Lecture: 30 h, 3 ECTS, Exam</li><li>• Classes: 15 h, 2 ECTS, Graded credit</li></ul>
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### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	has a general knowledge of basic concepts and principles concerning kinematics of a material point, dynamics of a material point, motion of a system of material points and rigid bodies, the principle of conservation of momentum, angular momentum, mechanical energy, work, kinetic and potential energy, mechanical waves allowing understanding of physical phenomena.	K1_IST_W02
<b>In terms of skills</b>		
PEU_U01	is able to carry out a quantitative analysis related to a physical problem and formulate qualitative conclusions	K1_IST_U19

### Program content ensuring learning outcomes

Acquisition of knowledge, taking into account its application aspects, in kinematics and dynamics, including issues of work

and mechanical energy, mechanical waves and principles of conservation of energy and momentum

### Calculation of ECTS points

<b>Activity form</b>	<b>Activity hours</b>
Lecture	30
Classes	15
Preparaton for classes	30
Prepararation for an exam/credit	46
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 125



## Mathematical Analysis 1

### Educational subject description sheet

#### Basic information

<p><b>Field of study</b> Applied Computer Science</p> <p><b>Speciality</b> -</p> <p><b>Organizational unit</b> Faculty of Information and Communication Technology</p> <p><b>Study level</b> first degree engineering</p> <p><b>Study form</b> full-time studies</p> <p><b>Education profile</b> general academic profile</p>	<p><b>Education cycle</b> 2025/2026</p> <p><b>Subject code</b> W4NIST/000S.11PM.00243.25</p> <p><b>Lecture languages</b> English</p> <p><b>Mandatoriness</b> Obligatory</p> <p><b>Block</b> Subjects of basic education - mathematics</p>
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<p><b>Semester</b> Semester 1</p>	<p><b>Activities, hours, ECTS and examination</b></p> <ul style="list-style-type: none"> <li>• Lecture: 30 h, 4 ECTS, Exam</li> <li>• Classes: 30 h, 4 ECTS, Graded credit</li> </ul>
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#### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	knows the graphs and properties of basic elementary functions	K1_IST_W01
PEU_W02	knows basic notions and theorems of differential calculus of functions of a single variable	K1_IST_W01
PEU_W03	knows the concept of the definite integral, its properties and the basic applications	K1_IST_W01
<b>In terms of skills</b>		
PEU_U01	can solve typical equations and inequalities with elementary functions	K1_IST_U19
PEU_U02	can examine a function and draw its graph	K1_IST_U19
PEU_U03	can evaluate typical indefinite integrals and calculate definite integrals	K1_IST_U19

PEU_U04	can apply differential and integral calculus to solve practical problems	K1_IST_U19
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### Program content ensuring learning outcomes

Exposition of basic elementary functions and their properties.

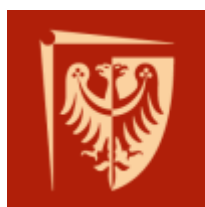
Exposition of basic notions and theorems of differential calculus of functions of a single variable.

Introduction of the concept of the definite integral, its basic properties and methods of calculation.

Presentation of practical applications of methods of differential and integral calculus of functions of a single variable.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	30
Preparaton for classes	70
Self-study of class topics	50
Preparation for an exam/credit	16
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 200



## Linear Algebra and Analytic Geometry

Educational subject description sheet

### Basic information

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.11PM.00242.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Subjects of basic education - mathematics

<b>Semester</b> Semester 1	<b>Examination</b> Exam	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Classes: 30	

### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	knows the basic properties of complex numbers	K1_IST_W01
PEU_W02	knows basic concepts and theorems concerning matrices	K1_IST_W01
PEU_W03	knows basic terms and theorems concerning algebra of polynomials	K1_IST_W01
PEU_W04	knows basic methods of solving linear equations	K1_IST_W01
PEU_W05	knows methods of describing straight lines, planes, and conic curves	K1_IST_W01
<b>In terms of skills</b>		

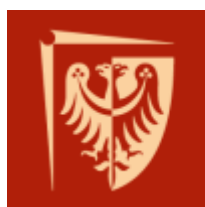
PEU_U01	is able to perform operations on complex numbers	K1_IST_U19
PEU_U02	is able to use matrix notation and apply transformations specific to matrix algebra and determinants	K1_IST_U19
PEU_U03	is able to decompose a polynomial into linear and quadratic factors and a rational fraction into real simple fractions	K1_IST_U19
PEU_U04	is able to solve systems of linear equations efficiently	K1_IST_U19
PEU_U05	is able to solve problems concerning mutual positions of points, lines and vectors in Euclidean space	K1_IST_U19

### Program content ensuring learning outcomes

- To familiarize with the basic concepts of linear algebra and analytic geometry.
- To present methods for solving basic problems involving complex numbers, matrices, systems of equations and analytic geometry in Euclidean space  $\mathbb{R}^3$ .

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	30
Preparaton for classes	30
Preparation for an exam/credit	6
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 100



## Computer Architecture Educational subject description sheet

### Basic information

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.12PK.03916.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 2	<b>Activities, hours, ECTS and examination</b> <ul style="list-style-type: none"><li>• Lecture: 30 h, 2 ECTS, Graded credit</li><li>• Laboratory: 30 h, 2 ECTS, Graded credit</li></ul>
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### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Is familiar with different computer architectures including parallel computer architectures	K1_IST_W06
PEU_W02	Understands the organisation of computer memory and the design decisions behind it	K1_IST_W06
PEU_W03	Understands the principles of pipelined processing, including how problems associated with this type of processing are solved	K1_IST_W06
PEU_W04	Understands the history of the development of computer architectures and future computer architectures, including GPU, TPU and quantum architectures	K1_IST_W06
<b>In terms of skills</b>		
PEU_U01	Can write simple programs in the assembly language of the RISC architecture	K1_IST_U04

PEU_U02	Is able to design and build simple combinatorial and sequential circuits	K1_IST_U05
PEU_U03	Can select the right architecture for specific tasks	K1_IST_U04

### Program content ensuring learning outcomes

The curriculum content includes knowledge of the operation of computer systems with different architectures. As part of the course, students will be introduced to the fundamental concepts of computer architecture design to be able to better understand the low-level operation of systems that perform computations: CPUs or specialized computing units (e.g., GPUs). Special emphasis is placed on RISC architectures. The course also includes elements of the history of the development of computer architectures and a presentation of the latest trends concerning them.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for an exam/credit	8
Self-study of class topics	8
Preparation for classes	24
<b>Student workload</b>	<b>Hours</b> 100



## Operating Systems Educational subject description sheet

### Basic information

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.12PK.03917.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 2	<b>Activities, hours, ECTS and examination</b> <ul style="list-style-type: none"><li>• Lecture: 30 h, 2 ECTS, Graded credit</li><li>• Laboratory: 30 h, 2 ECTS, Graded credit</li></ul>
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### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Student knows and understands operating systems' algorithms and resource management strategies.	K1_IST_W08
<b>In terms of skills</b>		
PEU_U01	Student has ability to analyze and evaluate basic operating systems' algorithms and resource management methods.	K1_IST_U06

### Program content ensuring learning outcomes

Definition of an operating system, its basic components, functions of an OS, monitors, virtual machines. History of operating systems - history of computers, development of operating systems. Processes - process structure, multitasking, context switching, process scheduling (FCFS, SJF, OPT, round-robin scheduling algorithms), threads, inter-process communication (shared memory, sockets). Concurrency and synchronization - multitasking, mutual exclusion (semaphores, monitors, critical

section problem, deadlock detection and avoidance). Memory management - Physical and logical memory, memory allocation (strategies: best fit, next fit, last fit strategies), virtual memory (paging swapping, segmentation), frame allocation algorithms, page fault frequency. I/O and file systems - Input-output architecture, I/O control strategies, interruptions, disk scheduling strategies, file systems (implementation - files, directories, symbolic links), disk space management (blocks and free space allocation strategies). Protection in operating systems. Distributed systems - memory, process and I/O management in distributed systems. Distributed file systems.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for classes	20
Preparation for an exam/credit	8
Credit/Exam	4
Self-study of class topics	8
<b>Student workload</b>	<b>Hours</b> 100



Data Structures and Algorithms  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.12PK.03155.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 2	<b>Examination</b> Exam	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Classes: 15	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	The student knows abstract data types, dynamic data structures, understands asymptotic notation and knows basic algorithms from various areas of algorithmics.	K1_IST_W03
<b>In terms of skills</b>		
PEU_U01	The student is able to create an implementation of abstract data types and algorithms from various areas of algorithmics.	K1_IST_U01

## Program content ensuring learning outcomes

Data structures and algorithms used in computer programs will be presented.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	15
Preparaton for classes	41
Credit/Exam	4
Preparation for an exam/credit	10
<b>Student workload</b>	<b>Hours</b> 100



Data Structures and Algorithms (L)  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.12PK.03156.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 2	<b>Activities, hours, ECTS and examination</b> • Laboratory: 30 h, 2 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of skills</b>		
PEU_U01	The student is able to create an implementation of abstract data types and algorithms from various areas of algorithmics.	K1_IST_U01

**Program content ensuring learning outcomes**

Data structures and algorithms used in computer programs will be practiced.

**Calculation of ECTS points**

<b>Activity form</b>	<b>Activity hours</b>
Laboratory	30

Preparaton for classes	20
<b>Student workload</b>	<b>Hours</b> 50



Physics 2 B  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.12PF.03157.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Subjects of basic education - physics
<b>Education profile</b> general academic profile	

<b>Semester</b> Semester 2	<b>Activities, hours, ECTS and examination</b> • Lecture: 30 h, 2 ECTS, Exam
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	describes the basic concepts and principles of electricity, magnetism, the fundamentals of optics, elements of the special theory of relativity, the fundamentals of quantum physics and the fundamentals of atomic physics that allow an understanding of physical phenomena	K1_IST_W02

**Program content ensuring learning outcomes**

Acquisition of knowledge, taking into account its applied aspects, from the following departments: electricity, magnetism, fundamentals of optics, elements of the special theory of relativity, fundamentals of quantum physics, fundamentals of atomic physics.

## Calculation of ECTS points

<b>Activity form</b>	<b>Activity hours</b>
Lecture	30
Preparation for an exam/credit	16
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 50



Basic Physics Laboratory  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.12PF.02373.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Subjects of basic education - physics
<b>Education profile</b> general academic profile	

<b>Semester</b> Semester 2	<b>Activities, hours, ECTS and examination</b> • Laboratory: 15 h, 2 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	describes the methods of measuring various physical quantities	K1_IST_W02
<b>In terms of skills</b>		
PEU_U01	uses simple measuring devices and performs measurements of basic physical quantities using the measuring station instructions	K1_IST_U06
PEU_U02	develops measurement results and conducts an analysis of measurement uncertainty using engineering tools in the form of a report	K1_IST_U19

**Program content ensuring learning outcomes**

The laboratory aims to familiarize the participant with methods of measuring various physical quantities and to master the skills of operating basic measuring devices in order to conduct a simple experiment according to the instructions. It allows the participant to learn the basics of analyzing measurement uncertainty and to master the skills related to the development

of experimental results using engineering tools and their presentation in the form of a report. Participants conduct experiments in groups, which allows them to consolidate the ability to work in teams.

### Calculation of ECTS points

<b>Activity form</b>	<b>Activity hours</b>
Laboratory	15
Preparation of a report/summary/presentation/paper	30
Preparation for classes	5
<b>Student workload</b>	<b>Hours</b> 50



Discrete Mathematics  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.12PM.03158.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Subjects of basic education - mathematics

<b>Semester</b> Semester 2	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 5.0
	<b>Activities and hours</b> Lecture: 30 Classes: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	A student knows and understands basic concepts of discrete mathematics applicable to the construction and understanding of simple tasks of information and knowledge processing in the context of computer - based systems.	K1_IST_W01
PEU_W02	A student knows and understands basic concepts of discrete mathematics applicable to the construction and understanding of simple tasks of information retrieval in the context of computer - based systems.	K1_IST_W01

PEU_W03	A student knows and understands basic concepts of discrete mathematics applicable to the construction and understanding of simple problems of discrete optimization in the context of computer - based systems.	K1_IST_W01
<b>In terms of skills</b>		
PEU_U01	Performs calculations and analyzes properties of basic and generalised operations from classic set-theory. Performs operations on multisets and k-multisets.	K1_IST_U19
PEU_U02	Can verify the laws of classical set calculus by transformation to equivalent problems expressed by classical propositional calculus. Uses the binary method and Gentzen's deductive sequence system for verifying problems in classical propositional calculus.	K1_IST_U19
PEU_U03	Develops and demonstrates the application of quantifier calculus and relational systems to simple system modeling tasks and to issues of information and knowledge processing in information systems.	K1_IST_U19
PEU_U04	Performs operations on relations, including the composition of relations and the transitive closure and transitive reduction operations (for binary relations).	K1_IST_U19
PEU_U05	Uses exemplary models of the space of discrete sets and the space of equivalence relations based on selected distance and similarity measures to solve simple tasks of knowledge processing, information retrieval and discrete optimization in information systems.	K1_IST_U19
PEU_U06	Uses an information system model and decision tables to solve simple knowledge processing tasks in IT systems.	K1_IST_U19

### Program content ensuring learning outcomes

Calculus of classical sets. Calculus of k - multisets and multisets. Relational systems. Functionless calculus of quantifiers. Theory of relations and operations on relations. Distance and similarity function. Space of sets, equivalence relations, sequences and hierarchical discrete objects. Approximation spaces and rough sets. Pawlak's information system and decision tables.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	30
Self-study of class topics	65
<b>Student workload</b>	<b>Hours</b> 125



Mathematical Analysis 2  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.12PM.00248.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Subjects of basic education - mathematics

<b>Semester</b> Semester 2	<b>Examination</b> Exam	<b>Number of ECTS points</b> 7.0
	<b>Activities and hours</b> Lecture: 30 Classes: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	knowledge of the basic criteria of convergence of numerical series and properties of power series	K1_IST_W01
PEU_W02	knowledge of basic concepts and theorems of differential calculus of functions of many variables	K1_IST_W01
PEU_W03	knowledge of methods of calculating double integrals	K1_IST_W01
PEU_W04	knowledge of the concept of Laplace transform	K1_IST_W01
<b>In terms of skills</b>		

PEU_U01	ability to test convergence of numerical series and to develop functions into a power series using expansions of elementary functions	K1_IST_U19
PEU_U02	ability to calculate partial derivatives, directional derivatives and gradient of functions of many variables and ability to interpret the obtained quantities, ability to solve optimization tasks for functions of two variables	K1_IST_U19
PEU_U03	ability to calculate double integrals and use them to calculate areas, volumes and selected physical quantities	K1_IST_U19
PEU_U04	ability to use Laplace transform to solve linear differential equations of the first and second order	K1_IST_U19

### Program content ensuring learning outcomes

- Familiarization with the basic criteria of convergence of numerical series and properties of power series.
- To familiarize with the basic concepts and theorems of differential calculus of functions of many variables.
- Familiarization with the concept of the double integral, methods of its calculation and examples of application.
- To familiarize with the basic concepts of ordinary differential equations and the use of the Laplace transform to solve linear equations.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	30
Preparation for classes	70
Self-study of class topics	30
Preparation for an exam/credit	11
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 175



Basics of Entrepreneurship  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.14HS.03160.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Subjects from the fields of humanities or social sciences
<b>Education profile</b> general academic profile	

<b>Semester</b> Semester 3	<b>Activities, hours, ECTS and examination</b> • Lecture: 30 h, 2 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	PEK_W01 has a structured knowledge of creating organizational and legal forms of conducting business activity in terms of creating new enterprises,	K1_IST_W19
PEU_W02	PEK_W02 characterizes and knows the basic areas of capital raising and strategies, models, management methods and development of business organization.	K1_IST_W19

**Program content ensuring learning outcomes**

Acquiring knowledge of entrepreneurship.  
Getting to know the instruments (strategies, models, methods) necessary for business management  
An acquaintance with principles of a business plan's preparation and presentation.

## Calculation of ECTS points

<b>Activity form</b>	<b>Activity hours</b>
Lecture	30
Preparation for an exam/credit	20
<b>Student workload</b>	<b>Hours</b> 50



Computer Networks  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.14PK.01917.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 3	<b>Examination</b> Exam	<b>Number of ECTS points</b> 7.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30 Seminar: 15	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Acquiring knowledge in the field of layered computer networks, construction and functionality of network protocols, principles of network protocols cooperation in the stacks.	K1_IST_W09
PEU_W02	Has basic knowledge of computer network architecture, operation, construction, security, and services.	K1_IST_W09
<b>In terms of skills</b>		

PEU_U01	Possesses skills in basic configuration of network devices, as well as analysis of their operation and detection of basic errors in computer networks. Possesses basic skills in securing active network devices and computer networks.	K1_IST_U07, K1_IST_U08
PEU_U02	Has the ability to acquire, analyse and synthesise knowledge from a variety of sources. Can write an essay and prepare a presentation on a given topic. Can take an active part in discussions.	K1_IST_U16, K1_IST_U18

### Program content ensuring learning outcomes

Network protocols organized in layered network models (TCP/IP, ISO/OSI).

Elements of designing and solving problems in computer networks.

Configuring network devices using CLI and GUI interfaces.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Seminar	15
Credit/Exam	4
Preparation for classes	60
Preparation for an exam/credit	16
Conducting literature research	5
Preparation of a report/summary/presentation/paper	15
<b>Student workload</b>	<b>Hours</b> 175



Effective Programming Techniques  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.14PK.03161.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 3	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 15 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Knows the mechanisms of object-oriented programming in languages that require manual memory management	K1_IST_W03
PEU_W02	Knows the techniques of addressing memory and practical use of pointers	K1_IST_W03
<b>In terms of skills</b>		
PEU_U01	Is able to write effective programs in accordance with the object-oriented programming paradigm in languages that require manual memory management	K1_IST_U01, K1_IST_U02

PEU_U02	Is able to address memory and use the mechanisms offered by pointers in practice.	K1_IST_U01, K1_IST_U02
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### Program content ensuring learning outcomes

Familiarization with the basics of C++ programming

Learning and understanding issues related to memory allocation and deallocation during program execution.

Learning and understanding issues related to control flow during program execution.

Learning and understanding issues related to source code behavior and quality assessment.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Laboratory	30
Preparaton for classes	15
Conducting empirical studies	40
<b>Student workload</b>	<b>Hours</b> 100



Programming Paradigms  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.14PK.03162.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 3	<b>Examination</b> Exam	<b>Number of ECTS points</b> 7.0
	<b>Activities and hours</b> Lecture: 30 Classes: 15 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Enumerate and characterize the basic programming paradigms.	K_IST_W04
PEU_W02	Know which programming languages support these paradigms.	K_IST_W04
PEU_W03	Know typical for basic paradigms programming mechanisms.	K_IST_W04
PEU_W04	Know common abstractions and mechanisms that support those abstractions in programming languages.	K_IST_W04
<b>In terms of skills</b>		
PEU_U01	Implement programs in accordance with the given specification.	K1_IST_U02

PEU_U02	Select the programming paradigm that best suits the problem in hand.	K1_IST_U02
PEU_U03	Choose appropriate constructs available in programming language depending on the problem to be solved.	K1_IST_U02
PEU_U04	Use the standard documentation of programming languages.	K1_IST_U02
PEU_U05	Use a modern programming environment (e.g. IntelliJ) and programming tools.	K1_IST_U02

### Program content ensuring learning outcomes

The "Programming Paradigms" subject provides a comprehensive exploration of various programming styles, ensuring students achieve a robust understanding of diverse programming concepts and techniques. The curriculum spans both functional and imperative paradigms, covering essential topics to meet learning outcomes. Beginning with functional programming, lectures introduce students to curried and uncurried forms, tail recursion, and pattern matching, foundational elements for functional coding. Advanced topics, such as higher-order functions, algebraic data types, and evaluation strategies (eager vs. lazy), deepen their understanding and prepare them for computationally efficient programming approaches. Imperative programming is explored through computational effects and abstract data types, including an introduction to monads to encapsulate state and side effects, providing a summary of functional programming principles. Object-oriented programming (OOP) follows, introducing familiar constructs and new ones, such as traits and mixins, to enhance code reusability and modularity. Further lectures address variance properties and bounded polymorphism, giving students insights into type safety and flexibility in OOP. Concurrent programming, crucial for modern applications, is explored through threads, shared memory, actors, and message passing, which illustrate both low-level and high-level concurrency handling methods. The program also covers reactive programming, coroutines, event handling, GUI development, and introduces logic programming, enriching students' adaptability across programming domains. Complementary class hours offer hands-on sessions, reinforcing theoretical knowledge with practical exercises across the paradigms. By the end of the course, students will have gained proficiency in functional, imperative, concurrent, and logic programming, meeting key learning outcomes for diverse and adaptable software development skills.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	15
Laboratory	30
Preparation for classes	30
Self-study of class topics	20
Preparation for an exam/credit	16
Credit/Exam	4
Preparation of a report/summary/presentation/paper	30
<b>Student workload</b>	<b>Hours</b> 175



## Theory of Probability and Statistics

### Educational subject description sheet

#### Basic information

<p><b>Field of study</b> Applied Computer Science</p> <p><b>Speciality</b> -</p> <p><b>Organizational unit</b> Faculty of Information and Communication Technology</p> <p><b>Study level</b> first degree engineering</p> <p><b>Study form</b> full-time studies</p> <p><b>Education profile</b> general academic profile</p>	<p><b>Education cycle</b> 2025/2026</p> <p><b>Subject code</b> W4NIST/000S.14PM.03163.25</p> <p><b>Group of classes</b> Yes</p> <p><b>Lecture languages</b> English</p> <p><b>Mandatoriness</b> Obligatory</p> <p><b>Block</b> Subjects of basic education - mathematics</p>
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<p><b>Semester</b> Semester 3</p>	<p><b>Examination</b> Exam</p> <p><b>Activities and hours</b> Lecture: 30 Classes: 30 Laboratory: 15</p>	<p><b>Number of ECTS points</b> 7.0</p>
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#### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	has knowledge of the nature and properties of probability, and probabilistic space, has knowledge of methods of calculating probability and conditional probability of events	K1_IST_W01
PEU_W02	knows the integer probability theorem for events and Bayes' formula, and has knowledge of the reliability of networked systems	K1_IST_W01
PEU_W03	has knowledge of random variables, probability distribution, distribution of a random variable; has knowledge of basic parameters of a random variable distribution and their interpretation	K1_IST_W01

PEU_W04	knows the limit theorems and their interpretation, knows the inequalities of probability calculus, knows how to pre-analyse data for probabilistic analysis	K1_IST_W01
PEU_W05	knows the point estimate and the maximum likelihood estimators.	K1_IST_W01
PEU_W06	has knowledge of confidence intervals for the mean and variance of a normal distribution and for proportions, has knowledge of statistical hypothesis testing, tests for the mean and variance of a normal distribution and tests for proportions	K1_IST_W01
PEU_W07	is familiar with tests of concordance and independence of samples, the chi-square test, has knowledge of analysis of variance and one-dimensional linear regression	K1_IST_W01
<b>In terms of skills</b>		
PEU_U01	can calculate probabilities of events, conditional probabilities and total probability.	K1_IST_U19
PEU_U02	can calculate the reliability of connections	K1_IST_U19
PEU_U03	can calculate the distribution and the distribution of a random variable and the basic parameters of random variables.	K1_IST_U19
PEU_U04	is able to use estimation and maximum likelihood estimators, to test statistical hypotheses on the mean and variance of a normal distribution and to determine unidimensional linear regression	K1_IST_U19

### **Program content ensuring learning outcomes**

The program covers the fundamentals of probability theory and statistics. It includes topics on random events, conditional probability, event independence, and distributions of random variables. It teaches data analysis, parameter estimation, hypothesis testing, and statistical methods like linear regression and variance analysis. Theoretical lessons are complemented by practical exercises and labs using statistical software.

### **Calculation of ECTS points**

<b>Activity form</b>	<b>Activity hours</b>
Lecture	30
Classes	30
Laboratory	15
Preparation for classes	30
Preparation for an exam/credit	20
Preparation of a report/summary/presentation/paper	30
Self-study of class topics	16
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 175



Foreign Language 1.1  
Educational subject description sheet

**Basic information**

<b>Field of study</b> lektoraty	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> PWRSJOS.86JO.01761.25
<b>Organizational unit</b> Wrocław University of Science and Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree	<b>Mandatoriness</b> Elective
<b>Study form</b> full-time studies	<b>Block</b> Foreign languages
<b>Education profile</b> general academic profile	

<b>Semesters</b> Semester 2, Semester 3	<b>Activities, hours, ECTS and examination</b> • Classes: 60 h, 3 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of skills</b>		
PEU_U01	The student has knowledge, skills and competences specified for the appropriate language level: knows and uses linguistic resources (grammatical, lexical) and those from the academic environment specified at the level; uses general and selective reading and comprehension skills; creates written forms of expression; communicates in family, social, academic and professional environments; develops social competences by working in a group and recognizing the intercultural context.	SJO_S1_U01

**Program content ensuring learning outcomes**

Classes, topic and grammar related content.

## Calculation of ECTS points

<b>Activity form</b>	<b>Activity hours</b>
Classes	60
Preparaton for classes	30
<b>Student workload</b>	<b>Hours</b> 90



Sport activities 1  
Educational subject description sheet

**Basic information**

<b>Field of study</b> wychowanie fizyczne	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> PWRSWFS.8EWF.04468.25
<b>Organizational unit</b> Wrocław University of Science and Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree	<b>Mandatoriness</b> Elective
<b>Study form</b> full-time studies	<b>Block</b> Physical education classes
<b>Education profile</b> general academic profile	

<b>Semesters</b> Semester 2, Semester 3, Semester 4	<b>Activities, hours, ECTS and examination</b> • Classes: 30 h, 0 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of skills</b>		
PEU_U01	The participant knows how to organize health-promoting training according to his or her interests, using the principles of a selected sports discipline or form of recreation.	SWF_S1_U01
PEU_U02	The student knows training methods that develop motor skills using their own body weight and various equipment.	SWF_S1_U01
PEU_U03	The student knows the basic technique of shaping exercises needed to prepare the body for physical exercise.	SWF_S1_U01
PEU_U04	The student knows the basic rules of safe behavior during physical activity.	SWF_S1_U01
PEU_U05	The student is able to develop a short- and long-term training plan adequate to his or her abilities.	SWF_S1_U01

PEU_U06	The student knows the principles of strengthening the deep and peripheral stabilization apparatus and the technique of basic exercises shaping aerobic and strength capacity.	SWF_S1_U01
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### Program content ensuring learning outcomes

Sports activities – ABT, aikido, badminton, bodyART, body ball, Brazilian Jiu Jitsu, Callanetics, cuban salsa fit, futsal, yoga, jogging, judo, karate, basketball, bodybuilding, athletics, body shaping, skiing, Nordic walking, pilates, football, handball, volleyball, swimming, pump, rugby, self-defense, shape, squash, stretch-one, ballroom dancing, table tennis, tennis, functional training, health-promoting training, mountain hiking, cycling tourism, floorball, rowing, climbing, corrective classes, Zumba, corrective classes for students with disabilities.

### Calculation of ECTS points

Activity form	Activity hours
Classes	30
<b>Student workload</b>	<b>Hours</b> 30



Systems Analysis and Decision Support Methods  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.18PK.03166.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 4	<b>Examination</b> Exam	<b>Number of ECTS points</b> 5.0
	<b>Activities and hours</b> Lecture: 30 Classes: 15	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Knows basic ideas, problems and methods of systems modelling and identification.	K1_IST_W11
PEU_W02	Knows typical decision making tasks and knows methods of solving optimization problems.	K1_IST_W11
<b>In terms of skills</b>		
PEU_U01	Knows how to formulate decision making problems.	K1_IST_U19

PEU_U02	Knows how to use MATLAB and SIMULINK for engineering computations, in particular for systems modelling and identification.	K1_IST_U19
PEU_U03	Knows how to use computer engineering software to solve optimization tasks and to develop decision making support systems.	K1_IST_U19

### Program content ensuring learning outcomes

Knowledge about methods of modelling static and dynamic systems.

Acquisition of skills necessary to develop computer models of technical and non-technical processes.

Learning how to formulate typical decision making problems and how to solve them.

Learning how to use computer engineering software to develop decision making support systems and solve optimization tasks.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Classes	15
Preparaton for classes	46
Conducting literature research	30
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 125



Systems Analysis and Decision Support Methods (L)  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.18PK.03167.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 4	<b>Activities, hours, ECTS and examination</b> • Laboratory: 15 h, 1 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Knows basic ideas, problems and methods of systems modelling and identification.	K1_IST_W11
PEU_W02	Knows typical decision making tasks and knows methods of solving optimization problems.	K1_IST_W11
<b>In terms of skills</b>		
PEU_U01	Knows how to formulate decision making problems.	K1_IST_U06
PEU_U02	Knows how to use MATLAB and SIMULINK for engineering computations, in particular for systems modelling and identification.	K1_IST_U06
PEU_U03	Knows how to use computer engineering software to solve optimization tasks and to develop decision making support systems.	K1_IST_U06

## Program content ensuring learning outcomes

Knowledge about methods of modelling static and dynamic systems.

Acquisition of skills necessary to develop computer models of technical and non-technical processes.

Learning how to formulate typical decision making problems and how to solve them.

Learning how to use computer engineering software to develop decision making support systems and solve optimization tasks.

## Calculation of ECTS points

Activity form	Activity hours
Laboratory	15
Preparaton for classes	1
Preparation of a project	4
Conducting empirical studies	2
Preparation of a report/summary/presentation/paper	3
<b>Student workload</b>	<b>Hours</b> 25



Script Languages  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.18PK.03168.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 4	<b>Examination</b> Exam	<b>Number of ECTS points</b> 5.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	The student explains the grammar constructions of selected scripted language.	K1_IST_W03
PEU_W02	The student know how scripted code can collaborate with the external IT environment	K1_IST_W03
<b>In terms of skills</b>		
PEU_U01	The student develops script applications that use the services and resources of the operating system.	K1_IST_U02
PEU_U02	The student debug and test applications to fix errors.	K1_IST_U01

## Program content ensuring learning outcomes

This course focuses on using a scripting language (Python) as a tool to control and orchestrate everyday operations in OS.  
Main content:

- Language introduction (syntax, grammar, idioms)
- Operations on local and remote resources (files, network connections)
- Controlling and interoperating with external applications and services (databases, text editors, spreadsheets).
- Building standalone applications (console, desktop)
- Principles of writing a good code (debugging, testing)

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparaton for classes	30
Preparation of a project	35
<b>Student workload</b>	<b>Hours</b> 125



Databases  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.18PK.00257.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 4	<b>Examination</b> Exam	<b>Number of ECTS points</b> 5.0
	<b>Activities and hours</b> Lecture: 30 Classes: 15	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Describes the principles of data modeling at different levels of abstraction	K1_IST_W12
PEU_W02	Presents basic transformation rules of data models and their verification	K1_IST_W12
PEU_W03	Describes implementation rules of data models in a DBMS	K1_IST_W12
PEU_W04	Presents the role and possibilities of using the SQL standard in a DB systems	K1_IST_W12
PEU_W05	Explains the rules for defining architecture of DB systems	K1_IST_W12

<b>In terms of skills</b>		
PEU_U01	Defines a conceptual data model using UML	K1_IST_U03
PEU_U02	Transforms conceptual data model into a physical model, taking into account the business rules and domain constraints	K1_IST_U03
PEU_U03	Removes anomalies of data using the normalization process	K1_IST_U03
PEU_U04	Defines queries using DML database languages and their implementation in a DBMS for searching and processing of data in databases	K1_IST_U03

### **Program content ensuring learning outcomes**

1. Gaining the basic knowledge about databases, data models and their implementation in a DBMS
2. Acquisition of the ability to define and process data stored in databases

### **Calculation of ECTS points**

<b>Activity form</b>	<b>Activity hours</b>
Lecture	30
Classes	15
Preparation for an exam/credit	46
Preparation for classes	30
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 125



Databases (L)  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.18PK.03855.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 4	<b>Activities, hours, ECTS and examination</b> • Laboratory: 30 h, 2 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Describes implementation rules of data models in a DBMS	K1_IST_W12
<b>In terms of skills</b>		
PEU_U01	Transforms conceptual data model into a physical model, taking into account the business rules and domain constraints	K1_IST_U03
PEU_U02	Defines queries using DML database languages and their implementation in a DBMS for searching and processing of data in databases	K1_IST_U04

**Program content ensuring learning outcomes**

Acquisition of the ability to define and process data stored in databases

## Calculation of ECTS points

<b>Activity form</b>	<b>Activity hours</b>
Laboratory	30
Preparaton for classes	20
<b>Student workload</b>	<b>Hours</b> 50



Basics of Software Engineering (L)  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.18PK.03171.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 4	<b>Activities, hours, ECTS and examination</b> • Laboratory: 15 h, 1 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of skills</b>		
PEU_U01	Student defines requirements using different techniques.	K1_IST_U03
PEU_U02	Student creates a user interface prototype.	K1_IST_U03
PEU_U03	Student develops a system data model with business constraints on the software system .	K1_IST_U03
PEU_U04	Student defines test cases.	K1_IST_U03

**Program content ensuring learning outcomes**

Definition and specification of requirements. Domain modeling and constraint writing. Tests.

## Calculation of ECTS points

<b>Activity form</b>	<b>Activity hours</b>
Laboratory	15
Preparaton for classes	10
<b>Student workload</b>	<b>Hours</b> 25



Basics of Software Engineering  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.18PK.03172.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Obligatory
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 4	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 3.0
	<b>Activities and hours</b> Lecture: 15 Classes: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Student characterizes software lifecycle models	K1_IST_W05
PEU_W02	Student distinguishes and describes basic UML and OCL constructs	K1_IST_W05
PEU_W03	Student describes and distinguishes types of tests and test levels	K1_IST_W05
<b>In terms of skills</b>		
PEU_U01	Student prepares software requirements using different techniques	K1_IST_U03
PEU_U02	Student creates basic UML models and OCL constraints	K1_IST_U03
PEU_U03	Student defines test cases.	K1_IST_U03

## Program content ensuring learning outcomes

Lifecycle models. Requirements specification techniques. Domain modeling. Testing.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Classes	30
Preparaton for classes	16
Preparation of a report/summary/presentation/paper	4
Preparation for an exam/credit	6
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 75



## Foreign Language 1.2

### Educational subject description sheet

#### Basic information

<p><b>Field of study</b> lektoraty</p> <p><b>Speciality</b> -</p> <p><b>Organizational unit</b> Wrocław University of Science and Technology</p> <p><b>Study level</b> first degree</p> <p><b>Study form</b> full-time studies</p> <p><b>Education profile</b> general academic profile</p>	<p><b>Education cycle</b> 2025/2026</p> <p><b>Subject code</b> PWRSJOS.8CJO.01766.25</p> <p><b>Lecture languages</b> English</p> <p><b>Mandatoriness</b> Elective</p> <p><b>Block</b> Foreign languages</p>
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<p><b>Semesters</b> Semester 3, Semester 4</p>	<p><b>Activities, hours, ECTS and examination</b> • Classes: 60 h, 3 ECTS, Graded credit</p>
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#### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of skills</b>		
PEU_U01	Student has knowledge, skills and competences consistent with the requirements specified for the CEFR level B2 minimum; knows, understands and uses linguistic means (grammatical, lexical and stylistic) typical of academic, specialist and technical languages used in the field of study and used in the academic and professional environment; communicates effectively in interdisciplinary teams, practicing communication, creativity and critical thinking skills; appreciates the need to improve their skills in the field of specialized languages.	SJO_S1_U01

#### Program content ensuring learning outcomes

B2.2 English, French, Spanish, German  
C1.2 English, German  
General educational content

Self-presentation and team building, e.g. student's own profile in the context of a technical university and interests in the field of science; effectively presenting yourself, your interests and ideas in academic and professional contexts, interactive team-building tasks.

Presentation on a topic related to the field of study and students' scientific interests - presentation structure, development and discussion of visual materials - charts, tables, illustrations; using characteristic phrases and expressions, presenting a presentation and conducting a discussion related to the presentation.

Preparation for individual and project work with selected issues in a specialized language related to the field being studied - materials selected by students and the instructor.

Language in communication on academic topics using specialized language - e.g. formulating and exchanging views supported by arguments, joining the discussion, paraphrasing the presented content, moving on to subsequent points, summarizing statements, using characteristic phrases and expressions; taking part in various forms of interaction, using various discourse strategies.

### Calculation of ECTS points

Activity form	Activity hours
Classes	60
Preparaton for classes	30
<b>Student workload</b>	<b>Hours</b> 90



Sport activities 2  
Educational subject description sheet

**Basic information**

<b>Field of study</b> wychowanie fizyczne	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> PWRSWFS.83CWF.04469.25
<b>Organizational unit</b> Wrocław University of Science and Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Physical education classes

<b>Semesters</b> Semester 3, Semester 4, Semester 5, Semester 6	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 0.0
	<b>Activities and hours</b> Classes: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of skills</b>		
PEU_U01	The participant knows how to organize health-promoting training according to his or her interests, using the principles of a selected sports discipline or form of recreation.	SWF_S1_U01
PEU_U02	The student knows training methods that develop motor skills using their own body weight and various equipment.	SWF_S1_U01
PEU_U03	The student knows the basic technique of shaping exercises needed to prepare the body for physical exercise.	SWF_S1_U01
PEU_U04	The student knows the basic rules of safe behavior during physical activity.	SWF_S1_U01
PEU_U05	The student is able to develop a short- and long-term training plan adequate to his or her abilities.	SWF_S1_U01

PEU_U06	The student knows the principles of strengthening the deep and peripheral stabilization apparatus and the technique of basic exercises shaping aerobic and strength capacity.	SWF_S1_U01
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### Program content ensuring learning outcomes

Sports activities – ABT, aikido, badminton, bodyART, body ball, Brazilian Jiu Jitsu, Callanetics, cuban salsa fit, futsal, yoga, jogging, judo, karate, basketball, bodybuilding, athletics, body shaping, skiing, Nordic walking, pilates, football, handball, volleyball, swimming, pump, rugby, self-defense, shape, squash, stretch-one, ballroom dancing, table tennis, tennis, functional training, health-promoting training, mountain hiking, cycling tourism, floorball, rowing, climbing, corrective classes, Zumba, corrective classes for students with disabilities.

### Calculation of ECTS points

Activity form	Activity hours
Classes	30
<b>Student workload</b>	<b>Hours</b> 30



Linux Server Administration  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.18PK.03176.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 4	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 5.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	acquires basic knowledge in the administration of Linux server and workstation and basic knowledge in the administration of network infrastructure and network services using Linux.	K1_IST_W08
<b>In terms of skills</b>		
PEU_U01	acquires practical skills in the administration of Linux server and workstation and basic knowledge in the administration of network infrastructure and network services using Linux.	K1_IST_U14

## Program content ensuring learning outcomes

The course introduces students to Linux system administration in server and desktop environments, as well as managing network infrastructure and services. Covered topics include the fundamentals of Linux, such as various distributions, system architecture, installation, and the use of the text console and scripts. Students learn to manage users, groups, disks, file systems, backups, and administrative task scheduling. The course also addresses software installation, updates, and removal. It includes the configuration of network connections, firewalls, DHCP and DNS servers, file servers (NFS, Samba, FTP), and web servers (including CMS). Additionally, students are introduced to printing, the X Window graphical environment, virtualization, remote administration, and server security. The course ends up with knowledge tests.

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for classes	36
Preparation for an exam/credit	10
Credit/Exam	4
Preparation of a report/summary/presentation/paper	15
<b>Student workload</b>	<b>Hours</b> 125



Managing IT Infrastructure  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.18PK.03177.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 4	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 5.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	knows the basic local system resources (accounts, groups, printers, files) and how to manage them (configuration, permissions)	K1_IST_W08
PEU_W02	knows directory services and how to use them to centralise management	K1_IST_W08
PEU_W03	knows selected services supporting: network operations, remote access and network traffic security	K1_IST_W08
<b>In terms of skills</b>		
PEU_U01	configures user access to system resources	K1_IST_U14

PEU_U02	uses directory services for centralised management of a group of computers	K1_IST_U14
PEU_U03	configures selected network services and functions	K1_IST_U14

### Program content ensuring learning outcomes

1. Management of a single Windows Server machine.
2. Management of Active Directory directory services.
3. Management of services supporting the network infrastructure (DNS servers, DHCP, etc.).

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparaton for classes	30
Preparation for an exam/credit	10
Self-study of class topics	6
Preparation of a report/summary/presentation/paper	15
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 125



Routing and Switching in Computer Networks  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.18PK.03178.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 4	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 5.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	He has a structured knowledge of the configuration and operation of network operating systems.	K1_IST_W08
PEU_W02	Has structured knowledge about the functionality and operation of protocols and services supporting computer networks.	K1_IST_W08
<b>In terms of skills</b>		
PEU_U01	Has skills related to configuration of various types of network protocols, network services, network operating systems, as well as analysis of their operation and detection of basic errors in computer networks.	K1_IST_U14

## Program content ensuring learning outcomes

Management and administration of network operating systems based on Cisco IOS.  
Automation in computer networks.  
Protocols and services supporting the operation of computer networks.  
Configuration of protocols and network services on active devices.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for classes	36
Preparation for an exam/credit	10
Credit/Exam	4
Preparation of a report/summary/presentation/paper	15
<b>Student workload</b>	<b>Hours</b> 125



Presentation Techniques  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.110HS.03179.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Subjects from the fields of humanities or social sciences
<b>Education profile</b> general academic profile	

<b>Semester</b> Semester 5	<b>Activities, hours, ECTS and examination</b> • Seminar: 30 h, 2 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of skills</b>		
PEU_U01	Student is able to prepare various types of presentations and presentations of own solutions and achievements.	K1_IST_U18
PEU_U02	Student is able to critically analyze the speeches and presentations of other people, organizations and institutions.	K1_IST_U18

**Program content ensuring learning outcomes**

1. Basics of interpersonal communication: basic concepts and models
2. Basics of interpersonal communication: principles of creating an effective message, credibility of the sender
3. The role of verbal communication (dictionary, grammar, functions of words, sentences and questions)
4. The role of non-verbal communication (voice and its characteristics, facial expressions and gestures, distance)
5. Types of messages and their functions in various areas of social communication
6. The specificity of communication in various areas of social communication - matching messages to the auditorium

7. Mechanisms of self-presentation in interpersonal communication
8. Rules for the development of effective multimedia presentations
9. Rules for the development of effective multimedia presentations – case studies
10. Principles of effective data presentation
11. Elevator pitch - development of a brief speech and presentation
12. Stress related to public speeches and methods of coping with it
13. Analysis of students' own speeches and presentations
14. Analysis of students' own speeches and presentations, cont.
15. Analysis of students' own speeches and presentations, cont. Summary of classes.

### Calculation of ECTS points

Activity form	Activity hours
Seminar	30
Preparation of a report/summary/presentation/paper	10
Preparation for an exam/credit	10
<b>Student workload</b>	<b>Hours</b> 50



Cybersecurity  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.110PK.03902.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 5	<b>Activities, hours, ECTS and examination</b> <ul style="list-style-type: none"><li>• Lecture: 30 h, 3 ECTS, Exam</li><li>• Laboratory: 30 h, 2 ECTS, Graded credit</li></ul>
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Has knowledge about security threats	K1_IST_W10
PEU_W02	Has knowledge of selected issues in cryptology	K1_IST_W10
PEU_W03	Has knowledge about methods of ensuring security	K1_IST_W10
<b>In terms of skills</b>		
PEU_U01	Is able to identify threats to IT security	K1_IST_U08
PEU_U02	Is able to identify needs in the field of IT systems protection	K1_IST_U08
PEU_U03	Is able to choose protection methods to ensure IT security	K1_IST_U08

## Program content ensuring learning outcomes

Understanding the current problems related to data security and information systems

Understanding the methods and examples of solutions related to guaranteeing a high level of security.

Understanding the methods of security design for information systems.

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Self-study of class topics	30
Preparation for an exam/credit	11
Credit/Exam	4
Laboratory	30
Preparation for classes	20
<b>Student workload</b>	<b>Hours</b> 125



## Introduction to IoT Educational subject description sheet

### Basic information

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.110PK.03918.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 5	<b>Activities, hours, ECTS and examination</b> <ul style="list-style-type: none"><li>• Lecture: 30 h, 3 ECTS, Exam</li><li>• Laboratory: 30 h, 2 ECTS, Graded credit</li></ul>
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### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	The student characterizes, defines and cites basic knowledge of the theoretical foundations of the Internet of Things and the programming of devices in it.	K1_IST_W09
<b>In terms of skills</b>		
PEU_U01	The Student configures and uses basic communication protocols used in the Internet of Things.	K1_IST_U07
PEU_U02	The Student implements and configures basic Internet of Things devices.	K1_IST_U04

### Program content ensuring learning outcomes

Knowledge of the operation of the Internet of Things as it relates to the design and programming of IoT devices,

communication and application protocols, computing and data processing, security and privacy.  
 Basic practical skills in programming Internet of Things devices based on Arduino board and Raspberry Pi kits, and creating more complex software to integrate Internet of Things devices.

### Calculation of ECTS points

<b>Activity form</b>	<b>Activity hours</b>
Lecture	30
Laboratory	30
Credit/Exam	4
Preparation for an exam/credit	20
Preparation for classes	28
Preparation of a report/summary/presentation/paper	10
Self-study of class topics	3
<b>Student workload</b>	<b>Hours</b> 125



Software Engineering  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.110PK.00288.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 5	<b>Activities, hours, ECTS and examination</b> <ul style="list-style-type: none"><li>• Lecture: 30 h, 3 ECTS, Exam</li><li>• Project: 30 h, 3 ECTS, Graded credit</li></ul>
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Student designs software and databases	K1_IST_W14
<b>In terms of skills</b>		
PEU_U01	The student describes the requirements and, using the selected modeling language, models selected software elements, the database schema and plans the method of verifying the solution.	K1_IST_U03
PEU_U02	The student implements software and designs databases for simple, typical applications and verifies the correctness of the solution.	K1_IST_U04
PEU_U03	The student cooperates with other people in team projects.	K1_IST_U21

## Program content ensuring learning outcomes

- C1 Familiarity with basic concepts of software engineering
- C2 Familiarity with requirements engineering principles and techniques
- C3 Familiarity with main aspects of modelling, design and testing of information systems

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Project	30
Preparation for classes	10
Preparation of a project	60
Credit/Exam	4
Preparation for an exam/credit	16
<b>Student workload</b>	<b>Hours</b> 150



## Web Systems Programming Educational subject description sheet

### Basic information

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.110PK.03187.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 5	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Recognizes and translates the operation of selected Web programming language commands.	K1_IST_W07
PEU_W02	Selects the right technologies for programming components of web systems.	K1_IST_W07
<b>In terms of skills</b>		
PEU_U01	Adapts, arranges, and reorganizes operating systems or their components in accordance with submitted requirements.	K1_IST_U11

PEU_U02	Independently constructs simple web systems in accordance with the submitted requirements.	K1_IST_U11
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### Program content ensuring learning outcomes

Gaining knowledge and skills in the field of creating IT systems based on the client-server model using the HTTP protocol for communication.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for an exam/credit	5
Preparation for classes	35
<b>Student workload</b>	<b>Hours</b> 100



Developing Web Applications with .NET  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.110PK.03188.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 5	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	The student names and describes the operation of basic software components used in the implementation of web applications on the .NET platform.	K1_IST_W07
<b>In terms of skills</b>		
PEU_U01	The student is able to analyze and select appropriate C# types and constructs that support the implementation of a web application using appropriate elements of auxiliary languages.	K1_IST_U11

## Program content ensuring learning outcomes

Frontend and backend languages and techniques for creating web applications will be presented.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for an exam/credit	5
Preparation for classes	35
<b>Student workload</b>	<b>Hours</b> 100



Database Programming  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.110PK.03190.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 5	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 15 Project: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	He has a basic knowledge about the programming environment of the chosen relational database.	K1_IST_W14
PEU_W02	He has knowledge of the basics of the SQL language.	K1_IST_W14
PEU_W03	He has knowledge necessary for building advanced SQL language queries.	K1_IST_W14
PEU_W04	He knows the structures of database programming language on the server side.	K1_IST_W14

PEU_W05	He has knowledge of object-oriented relational database extensions.	K1_IST_W14
<b>In terms of skills</b>		
PEU_U01	He can navigate in the programming environment of the chosen relational database.	K1_IST_U03
PEU_U02	He can construct basic SQL language queries.	K1_IST_U03, K1_IST_U04
PEU_U03	He can construct advanced SQL language queries.	K1_IST_U03, K1_IST_U04
PEU_U04	He can program the database on the server side.	K1_IST_U04
PEU_U05	He can use the object-oriented extensions of the relational database, both in the definition of database scheme as well as programming on the server side.	K1_IST_U04

### **Program content ensuring learning outcomes**

1. Preliminary information on the chosen DBMS.
2. SQL language - basic queries in the dialect of the selected DBMS.
3. SQL language - advanced queries in the dialect of the selected DBMS.
4. Programming language on the server side - commands and their syntax on the example of a selected DBMS.
5. Advanced mechanisms of programming language on the server side on the example of a selected DBMS.
6. Object-oriented extensions of the relational database both within the definition of the database schema and programming on the database server side on the example of the selected DBMS.

### **Calculation of ECTS points**

<b>Activity form</b>	<b>Activity hours</b>
Lecture	15
Project	30
Preparation of a report/summary/presentation/paper	10
Preparation of a project	36
Preparation for an exam/credit	5
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 100



Database Design  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.110PK.03191.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 5	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 15 Project: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	has basic knowledge on methods and tools of database design	K1_IST_W14
PEU_W02	student can describe the stages of database design	K1_IST_W14
<b>In terms of skills</b>		
PEU_U01	The student is able to independently develop the individual phases of database design.	K1_IST_U03
PEU_U02	The student is able to independently implement a database.	K1_IST_U04
PEU_U03	The student is able to select the appropriate database design tool.	K1_IST_U03

## Program content ensuring learning outcomes

- Database design methodology: stages of design and challenges
- Selected UML elements: class diagrams in database design
- ER schema design: creating entities, attributes, and relationships
- Relational schema design: conversion and normalization of schemas
- Database models: conceptual, logical, and physical
- Database design tools
- Integrity constraints: definition and implementation
- Interface and report design
- Schema implementation and correctness verification

## Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Project	30
Preparation for an exam/credit	5
Preparation of a report/summary/presentation/paper	10
Preparation of a project	36
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 100



Mobile Applications for Android Platform  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.110PK.03193.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 5	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Knows the basic elements of mobile application architecture for the Android platform.	K1_IST_W07
PEU_W02	Describes how to implement solutions for Android applications regarding the basic functionalities of typical applications.	K1_IST_W07
<b>In terms of skills</b>		
PEU_U01	Is able to implement mobile applications for the Android platform with functionalities implemented in typical applications.	K1_IST_U11

## Program content ensuring learning outcomes

The course concerns programming applications for mobile devices with the Android system, in particular smartphones and tablets.

The program covers the implementation of native view-based applications and Jetpack Compose applications, including the implementation of selected basic functionalities such as menus, views with content adapters, handling persistent data (including database), multimedia elements, sensors, etc.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for an exam/credit	10
Preparation of a project	30
<b>Student workload</b>	<b>Hours</b> 100



Mobile Applications for iOS Platform  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.110PK.03194.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 5	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Knows and understands the specificity of mobile applications.	K1_IST_W07
PEU_W02	Knows how to design and implement mobile applications.	K1_IST_W07
PEU_W03	Knows programming tools.	K1_IST_W07
<b>In terms of skills</b>		
PEU_U01	Defines a set of functional requirements of a mobile application, and - based on the definition - designs a mobile application.	K1_IST_U11
PEU_U02	Implements a mobile application in accordance to the design.	K1_IST_U11

PEU_U03	Publishes a mobile application.	K1_IST_U11
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### Program content ensuring learning outcomes

iOS Programming ensures comprehensive learning outcomes by offering a well-structured combination of lectures and laboratory sessions that guide students through the development of modern mobile applications using Apple’s tools and guidelines. The lectures begin with an introduction to Apple devices, Mac OS, and a review of prominent mobile applications to set the foundation. UI/UX design principles, including material design, touch interactions, and Apple’s Human Interface Guidelines, are explored to equip students with essential skills for creating intuitive and visually appealing applications. Voice communication, such as Siri integration, and tools for multimedia processing are also covered, emphasizing modern app functionality.

Students gain hands-on experience with Xcode and Swift, understanding the structure and fundamental elements of Swift applications, along with core libraries for robust application development. Advanced topics include multimedia application development using libraries and frameworks, augmented reality integration, and multimedia data handling, such as compression formats and video/audio streaming. The lectures culminate in a discussion of interaction mechanisms and perspectives on multimedia techniques, preparing students for the future of mobile application development.

Laboratory sessions provide practical implementation experience, starting with interactive games and animations in both Android Studio and Xcode. Students develop multimedia-rich applications, such as photo galleries with animations and audio effects, and work on a capstone project—a virtual museum showcasing the integration of advanced multimedia techniques. By demonstrating their virtual museum projects, students showcase their mastery of modern development tools and technologies, achieving the learning outcomes required for iOS programming excellence.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparaton for classes	10
Preparation of a report/summary/presentation/paper	10
Preparation of a project	20
<b>Student workload</b>	<b>Hours</b> 100



Artificial Intelligence  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03919.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Activities, hours, ECTS and examination</b> <ul style="list-style-type: none"><li>• Lecture: 30 h, 2 ECTS, Exam</li><li>• Laboratory: 30 h, 2 ECTS, Graded credit</li></ul>
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Getting to know the field of Artificial Intelligence.	K1_IST_W13
PEU_W02	Learning the basic intelligent techniques, applicable to various types of problems	K1_IST_W13
<b>In terms of skills</b>		
PEU_U01	The ability to correctly identify problems suitable for the use of intelligent methods.	K1_IST_U06
PEU_U02	Ability to select the appropriate intelligent technique for a given problem.	K1_IST_U06

## Program content ensuring learning outcomes

An overview of AI methods is presented, starting from symbolic methods based on state space searching and knowledge representation, through machine learning methods including neural networks, to contemporary deep learning methods and generative AI. Students will also learn about selected AI problems and applications. In laboratory classes, students are taught practical issues of applying selected AI methods through solving simple problems. The methods are chosen to illustrate the various sections discussed in the lecture. The aim of the course is to signal the spectrum of AI methods and to encourage students to take a creative approach to the application of AI.

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for classes	20
Self-study of class topics	10
Credit/Exam	4
Preparation for an exam/credit	6
<b>Student workload</b>	<b>Hours</b> 100



Business Data Modelling and Analysis  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03920.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Major-specific subjects
<b>Education profile</b> general academic profile	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Activities, hours, ECTS and examination</b> <ul style="list-style-type: none"><li>• Lecture: 30 h, 2 ECTS, Exam</li><li>• Laboratory: 30 h, 2 ECTS, Graded credit</li></ul>
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	- Student has basic knowledge on business data modelling. - Student has basic knowledge on typical business data architectures. - Student has basic knowledge on ETL, reporting, visualization, and analysis processes.	K1_IST_W12
<b>In terms of skills</b>		
PEU_U01	Student has basic skills in using SQL for data analysis. Student has basic skills in ETL proces design and implementation. Student has skill in business data model design, its utilisation for data reporting and visualisation, and can correctly interpret obtain results.	K1_IST_U06

**Program content ensuring learning outcomes**

The goal of the course is to present business data modelling and analysis solutions. The major part of the course revolves

around the difference between OLTP and OLAP processing/data/needs with a particular focus on architecture, features, and benefits of a traditional data warehouse systems. The course outlines specific needs for data marts and data lakes, presents design steps of a small data analysis system, in particular focusing on dimensional data model and data loading into a data warehouse, writing aggregation queries, creating materialized query tables, etc. Furthermore, the course demonstrates approaches to data analysis using popular Business Intelligence (BI) tools such as Tableau or Power BI, with a particular focus on data visualisation and creation of data reports and dashboards.

### Calculation of ECTS points

<b>Activity form</b>	<b>Activity hours</b>
Lecture	30
Laboratory	30
Preparation for classes	13
Preparation of a project	15
Preparation for an exam/credit	8
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 100



Internship  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PZ.01767.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Lecture languages</b> English
<b>Study level</b> first degree engineering	<b>Mandatoriness</b> Obligatory
<b>Study form</b> full-time studies	<b>Block</b> Internship
<b>Education profile</b> general academic profile	

<b>Semester</b> Semester 6	<b>Activities, hours, ECTS and examination</b> • Internship: 150 h, 6 ECTS, Graded credit
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**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of skills</b>		
PEU_U01	Has the ability to work individually and in a team.	K1_IST_U23
PEU_U02	Is able to use the acquired knowledge to creatively analyze and solving IT problems	K1_IST_U23

**Program content ensuring learning outcomes**

The course program includes the application of acquired knowledge in real working conditions, preparing students for both individual and team-based work in a professional environment. Students carry out tasks tailored to the specifics of their chosen internship site, allowing for individualized experiences and the acquisition of specialized skills.

**Calculation of ECTS points**

<b>Activity form</b>	<b>Activity hours</b>
Internship	150
<b>Student workload</b>	<b>Hours</b> 150



Introduction to IT Project Management  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03200.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 15 Laboratory: 30 Seminar: 15	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Understands the stages of the project lifecycle and is familiar with the key components of a project plan.	K1_IST_W17
PEU_W02	Demonstrates knowledge of fundamental concepts related to planning, scheduling, and cost estimation of a project; understands the responsibilities of key project members and is familiar with the roles within a project.	K1_IST_W17
<b>In terms of skills</b>		

PEU_U01	Is capable of planning tasks and resources necessary for the successful execution of a project.	K1_IST_U09
PEU_U02	Demonstrates the ability to prepare a presentation and develop a report on a given topic, utilizing both English literature.	K1_IST_U16, K1_IST_U18
PEU_U03	Is able to analyze and report on the progress of project implementation.	K1_IST_U09, K1_IST_U18
PEU_U04	Is capable of preparing project documentation.	K1_IST_U09, K1_IST_U18

### Program content ensuring learning outcomes

- Planning and scheduling methods in traditional and agile methodologies.
- Resource management in a project.
- Project cost estimation.
- Ensuring quality in the implementation process of IT products.
- Risk management in IT projects.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Laboratory	30
Seminar	15
Preparation for classes	10
Preparation of a report/summary/presentation/paper	10
Preparation for an exam/credit	6
Self-study of class topics	5
Credit/Exam	4
Conducting literature research	5
<b>Student workload</b>	<b>Hours</b> 100



Support for IT Project Management  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03201.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 15 Laboratory: 30 Seminar: 15	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	student has a basic knowledge of methods for IT project management	K1_IST_W17
PEU_W02	student knows categories of software tools aiding IT project management	K1_IST_W17
<b>In terms of skills</b>		
PEU_U01	student can select and utilize aiding software tools appropriate for different phases of IT project management	K1_IST_U09

PEU_U02	student is able to carry out work breakdown, allocate resources, schedule and monitor accomplishment of a small IT project	K1_IST_U09
PEU_U03	student can retrieve and utilize information from recommended sources and acquire knowledge on his own	K1_IST_U16
PEU_U04	student understands the necessity of working systematically and creatively to accomplish the course	K1_IST_U16, K1_IST_U18
PEU_U05	student is capable of cooperating in a team utilizing software tools aiding IT project management	K1_IST_U18

### Program content ensuring learning outcomes

Familiarize students with basic methods for IT project management.

Familiarize students with categories of software tools aiding IT project management.

Gaining skills in work breakdown, planning, scheduling, cost estimation, and monitoring in IT projects.

Gaining skills in utilizing software tools aiding IT project management.

Gaining skills in working and cooperating with a team utilizing software tools aiding IT project management.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	15
Laboratory	30
Seminar	15
Preparaton for classes	10
Conducting literature research	5
Preparation for an exam/credit	6
Preparation of a report/summary/presentation/paper	10
Self-study of class topics	5
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 100



Distributed Computer Systems  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03203.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Knows the basic architectures of distributed computer systems and example solutions of such systems.	K1_IST_W07
PEU_W02	Describe selected technologies and techniques for implementing applications in distributed processing environment.	K1_IST_W07
<b>In terms of skills</b>		
PEU_U01	Is able to implement basic applications in a distributed computing environment using selected technologies.	K1_IST_U11

PEU_U02	Is able to obtain information from traditional and electronic sources in Polish and English in the field of distributed systems and applications.	K1_IST_U16
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### Program content ensuring learning outcomes

The course concerns issues related to the architecture of distributed systems and selected techniques and technologies for implementing distributed applications, including RPC, web applications (including REST services and web clients), queue systems, microservices and containerized services, P2P. The lecture also discusses selected problems in the operation of distributed systems.

The laboratory covers tasks of implementing distributed applications using the discussed solutions such as gRPC, REST services (and clients of these services), containerization of services, etc.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for an exam/credit	10
Preparation of a project	30
<b>Student workload</b>	<b>Hours</b> 100



Cloud Programming  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03204.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Identifies different cloud computing models and types of services offered.	K1_IST_W07
PEU_W02	Identifies and characterizes IaC (Infrastructure as Code) tools.	K1_IST_W07
<b>In terms of skills</b>		
PEU_U01	Implements cloud-based applications utilizing various types of data services, compute services, application services, and serverless services.	K1_IST_U11, K1_IST_U16

## Program content ensuring learning outcomes

Introduction to the subject matter.

Description of the course program, class organization, and assessment rules.

Introduction to basic concepts, evolution, and standardization in the field of cloud computing.

Cloud security principles.

Core cloud services.

Docker and Packer.

Infrastructure as Code (IaC) tools.

Data storage in the cloud (files and databases).

Serverless architecture and its applications.

Design and implementation of a cloud application.

Continuous Integration (CI) tools.

Best practices in cloud solutions.

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for classes	15
Self-study of class topics	25
<b>Student workload</b>	<b>Hours</b> 100



Game Programming  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03206.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Names and describes the basic concepts used in the design and implementation of video games.	K1_IST_W16
<b>In terms of skills</b>		
PEU_U01	Programs a simple 2D/3D game using the selected engine.	K1_IST_U13

**Program content ensuring learning outcomes**

Design and implementation of simple 2D and 3D games using the selected game engine.

## Calculation of ECTS points

<b>Activity form</b>	<b>Activity hours</b>
Lecture	30
Laboratory	30
Preparaton for classes	20
Preparation for an exam/credit	5
Preparation of a project	15
<b>Student workload</b>	<b>Hours</b> 100



Advanced Web Technologies  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03207.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Characterizes, defines and explains the operation of selected advanced web system development technologies	K1_IST_W16
PEU_W02	Properly identifies technologies for producing web systems	K1_IST_W16
<b>In terms of skills</b>		
PEU_U01	Develops web-based systems	K1_IST_U13
PEU_U02	Properly selects web system development technologies to meet requirements	K1_IST_U13
PEU_U03	Uses selected advanced web technologies	K1_IST_U13

PEU_U04	Presents and argues the web technologies used in his work	K1_IST_U13
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### Program content ensuring learning outcomes

Knowledge of advanced web technologies including discussion of web application architecture and design patterns used. Discussion of selected programming languages and frameworks used in web applications. Discussion of the APIs used in web technologies. Discussion of the design and prototyping process.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation of a project	20
Preparaton for classes	13
Preparation of a report/summary/presentation/paper	3
Preparation for an exam/credit	4
<b>Student workload</b>	<b>Hours</b> 100



Computer Graphics  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03209.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Knows color spaces used in CG and understands differences between them	K1_IST_W15
PEU_W02	Knows principles of transformation composition in homogenous coordinates	K1_IST_W15
PEU_W03	Understands principles of curves modeling in 2D	K1_IST_W15
PEU_W04	Knows properties of commonly used 3d rendering methods	K1_IST_W15
PEU_W05	Knows and understands stages of typical 3D rendering pipeline	K1_IST_W15

PEU_W06	Knows most popularly used geometry representation techniques for 3D	K1_IST_W15
PEU_W07	Knows and correctly interprets components of Phong lighting model formula	K1_IST_W15
<b>In terms of skills</b>		
PEU_U01	Can implement procedural pattern rendering of regular 2D using raster and vector approach	K1_IST_U12
PEU_U02	Is able to design and implement graphical UI using standard software components available in Java	K1_IST_U12
PEU_U03	Can construct the transformation matrix in homogenous coordinates corresponding to visually specified transformation	K1_IST_U12
PEU_U04	Can implement simple CG applications for 3D rendering based on OpenGL usage	K1_IST_U12
PEU_U05	Can select scene description methods according to specified CG application and is able to find out reasons of defects appearing in obtained images	K1_IST_U12
PEU_U06	Is able to evaluate efficiency of low-level methods and algorithms used in 2D and 3D CG	K1_IST_U12

### Program content ensuring learning outcomes

The curriculum content covers the theory and practice of the most commonly used computer graphics methods. Topics presented include the physiology of vision and their relationship to computer graphics techniques, methods for simple visualization of 3D scenes using the OpenGL library, and advanced methods for photorealistic visualization including the ray-tracing method, methods derived from the concept of photon maps, and methods for simulating diffuse lighting. Students attending the course will gain knowledge and practical skills to implement software using 2D and 3D computer graphics.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Preparation for classes	10
Credit/Exam	4
Preparation of a report/summary/presentation/paper	5
Self-study of class topics	5
Preparation of a project	10
Preparation for an exam/credit	6
<b>Student workload</b>	<b>Hours</b> 100



Programming Multimedia Applications  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03210.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Knows and understands the specifics of multimedia applications.	K1_IST_W15
PEU_W02	Has knowledge of designing and programming multimedia applications.	K1_IST_W15
<b>In terms of skills</b>		
PEU_U01	Is able to define a set of potential functional requirements of a multimedia application and design a multimedia application based on this set.	K1_IST_U12
PEU_U02	Can develop a multimedia application.	K1_IST_U12

## Program content ensuring learning outcomes

Program content includes: a discussion of the importance of multimedia and popular application areas, a review of selected multimedia applications, a discussion of issues related to the user interface and human-computer interaction, interface standards on mobile platforms, a review of programming techniques for mobile platforms, issues related to creating mobile applications, a discussion of topics related to generative artificial intelligence, an introduction to creating computer games, and the basics of virtual reality and augmented reality.

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	30
Self-study of class topics	5
Preparation of a project	10
Credit/Exam	4
Preparation for an exam/credit	6
Preparation for classes	10
Preparation of a report/summary/presentation/paper	5
<b>Student workload</b>	<b>Hours</b> 100



Digital Media Processing Techniques  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.120PK.03211.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 6	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 4.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 30	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	The student provides a comprehensive overview of the stages of analog media discretization and the methods employed in the generation of digital media.	K1_IST_W15
PEU_W02	The student provides an in-depth explanation of the methodologies employed in the compression of digital media.	K1_IST_W15
PEU_W03	The student is expected to demonstrate an understanding of the various digital media processing methods and techniques.	K1_IST_W15
PEU_W04	The student presents and elucidates the fundamental principles of multimedia product design.	K1_IST_W15

<b>In terms of skills</b>		
PEU_U01	The student demonstrates proficiency in the design of multimedia products, including the creation of presentations and animations.	K1_IST_U12
PEU_U02	The student is able to utilize specialized software for the processing and creation of multimedia products.	K1_IST_U12

### **Program content ensuring learning outcomes**

A comprehensive understanding of the principles and techniques involved in the creation and manipulation of digital media, including knowledge of the various methods and tools used for processing and compression. A grasp of the fundamental principles that underpin multimedia design. The capacity to utilise specialised software for the development of multimedia products, such as presentations and animations.

### **Calculation of ECTS points**

<b>Activity form</b>	<b>Activity hours</b>
Lecture	30
Laboratory	30
Preparaton for classes	10
Preparation of a report/summary/presentation/paper	5
Self-study of class topics	5
Preparation of a project	10
Credit/Exam	4
Preparation for an exam/credit	6
<b>Student workload</b>	<b>Hours</b> 100



IT Social and Professional Problems  
Educational subject description sheet

**Basic information**

<p><b>Field of study</b> Applied Computer Science</p> <p><b>Speciality</b> -</p> <p><b>Organizational unit</b> Faculty of Information and Communication Technology</p> <p><b>Study level</b> first degree engineering</p> <p><b>Study form</b> full-time studies</p> <p><b>Education profile</b> general academic profile</p>	<p><b>Education cycle</b> 2025/2026</p> <p><b>Subject code</b> W4NIST/000S.140HS.03212.25</p> <p><b>Lecture languages</b> English</p> <p><b>Mandatoriness</b> Obligatory</p> <p><b>Block</b> Subjects from the fields of humanities or social sciences</p>
<p><b>Semester</b> Semester 7</p>	<p><b>Activities, hours, ECTS and examination</b> • Lecture: 30 h, 2 ECTS, Graded credit</p>

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	PEU_W01 The student has knowledge of the protection of intellectual and industrial property related to the product of computing. The student is aware of copyright and patent law, in particular the solutions for personal and property rights. The student has knowledge of risk assessment in relation to the protection of intellectual and industrial property.	K1_IST_W20, K1_IST_W21, K1_IST_W22
PEU_W02	PEU_W02 The student is competent to implement the protection of IT works created in individual and group work. The student is competent to understand and formulate licences. Understand the transfer of copyright. Understand the nature of fair use and public use. In terms of social competences:	K1_IST_W20, K1_IST_W21, K1_IST_W22
PEU_W03	PEU_W03 The student is aware of the social aspects of the profession. He/she knows and understands the fundamental dilemmas of contemporary civilisation.	K1_IST_W21, K1_IST_W22

## Program content ensuring learning outcomes

- C1. Knowledge of how to solve social and legal problems related to IT and the IT profession.
- C2. Knowledge in the field of copyright, related rights and patent law, in particular knowledge of the nature of copyright, its subject and object parts, and knowledge in the field of author's personal and property rights in relation to information products.
- C3. Developing an awareness of the importance and understanding of the non-technical aspects and implications of engineering and computing activities, including their legal implications and environmental impact, and the related responsibility for decisions taken.

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Preparaton for classes	8
Credit/Exam	4
Self-study of class topics	8
<b>Student workload</b>	<b>Hours</b> 50



## Team Project Educational subject description sheet

### Basic information

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.140PK.03213.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects

<b>Semester</b> Semester 7	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 22.0
	<b>Activities and hours</b> Project: 120 Seminar: 15	

### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of skills</b>		
PEU_U01	Plans tasks within iterations and forecasts their execution time.	K1_IST_U20
PEU_U02	Cooperates with team members using modern means and tools.	K1_IST_U21
PEU_U03	Prepares documentation for the implementation of the engineering task.	K1_IST_U15, K1_IST_U17
PEU_U04	Searches for the necessary information and solves encountered (complex) engineering problems using various sources of information.	K1_IST_U10, K1_IST_U22
PEU_U05	It presents the solution from different perspectives (business, technical). He takes part in the discussion.	K1_IST_U17

<b>In terms of social competences</b>		
PEU_K01	Is able to critically evaluate the knowledge he has and the content he receives.	K1_IST_K01
PEU_K02	Appreciates the importance of knowledge, including expert knowledge in solving problems.	K1_IST_K02
PEU_K03	Respects the principles of professional ethics and is ready to perform various professional roles responsibly.	K1_IST_K03
PEU_K04	Shows initiative and acts in an entrepreneurial manner, is ready to take action for the benefit of the social environment and the public interest.	K1_IST_K04

### **Program content ensuring learning outcomes**

Project: Teamwork aimed at preparing a project vision, definition of requirements, definition of solution architecture. Plan and execute iterations as planned.

Seminar: Presentation of the product vision, intended business benefits, addressed problems, competitive products – according to the schedule. Presentation of the software product (in its current form), its basic functionalities, technologies used and approaches to solving problems – according to the schedule.

### **Calculation of ECTS points**

<b>Activity form</b>	<b>Activity hours</b>
Project	120
Seminar	15
Preparation of a project	300
Preparation of a report/summary/presentation/paper	25
Self-study of class topics	90
<b>Student workload</b>	<b>Hours</b> 550



## Data Science Educational subject description sheet

### Basic information

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.140PK.03215.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 7	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 6.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 45	

### Subject's learning outcomes

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	Student knows and describes the methods and tools of statistical data analysis, data mining, machine learning.	K1_IST_W18
PEU_W02	Student knows and describes the methods and tools for the analysis of large data sets, ensuring and verifying the quality of data and social media analyses.	K1_IST_W18
<b>In terms of skills</b>		
PEU_U01	Student is able to design and develop advanced data analysis processes.	K1_IST_U10

PEU_U02	Student is able to apply methods of statistical data analysis, data mining, machine learning.	K1_IST_U10
PEU_U03	Student is able to apply methods of analysis of large data sets, assurance and verification of data quality and social media analysis.	K1_IST_U10

## Program content ensuring learning outcomes

Course content:

- methods of design and development of advanced data analysis processes,
- methods and tools of statistical data analysis, data mining, machine learning,
- methods and tools to analyse large data sets, ensure and verify data quality and social media analysis.

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	45
Self-study of class topics	30
Preparation of a report/summary/presentation/paper	18
Preparation for classes	18
Preparation for an exam/credit	9
<b>Student workload</b>	<b>Hours</b> 150



Neural Networks  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.140PK.03216.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 7	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 6.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 45	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	He/she knows the theoretical basics, architecture and training methods neural networks presented in the lecture.	K1_IST_W18
<b>In terms of skills</b>		
PEU_U01	He/she is able to design, implement and train neural network model.	K1_IST_U10
PEU_U02	He/she is able to carry out experiments examining the effectiveness of the networks, perform analysis them and prepare a report on the experiments.	K1_IST_U10

## Program content ensuring learning outcomes

This course aims to provide knowledge in the field of neural network design, including various model architectures and learning methods. Additionally, it focuses on developing the skills needed to design and implement a neural network, as well as selecting the appropriate type to fit the specific problem being addressed.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	45
Preparation for classes	10
Preparation for an exam/credit	8
Conducting literature research	8
Preparation of a report/summary/presentation/paper	15
Conducting empirical studies	15
Self-study of class topics	15
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 150



Metaheuristics in Problems Solving  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.140PK.03217.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 7	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 6.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 45	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	PEU_W01: Has knowledge of approaches and methods used in machine learning	K1_IST_W18
PEU_W02	PEU_W02: Has knowledge of various metaheuristics applications	K1_IST_W18
PEU_W03	PEU_W03: Has knowledge of selected data preprocessing techniques	K1_IST_W18
PEU_W04	PEU_W04: Has knowledge of metaheuristics results validation	K1_IST_W18
PEU_W05	PEU_W05: Has knowledge of effective implementation of metaheuristics	K1_IST_W18

In terms of skills		
PEU_U01	PEU_U01: Can select a proper metaheuristic for given task	K1_IST_U10
PEU_U02	PEU_U02: Can design and implement application	K1_IST_U10
PEU_U03	PEU_U03: Can prepare and do an empirical experiments to examine metaheuristics effectiveness and usability	K1_IST_U10
PEU_U04	PEU_U04: Can prepare results analysis and do report of done experiments	K1_IST_U10

## Program content ensuring learning outcomes

Introduction to metaheuristics 2h  
 Introduction to Evolutionary Algorithms (EA) 2h  
 Solving problems and tasks using metaheuristics - research methodology 2h  
 Other metaheuristics: HillClimbing (HC), Tabu Search (TS), Simulated Annealing (SA) 2h  
 Introduction to EA specialization and extensions 2h  
 Specialization of EA: representation, fitness function and genetic operators 2h  
 Types and extensions of EA 4h  
 Hybrid metaheuristics 2h  
 Selected swarm-based metaheuristics: Ant Colony Optimization, Bee Colony Optimization, Particle Swarm Optimization 2h  
 Other selected metaheuristics 4h  
 Improving the effectiveness of metaheuristics 4h  
 Summary and recent directions 2h  
 Organization issues 2h  
 L1. Application of Evolutionary Algorithms to given problem A 7h  
 L2 Tabu Search (TS) usage to selected problem A 4,5h  
 L3 Simulated Annealing (SA) application to selected problem A 4,5h  
 L4 Comparison of EA, TS and SA implementation effectivency for selected problem A 9h  
 L5 Hybrids EA+SA and EA+TS used for solving problem A 9h  
 L6 Improving the effectiveness of metaheuristics - selected methods 9h

## Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	45
Preparaton for classes	25
Conducting empirical studies	18
Credit/Exam	4
Preparation of a report/summary/presentation/paper	18
Prepararation for an exam/credit	10
<b>Student workload</b>	<b>Hours</b> 150



Human-Computer Interaction  
Educational subject description sheet

**Basic information**

<b>Field of study</b> Applied Computer Science	<b>Education cycle</b> 2025/2026
<b>Speciality</b> -	<b>Subject code</b> W4NIST/000S.140PK.03218.25
<b>Organizational unit</b> Faculty of Information and Communication Technology	<b>Group of classes</b> Yes
<b>Study level</b> first degree engineering	<b>Lecture languages</b> English
<b>Study form</b> full-time studies	<b>Mandatoriness</b> Elective
<b>Education profile</b> general academic profile	<b>Block</b> Major-specific subjects
	<b>Subject related to scientific research</b> Yes

<b>Semester</b> Semester 7	<b>Examination</b> Graded credit	<b>Number of ECTS points</b> 6.0
	<b>Activities and hours</b> Lecture: 30 Laboratory: 45	

**Subject's learning outcomes**

Subject's outcome	Content	Learning outcome
<b>In terms of knowledge</b>		
PEU_W01	The student has practical knowledge in the field of Human-Computer Interaction.	K1_IST_W18
PEU_W02	The student has knowledge of methods and tools for designing interactive systems	K1_IST_W18
PEU_W03	The student has knowledge about the methods of user modeling and the personalization and adaptation of information systems	K1_IST_W18
PEU_W04	The student has knowledge of UX and usability research methods and availability of interactive systems	K1_IST_W18

In terms of skills		
PEU_U01	The student is able to analyze the context of system use IT	K1_IST_U10
PEU_U02	The student has the ability to plan and monitor user interface creation process	K1_IST_U10
PEU_U03	The student is able to design a user interface	K1_IST_U10

### Program content ensuring learning outcomes

C1: Familiarization with knowledge in the field of Human-Computer Interaction practice.

C2: Familiarization and ability to apply methods to ensure usability and user experience (UX).

C3: Introducing students to User-Centered Design methodology.

### Calculation of ECTS points

Activity form	Activity hours
Lecture	30
Laboratory	45
Preparation for classes	20
Preparation of a project	20
Conducting empirical studies	15
Preparation for an exam/credit	6
Preparation of a report/summary/presentation/paper	10
Credit/Exam	4
<b>Student workload</b>	<b>Hours</b> 150