



Lodz University
of Technology

Study programme

Faculty:	Faculty of Technical Physics, Information Technology and Applied Mathematics
Major:	Applied Computer Science
Level of study:	first-cycle programme (inżynier)
Form of study:	full-time studies
Academic year:	2026/27

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Basic information

Name of the field of study:	Applied Computer Science
Level of study:	first-cycle programme (inżynier)
Study profile:	general academic
Form of studies:	full-time studies
Duration of studies (number of semesters):	7
The number of ECTS points required to complete studies:	210
Total number of hours of classes:	2625
The number of ECTS points a student obtains as part of classes conducted with the direct participation of academic teachers or other persons conducting classes:	105
Professional title awarded to graduates:	inżynier
ISCED code:	0613
Language of study:	polish

Assigning the course to the disciplines to which the learning outcomes relate

Discipline	Percentage share
Technical computing and telecommunications	100%

Learning outcomes (in relation to the PQF)

No.	Learning outcome code	Learning Outcome Content	Reference to the universal characteristics of the first level of PRK	Reference to the second-level characteristics of the PRK, taking into account the second-level characteristics enabling the acquisition of engineering competences
1	1INS1	Knows and understands, at an advanced level, methods and tools in computer science, its mathematical foundations and related fields that enable explaining complex phenomena and relationships in IT systems.	P6U_W	P6S_WG
2	1INS2	Knows and understands professional duties in computing and evaluates them consciously, considering legal, ethical and economic conditions, including data protection and intellectual property, entrepreneurship principles, and practical applications.	P6U_W	P6S_WK
3	1INS3	Can select and use CS and related methods/tools to deliver complex IT projects in changing and not fully predictable working conditions.	P6U_U	P6S_UW
4	1INS4	Can design and conduct simple experiments/research or data analysis, interpret results and use them to improve computing solutions.	P6U_U	P6S_UW
5	1INS5	Can identify, formulate and analyze a complex, non-typical CS problem, critically assess gathered information, and propose solutions using appropriate methods and tools.	P6U_U	P6S_UW
6	1INS6	Can design an IT solution meeting given requirements, implement it using modern programming languages, integrate it with other solutions, and assess it for usability and security.	P6U_U	P6S_UW
7	1INS7	Can communicate clearly and precisely with specialists and non-specialists about CS topics, using a foreign language at least at B2, discuss solutions, and prepare technical documentation.	P6U_U	P6S_UK
8	1INS8	Can plan and organize own work and cooperate effectively in a (also interdisciplinary) project team, take roles, resolve conflicts and share responsibility for common goals.	P6U_U	P6S_UO, P6S_UU
9	1INS9	Is ready to critically evaluate own knowledge/skills, identify areas for development, learn systematically and independently, and seek expert input for complex engineering problems.	P6U_K	P6S_KK
10	1INS10	Is ready to take professional responsibility as a computing engineer, follows ethics/data protection/security rules, recognizes societal impacts of IT solutions, acts for the public interest and shows an entrepreneurial attitude in career planning and innovation.	P6U_K	P6S_KO, P6S_KR

Matrix of course modules in relation to learning outcomes and curriculum content

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
1	Algebra	Fundamentals of linear algebra for computing and engineering applications. Vectors and matrices: operations, properties and geometric interpretation. Systems of linear equations and solution methods, including Gaussian elimination. Vector spaces, basis and dimension, linear combinations, and linear dependence/independence. Linear transformations and their matrix representations. Eigenvalues and eigenvectors and their role in analysing transformations and systems. Applications of algebraic tools to computational modelling, stability analysis and the description of dynamic phenomena.	x		x							
2	Mathematical Analysis 1	Differential and integral calculus of single-variable functions with analytical and application-oriented focus. Limits of sequences and functions, and continuity with its computational implications. Derivatives: geometric and physical interpretation, differentiation rules, and analysis of monotonicity and extrema. Local approximations and basic error analysis, including Taylor expansions. Indefinite and definite integrals and their properties, fundamental integration techniques, and applications to computing areas, mean values and physical quantities. Numerical and functional series to the extent needed for convergence analysis and approximation. Solving computational and problem-based tasks typical for engineering applications.	x		x							
3	Physics 1	Fundamentals of classical mechanics with analytical and problem-oriented approach. Kinematics and dynamics of particles and rigid bodies, Newton's laws and their applications. Work, energy, linear and angular momentum and conservation principles in mechanical systems. Rotational motion and oscillations, including the harmonic oscillator and resonance. Mechanical waves: mathematical description, propagation and superposition. Introduction to basic electrical phenomena: charge, electric field, current and voltage, and elementary electric circuits. Analysis of physical principles relevant to computing, electronics and technical systems.	x		x							
4	Artificial Intelligence Tools	Programming environments and tool ecosystems used in AI and Data Science projects. Installation, configuration and management of computational environments, including virtual environments and dependency handling. Organisation of work using version control systems and code repositories. Project structuring, data and experiment management, and documentation of analytical workflows. Introduction to libraries and frameworks supporting data analysis and machine learning. Implementation of introductory AI projects covering environment setup, model development and result evaluation.			x							
5	Algorithms and Programming Fundamentals	Fundamentals of algorithms and structured programming in the context of solving computational problems. Construction of algorithms using control structures and basic data structures. Analysis of correctness and introduction to time and space complexity. Designing readable and modular programs according to good programming practices. Implementation and testing of algorithms in practical tasks.			x			x				
6	Introduction to Operating Systems	Fundamental functions and architecture of operating systems. Conceptual overview of process, memory and file system management. Introduction to virtualization and containerization as environment isolation techniques. Access control mechanisms and basic system security principles. Analysis of system configuration and the operating system's role in resource management.	x	x								

No.	Course name	Program content	1NS1	1NS2	1NS3	1NS4	1NS5	1NS6	1NS7	1NS8	1NS9	1NS10
7	Computer Aided Design	Fundamentals of CAD modeling and principles of technical graphics. Creation of technical drawings in accordance with standards and organization of engineering documentation. 3D modeling and visualization of objects. Dimensioning, preparation of documentation for publication and analysis of engineering design correctness.						x				
8	English B2 module I	The first part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
9	English B2+ module I	The first part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
10	English C1 module I	The first part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
11	German B2 module I	The first part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
12	Physics 2	Electromagnetism and wave phenomena from analytical and application-oriented perspectives. Electric and magnetic fields, Maxwell's laws and fundamentals of electromagnetic induction. Wave optics, interference and diffraction phenomena. Applications of electromagnetic principles in technical systems, telecommunications and electronics.	x		x							
13	Mathematical Analysis 2	Continuation of single-variable mathematical analysis and introduction to multivariable functions, continuity and differentiability, partial derivatives, gradient, multivariable optimisation, and multiple integrals. Discussion of power series and their convergence, as well as applications in solving differential equations.	x		x							
14	Discrete Mathematics with Elements of Cryptography	Fundamentals of combinatorics, graph theory, relations and functions, and elements of mathematical logic. Introduction to number theory in cryptographic applications. Symmetric and asymmetric encryption techniques and basic cryptographic algorithms. Applications of discrete methods in information security.	x		x							
15	High Level Programming	High-level programming with emphasis on Python. Data structures, functions, modules and object-oriented programming. Exception handling, file operations and use of libraries. Designing and implementing programs solving practical tasks.			x			x				
16	Operating Systems	Operating system models and architecture. Process and thread management, synchronization and scheduling. Memory organization, file systems and virtualization. Fundamentals of system security and operating environment administration.	x					x				

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
17	Fundamentals of Electronics	Properties and characteristics of electronic components: resistors, capacitors, diodes and transistors. Analysis of basic analogue circuits and their operating principles. Signal measurement and interpretation of electrical parameters. Design of simple amplifier circuits and analysis of their characteristics.	x		x							
18	Object Oriented Programming	Object-oriented programming as a paradigm for modelling software systems. Designing classes and objects using encapsulation, inheritance and polymorphism principles. Defining interfaces and managing dependencies between system components. Analysis of class responsibilities, modularity and code refactoring. Implementation and testing of object-oriented applications with clear and extensible structure.			x			x				
19	English B2 module II	The second part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
20	English B2+ module II	The second part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
21	English C1 module II	The second part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
22	German B2 module II	The second part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
23	Computer Networks	Network architecture models (OSI, TCP/IP) and their layered organization. Communication protocols at data link, network and transport layers (Ethernet, IP, TCP, UDP). Addressing, routing, switching and LAN configuration. Data transmission security mechanisms and basics of network diagnostics and traffic analysis. Practical configuration and laboratory exercises.	x					x				
24	Component Programming	Design and implementation of software components as building blocks of larger systems. Principles of modularity, separation of concerns and code reuse. Design patterns and interface contracts. Integration of components within applications and unit and integration testing. Analysis of component-based system architectures.			x			x				
25	Database Fundamentals	Data modelling using ER diagrams and normalization principles. Design of relational databases aligned with application requirements. SQL for data definition, manipulation and querying. Integrity constraints, indexes, views and transactions. Fundamentals of query optimization and database performance assessment.	x		x							
26	Data Exchange Standards	Data exchange standards based on XML and JSON and their role in system integration. Schema definition, validation and data conversion. Communication protocols and REST interfaces. Interoperability issues in distributed systems and ensuring consistency and correctness of exchanged information.			x							

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
27	Numerical Methods	Approximation and interpolation methods and analysis of numerical errors. Solving nonlinear equations and systems of linear equations. Numerical integration and differentiation. Stability and convergence of numerical algorithms. Applications of numerical methods in computer-based engineering computations.	x		x							
28	Computer Architecture and GPU Programming	Architecture of modern computer systems, including CPU organization and memory models. Memory hierarchy and its impact on computational performance. Fundamentals of parallel programming on GPUs and SIMD/data-parallel processing models. Analysis of processing pipelines and performance optimization. Identification of bottlenecks in computing systems.			x		x	x				
29	Concurrent Programming	Concurrency models and management of processes and threads. Synchronization mechanisms and inter-process communication. Race conditions, deadlocks and their avoidance. Designing concurrent applications with attention to safety and performance. Implementation and testing of solutions in high-level programming languages.			x			x				
30	English B2 module III	The third part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
31	English B2+ module III	The third part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
32	English C1 module III	The third part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
33	German B2 module III	The third part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
34	Fundamentals of Computer Graphics	Fundamentals of computer graphics from geometric and algorithmic perspectives. Representation of 2D/3D objects and scenes, transformations, projection, rasterisation and elements of the rendering pipeline. Basics of image modelling, colour spaces and colorimetry, with an introduction to image processing. Analysis of quality-performance trade-offs and exercises developing implementation and result interpretation skills.	x		x							
35	Digital Communication and Signal Processing	Fundamentals of analysing and processing analog and digital signals in telecommunications and multimedia applications. Time- and frequency-domain representations, including the Fourier transform and spectrum interpretation. Filtering, sampling, quantisation and compression, as well as basics of modulation and coding. Discussion of how processing parameters affect signal quality and transmission robustness, supported by exercises developing method selection skills.	x		x							

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
36	Embedded Systems	Embedded system architecture and design principles with attention to resource constraints and timing requirements. Microcontrollers, peripherals, communication interfaces and fundamentals of low-level programming. Integration with sensors and actuators, interrupt handling and an introduction to real-time systems. Diagnostics, testing and analysis of prototype behaviour through laboratory tasks.	x					x				
37	Fundamentals of Software Engineering	Software engineering principles across the system lifecycle: requirements analysis and specification, architecture design, implementation planning and testing. Process models and selecting practices depending on project scale and risks, including traditional and agile approaches. Solution documentation, change and quality management, and fundamentals of software maintenance. Development of teamwork competences and assessment of development quality.					x	x		x		
38	Artificial Intelligence Algorithms	AI models and methods from an algorithmic perspective. Knowledge and problem representation, state-space search and heuristic techniques. Fundamentals of reasoning and decision making in intelligent systems, with an introduction to learning methods as elements of data-driven solutions. Analysis of limitations of classical approaches and preparation for further topics in machine learning and deep learning.			x	x						
39	Data Science Fundamentals	Introduction to the data analysis workflow: acquisition, preparation, exploration, basic modelling and result interpretation. Data processing, handling missing values and anomalies, and selecting representations for analysis. Introduction to statistical methods and simple predictive models used in descriptive and forecasting tasks. Evaluation of results using basic metrics and development of skills in communicating analytical conclusions.				x						
40	English B2 module IV	The fourth part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
41	English B2+ module IV	The fourth part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
42	English C1 module IV	The fourth part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
43	German B2 module IV	The fourth part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.							x			
44	Cybersecurity Fundamentals	Introduction to information, system and network security. Threats, vulnerabilities and fundamental protection mechanisms including cryptography, authentication and access control. Risk models, security policies and basics of incident analysis. Developing awareness of threats and responsible use of IT systems in engineering practice.			x	x						

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
45	Secure Applications in Secure Networks	Design and implementation of secure applications in networked and distributed environments. Access control mechanisms, encrypted communication, API security and protection against common application attacks. Fundamentals of security auditing, vulnerability testing and configuration verification. Secure-by-design principles and practical approaches to building attack-resilient solutions.					x	x				
46	Data Science Design and Practice	Implementation of a project covering the full data science lifecycle: problem definition, data acquisition, exploration, modelling, validation and presentation of results. Selection of appropriate methods and tools. Documentation of analytical processes and communication of findings through reports and presentations. Critical evaluation of assumptions and solution limitations.				x			x			
47	Data Visualization and Reporting	Principles of designing clear and reliable visualisations supporting decision-making. Selection of graphical forms appropriate to data characteristics and audience. Data storytelling and integration of visual outputs with analytical interpretation. Design of dashboards and interactive reports. Identification of cognitive biases and misleading visual practices.							x			
48	Computer Modeling and Animation	3D object and scene modeling. Deformation, rigging and keyframe animation. Physical simulations and procedural effects. Production pipelines for games and animated film. Integration of models with graphics engines.						x		x		
49	Mathematics for Computer Graphics	Coordinate spaces, transformation matrices and linear algebra in graphics. Projection and geometric transformations. Lighting models and normal vectors. Interpolation and approximation in image generation. Mathematical foundations of rendering.	x		x							
50	High-Availability and Automated Infrastructures	High-availability architectures, service redundancy and replication. Infrastructure as Code and infrastructure automation. DevOps practices, CI/CD pipelines and service orchestration. Monitoring, configuration management and business continuity assurance.			x			x				
51	Web Applications and Network Services	Web application architectures (frontend, backend, APIs). Client-server communication, RESTful services and service integration. Web security, authentication and authorization. Deployment in cloud and containerized environments.						x				
52	Security in Modern Software	Threat identification and attack models. Application vulnerabilities (including OWASP), code security analysis and penetration testing. Authentication and authorization mechanisms. Secure-by-design development principles and system resilience against attacks.						x				
53	Modern Software Development Environments	Tooling supporting collaborative software development: version control systems, CI/CD pipelines and automated builds/testing. Containerization and service orchestration. DevOps practices and continuous integration. Repository organization and dependency management.						x				
54	Image Processing and Analysis	Filtering, geometric transformations and morphological operations. Segmentation and edge detection. Spatial and frequency-domain image analysis. Feature extraction and introduction to image recognition. Implementation of image processing algorithms.				x						

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
55	Statistics and Probability Theory	Probability theory, random variables and distributions. Parameter estimation and hypothesis testing. Correlation and regression in data analysis. Statistical inference in engineering practice. Interpretation of results in data analysis contexts.				x						
56	Computer Games Fundamentals	Fundamentals of game design: mechanics, dynamics and aesthetics. Gameplay systems design and balancing. Production pipelines, team roles and engine environments. Game market analysis and business models. Critical evaluation of existing games.					x			x		
57	Narrative-Based Concept Design	Concept development for narrative-driven games. Story structure design and world-building. Character creation, dialogue systems and player motivation. Integration of narrative with gameplay mechanics. Preparation of concept documentation and narrative prototypes.							x	x		
58	Data Mining Methods for Data Science	Algorithmic methods for discovering patterns and relationships in data. Clustering, classification, dimensionality reduction and association rules in large-scale data analysis. Selection of quality metrics and interpretation of results in descriptive and predictive tasks. Model stability analysis and issues of overfitting and generalisation. Application of data mining methods in case studies.			x	x						
59	Data Engineering for Data Science	Design and implementation of data processing pipelines in large-scale and dynamic environments. Integration of data sources, batch and stream processing and data quality management. Big Data architectures and ETL/ELT tools. Data flow modelling with scalability and reliability considerations. Performance and cost evaluation of data processing solutions.			x	x						
60	Feature Engineering and Data Preparation	Techniques for feature selection, extraction and transformation in analytical and predictive tasks. Normalisation, standardisation and handling of missing values and anomalies. Dimensionality reduction and construction of new data representations. Analysis of how data quality affects model stability and performance. Documentation of preprocessing workflows and ensuring experimental reproducibility.				x						
61	Data Science Design and Practice	Implementation of a project covering the full data science lifecycle: problem definition, data acquisition, exploration, modelling, validation and presentation of results. Selection of appropriate methods and tools. Documentation of analytical processes and communication of findings through reports and presentations. Critical evaluation of assumptions and solution limitations.				x			x			
62	Data Visualization and Reporting	Principles of designing clear and reliable visualisations supporting decision-making. Selection of graphical forms appropriate to data characteristics and audience. Data storytelling and integration of visual outputs with analytical interpretation. Design of dashboards and interactive reports. Identification of cognitive biases and misleading visual practices.							x			

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
63	Engineering Competency Project	Team-based implementation of an engineering project integrating knowledge and skills acquired during the programme. Problem identification, requirements analysis and preparation of functional and technical specifications. System architecture design, implementation, component integration and development of testing and validation plans. Team management aspects including role allocation, scheduling, communication, progress monitoring and risk management. Presentation of project outcomes, documentation of design decisions and critical assessment of adopted solutions with respect to technical and organizational constraints.					x	x	x	x		x
64	Internship	Completion of an internship in a professional environment aligned with the programme profile. Performance of project and/or implementation tasks within technical teams and participation in organizational processes typical for IT enterprises. Familiarization with technologies, tools, quality standards and communication practices used in project structures. Application of academic knowledge to practical problem solving and development of professional competences, including responsibility, independence and teamwork. Preparation of a summary report and reflection on professional development outcomes.						x		x	x	
65	Diploma Proseminar	Preparation for the diploma thesis through refinement of the topic, objectives, scope and methodological assumptions. Literature review and critical analysis of existing solutions in the selected domain. Development of a preliminary solution concept, work schedule and thesis structure. Discussion of principles of academic and technical writing, source referencing and result presentation. Presentation of the thesis concept within the seminar group and discussion of adopted assumptions.							x	x	x	
66	Digital Forensics	Covers methodologies for securing and analysing digital evidence in the context of security incidents and cybercrime. Procedures for identification, preservation and recovery of data from storage media and IT systems while maintaining evidential integrity. Analysis of digital traces, system logs and network traffic for event reconstruction. Documentation of findings and preparation of formal forensic reports. Evaluation of evidence reliability and methodological limitations.							x			
67	Data Scalability and Big Data Techniques	Distributed computing architectures and Big Data systems. Batch and stream data processing in high-volume and heterogeneous environments. Distributed file systems (e.g., HDFS), computing clusters and horizontal/vertical scaling strategies. Trade-offs between performance, consistency and availability. Design of scalable analytical systems.					x	x				
68	Game Level Design	Game level design focusing on mechanics, environmental storytelling and player experience. Spatial structure, pacing, difficulty balancing and progression systems. Integration with game engines and gameplay systems. Iterative playtesting, player behavior analysis and gameplay optimization. Level prototyping in a selected engine.							x	x		
69	Networked Database Systems	Distributed database systems: replication, partitioning and synchronization. Data consistency mechanisms in networked environments. Distributed transactions and fault tolerance. Design of scalable storage systems for network applications.						x				
70	Software Quality in the Software Development Process	Installation, deployment and update processes. Production environment configuration and monitoring. Rollout and rollback strategies, SLA and service continuity. Integration of deployment processes with DevOps practices and cloud environments.			x			x				

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
71	High-Performance Computing	Parallel and distributed computing. Cluster architectures and GPU accelerators. Programming models: MPI, OpenMP and CUDA. Code optimization and task scheduling. HPC applications in simulations and large-scale data analysis.					x	x				
72	Game Narrative Design	Narrative structures and pacing in games. Integration of dramaturgy with gameplay mechanics. Dialogue systems and character relationships. Analysis of player narrative experience. Creation of narrative documentation and interactive scripts.							x	x		
73	Artificial Intelligence in Data Science	Application of supervised and unsupervised learning methods in data analysis. Predictive and classification models with validation and interpretation procedures. Integration of AI algorithms into analytical workflows and data infrastructures. Analysis of model limitations, risks of incorrect conclusions and generalisation issues. Case studies of AI applications in Data Science projects.				x						
74	Intelligent Business Analytics Systems	Business data modeling and analytics in enterprise environments. Data warehouse architectures, ETL processes and star/snowflake schemas. Decision Support Systems (DSS), OLAP tools and design and interpretation of KPI indicators. Integration of analytics tools with business processes. Case study analysis of BI implementations and evaluation of analytical solution effectiveness.				x						
75	NoSQL Databases	Non-relational database models: document, graph, columnar and key-value stores. Replication, partitioning and consistency mechanisms in distributed systems. Data modeling in NoSQL, fundamentals of querying and optimization, and analysis of applications in scalable systems. Overview of typical use cases and design trade-offs versus relational solutions.			x		x					
76	Data Scalability and Big Data Techniques	Distributed computing architectures and Big Data systems. Batch and stream data processing in high-volume and heterogeneous environments. Distributed file systems (e.g., HDFS), computing clusters and horizontal/vertical scaling strategies. Trade-offs between performance, consistency and availability. Design of scalable analytical systems.					x	x				
77	Diploma Seminar	Systematic presentation of diploma thesis progress and discussion of adopted methodology, scope and obtained results. Analysis of research and engineering problems, consultations with the supervisor and verification of schedule compliance. Development of skills in argumentation, result interpretation and formulation of conclusions. Preparation for public presentation and defense through structured presentations and subject-matter discussions.							x	x	x	
78	Final Project	Independent completion of an engineering thesis including literature review, problem formulation and development of a solution concept. Design and implementation of a system, algorithm or technical solution addressing the defined problem. Testing, validation and evaluation of obtained results. Preparation of comprehensive documentation covering analytical, design and implementation components and readiness for thesis defense.					x	x	x	x	x	
79	Social Aspects of Engineering	Analysis of ethical, social and legal aspects of engineering practice in the context of information technology development. Professional responsibility of engineers and the impact of IT systems on society, labor markets and user privacy. Legal regulations concerning data protection, intellectual property and information security. Case studies related to design failures, technological misuse and consequences of engineering decisions.		x								x

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
80	Entrepreneurship in IT Sector	Development and analysis of business models for digital products and services. Identification of market needs, value proposition design and planning growth strategies for technology ventures. Fundamentals of IT project financing, cost and risk management and innovation commercialization mechanisms. Case study analysis of technology startups and development of entrepreneurial competences in the IT sector.		x								x
81	Security of Containerized Applications	Principles of designing and maintaining secure containerized environments. Analysis of threats related to container images, runtime configuration and orchestration platforms such as Kubernetes. Isolation mechanisms, access control and secret management. Integration of security into CI/CD pipelines and vulnerability monitoring in cloud environments. Risk assessment and selection of practices reducing attack surface.		x	x							
82	Open Source Intelligence Techniques	Methods for acquiring, analysing and correlating information from open sources for situational awareness and threat identification. Work with public registers, online resources, social media and technical datasets. Assessment of credibility and completeness of information and identification of misinformation. Legal and ethical aspects of OSINT activities. Integration of multi-source data for threat profiling.				x		x				
83	Data Ethics and Storytelling	Data ethics, algorithmic bias and analytical responsibility. Information protection and regulatory compliance. Designing data-driven narratives and effective communication of analytical results. Identification of interpretative errors and misleading visualizations. Analysis of the societal and business impact of data and predictive models.		x								x
84	Multicriteria Analysis and Decision Making	Multicriteria decision-making methods (AHP, TOPSIS, ELECTRE). Decision problem modeling and definition of criteria and weights. Ranking of alternatives and sensitivity analysis. Decision-making under uncertainty and conflicting criteria. Implementation of selected methods in engineering and analytical tasks.			x	x						
85	Visual Identity Design	Design of comprehensive visual identity systems including logotypes, symbols, typography and color systems. Brand book creation and application guidelines for digital and print media. Visual consistency across communication channels. Case study analysis and development of a visual identity project.							x		x	
86	Computer Visual Effects	Visual effects techniques for film and games. Compositing, tracking, rotoscoping and CGI integration with live-action footage. Particle simulations, dynamic effects (fire, smoke, water) and color grading. VFX production pipeline organization and rendering quality/performance optimization.								x		
87	Application Maintenance Techniques	Software maintenance across the system lifecycle: monitoring, incident and error analysis, patch management and updates. Code refactoring, version control and change documentation. Planning system evolution and modernization. Integration of maintenance processes with CI/CD tools and DevOps practices.			x			x				
88	Software Deployment and Maintenance Processes	Installation, deployment and update processes. Production environment configuration and monitoring. Rollout and rollback strategies, SLA and service continuity. Integration of deployment processes with DevOps practices and cloud environments.			x			x				
89	IT Project Management Methods	Classical (PMBOK, PRINCE2) and agile (Scrum, Kanban, Lean) project management methodologies. Scope planning, scheduling, cost estimation and budget control. Risk, communication and stakeholder management. Project monitoring, quality control and reporting. Case study analysis of technology projects.					x			x		

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
90	Applications of Machine Learning	Practical applications of machine learning in business and technical data analysis. Implementation of classification and regression models in predictive systems. Applications in natural language processing, computer vision, recommender systems and anomaly detection. Integration of ML models into production environments and performance evaluation. Industrial case studies.				x						
91	Reasoning Under Uncertainty	Probabilistic models in decision systems. Bayesian networks and graphical dependency models. Probabilistic inference methods, parameter estimation and structure learning. Risk analysis and decision-making under incomplete information. Applications in decision support systems and AI.			x	x						
92	Computer Simulation Technologies	Simulation models and object dynamics. Physical simulations and particle systems. Numerical methods in simulation. Applications in games, VR/AR and training systems. Stability and performance analysis.				x						
93	Interface Design	User interface design with attention to ergonomics and accessibility. Interaction models and information architecture. Prototyping and usability testing. UI systems in applications and games. User experience (UX) analysis.				x						
94	Operating Systems and Service Hardening	Hardening of operating systems and network services in production environments. Security configuration, access policies, protocol protection and attack surface reduction. Configuration auditing, vulnerability assessment and fundamentals of incident response and documentation. System monitoring, event logging and introduction to best practices for maintaining secure services.		x	x			x				
95	Mobile Applications	Design and implementation of mobile applications with attention to platform specifics and application lifecycle. Application architecture, UI/UX design, integration with network and backend services, and local data handling. Mobile security aspects, permission management, and fundamentals of testing and debugging. Deployment to app stores, maintenance and updates; implementation projects are included.						x				
96	Distributed Applications and Services	Distributed system architectures and communication models between components. Service integration, distributed computing, scalability and fault tolerance. Synchronization, data consistency and fundamentals of designing failure-resilient systems. Load balancing, observability (monitoring, logging) and analysis of design trade-offs in distributed systems.					x	x				
97	Cybersecurity Fundamentals	Introduction to information, system and network security. Threats, vulnerabilities and fundamental protection mechanisms including cryptography, authentication and access control. Risk models, security policies and basics of incident analysis. Developing awareness of threats and responsible use of IT systems in engineering practice.			x	x						
98	Secure Applications in Secure Networks	Design and implementation of secure applications in networked and distributed environments. Access control mechanisms, encrypted communication, API security and protection against common application attacks. Fundamentals of security auditing, vulnerability testing and configuration verification. Secure-by-design principles and practical approaches to building attack-resilient solutions.					x	x				

No.	Course name	Program content	1NS1	1NS2	1NS3	1NS4	1NS5	1NS6	1NS7	1NS8	1NS9	1NS10
99	Artificial Intelligence in Cybersecurity	Application of machine learning methods in cybersecurity. Anomaly detection, incident classification, behavioral analytics and automated inference from security data. Feature selection, model evaluation and interpretation of results in operational contexts. Introduction to integrating models with monitoring processes and decision support for threat response.		x		x		x				
100	NoSQL Databases	Non-relational database models: document, graph, columnar and key-value stores. Replication, partitioning and consistency mechanisms in distributed systems. Data modeling in NoSQL, fundamentals of querying and optimization, and analysis of applications in scalable systems. Overview of typical use cases and design trade-offs versus relational solutions.			x		x					
101	Fundamentals of Virtual Systems	Covers hardware and software virtualization, containerization, orchestration, resource isolation and virtual environment management.						x				
102	Digital Forensics	Covers methodologies for securing and analysing digital evidence in the context of security incidents and cybercrime. Procedures for identification, preservation and recovery of data from storage media and IT systems while maintaining evidential integrity. Analysis of digital traces, system logs and network traffic for event reconstruction. Documentation of findings and preparation of formal forensic reports. Evaluation of evidence reliability and methodological limitations.							x			
103	Advanced Programming	Design patterns and software architectures. Programming paradigms (object-oriented, functional, concurrent). Advanced data structures and algorithms. Metaprogramming and code performance optimization. Refactoring and software quality analysis.					x	x				
104	Mobile Applications	Design and implementation of mobile applications with attention to platform specifics and application lifecycle. Application architecture, UI/UX design, integration with network and backend services, and local data handling. Mobile security aspects, permission management, and fundamentals of testing and debugging. Deployment to app stores, maintenance and updates; implementation projects are included.						x				
105	Distributed Applications and Services	Distributed system architectures and communication models between components. Service integration, distributed computing, scalability and fault tolerance. Synchronization, data consistency and fundamentals of designing failure-resilient systems. Load balancing, observability (monitoring, logging) and analysis of design trade-offs in distributed systems.					x	x				
106	High-Availability and Automated Infrastructures	High-availability architectures, service redundancy and replication. Infrastructure as Code and infrastructure automation. DevOps practices, CI/CD pipelines and service orchestration. Monitoring, configuration management and business continuity assurance.			x			x				
107	Web Applications and Network Services	Web application architectures (frontend, backend, APIs). Client-server communication, RESTful services and service integration. Web security, authentication and authorization. Deployment in cloud and containerized environments.						x				

No.	Course name	Program content	1NS1	1NS2	1NS3	1NS4	1NS5	1NS6	1NS7	1NS8	1NS9	1NS10
108	Selected Aspects of Network Applications	Modern networking protocols and service-oriented architectures. Integration of distributed and cloud-based systems. Performance, security and scalability of network applications. Case study analysis and implementation of selected solutions.						x				
109	NoSQL Databases	Non-relational database models: document, graph, columnar and key-value stores. Replication, partitioning and consistency mechanisms in distributed systems. Data modeling in NoSQL, fundamentals of querying and optimization, and analysis of applications in scalable systems. Overview of typical use cases and design trade-offs versus relational solutions.					x	x				
110	Fundamentals of Virtual Systems	Covers hardware and software virtualization, containerization, orchestration, resource isolation and virtual environment management.						x				
111	Networked Database Systems	Distributed database systems: replication, partitioning and synchronization. Data consistency mechanisms in networked environments. Distributed transactions and fault tolerance. Design of scalable storage systems for network applications.						x				
112	Graphics Programming	Real-time computer graphics programming. Rendering pipeline, geometry processing and programmable shading. Lighting models and rasterization techniques. GPU performance optimization and graphics resource management. Implementation of selected graphics algorithms.						x				
113	Graphic Design	Fundamentals of visual design: composition, typography and color theory. Designing visual communication for digital and print media. Analysis of visual perception and message readability. Creation of projects consistent with visual identity principles. Use of professional creative design tools.							x	x		
114	Selected Problems in Art History, Aesthetics and Composition	Historical and aesthetic contexts in art and visual media. Artistic movements and their impact on contemporary design. Principles of composition and visual perception. Analysis of artworks in terms of form, content and communicative function. Application of aesthetic knowledge in digital design.							x			
115	Computer Modeling and Animation	3D object and scene modeling. Deformation, rigging and keyframe animation. Physical simulations and procedural effects. Production pipelines for games and animated film. Integration of models with graphics engines.						x		x		
116	Mathematics for Computer Graphics	Coordinate spaces, transformation matrices and linear algebra in graphics. Projection and geometric transformations. Lighting models and normal vectors. Interpolation and approximation in image generation. Mathematical foundations of rendering.	x		x							
117	Digital Sculpting and Painting	Digital sculpting and organic modeling techniques. UV mapping and texturing. Procedural painting and material creation. Integration with production pipelines.			x		x					
118	Animated Film	Animated film production process from concept to post-production. Scriptwriting, storyboarding and animatics. Character and environment design. 2D and 3D animation techniques, audiovisual synchronization, editing and basics of animation directing. Production pipeline organization and teamwork in developing a short animated project.						x	x	x		

No.	Course name	Program content	1NS1	1NS2	1NS3	1NS4	1NS5	1NS6	1NS7	1NS8	1NS9	1NS10
119	Foundations of Film and TV Production	Image and sound capture techniques in film and television production. Framing, composition, lighting design and camera operation fundamentals. Audio recording and post-production. Linear and non-linear editing and production workflow organization. Introduction to broadcasting standards and media formats.							x			
120	Game Level Design	Game level design focusing on mechanics, environmental storytelling and player experience. Spatial structure, pacing, difficulty balancing and progression systems. Integration with game engines and gameplay systems. Iterative playtesting, player behavior analysis and gameplay optimization. Level prototyping in a selected engine.							x	x		
121	Advanced Optimization Methods	Deterministic and stochastic optimization methods. Linear and nonlinear programming, convex optimization and penalty methods. Gradient-based and approximate algorithms for decision problems. Convergence and computational efficiency analysis. Applications in engineering and data science.				x						
122	Artificial Intelligence Fundamentals	Knowledge representation and information models. Logic, knowledge graphs and reasoning mechanisms. State-space search algorithms and heuristics. Classical problem-solving techniques and expert systems. Limitations and challenges of AI systems.	x		x							
123	Machine Learning	Supervised and unsupervised learning for classification and regression. Cross-validation, regularization and ensemble methods. Data preparation and ML pipeline construction. Model evaluation and overfitting analysis. Implementation of selected algorithms.				x						
124	Image Processing and Analysis	Filtering, geometric transformations and morphological operations. Segmentation and edge detection. Spatial and frequency-domain image analysis. Feature extraction and introduction to image recognition. Implementation of image processing algorithms.				x						
125	Statistics and Probability Theory	Probability theory, random variables and distributions. Parameter estimation and hypothesis testing. Correlation and regression in data analysis. Statistical inference in engineering practice. Interpretation of results in data analysis contexts.				x						
126	Explainable Artificial Intelligence	Interpretability methods for machine learning models. XAI techniques (LIME, SHAP, PDP, saliency maps). Algorithmic bias detection and model auditing. Transparency of decision systems. Legal and ethical aspects of AI use.			x	x						
127	Introduction to Deep Learning	Neural network architectures (MLP, CNN, RNN). Backpropagation and loss optimization. Regularization and training stability. Representation learning. DL applications in computer vision and NLP.			x	x						
128	Data and Knowledge Acquisition	Data acquisition from databases, APIs and online sources. Information extraction from structured and unstructured data. Knowledge representation models. Data integration from multiple sources. Data quality and reliability assessment.				x						
129	High-Performance Computing	Parallel and distributed computing. Cluster architectures and GPU accelerators. Programming models: MPI, OpenMP and CUDA. Code optimization and task scheduling. HPC applications in simulations and large-scale data analysis.					x	x				

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
130	Requirements Engineering in IT Projects	Acquisition, analysis and documentation of functional and non-functional requirements. Business process modeling, use cases and system scenarios. Stakeholder roles and requirement conflict management. Validation, verification and traceability throughout the project lifecycle.							x	x		
131	Metaheuristics and Their Applications	Metaheuristic algorithms including evolutionary algorithms, particle swarm optimization, simulated annealing and GRASP. Solution space analysis and exploration-exploitation balance. Stopping criteria and computational complexity analysis. Applications in combinatorial and continuous optimization problems.			x							
132	Advanced Programming	Design patterns and software architectures. Programming paradigms (object-oriented, functional, concurrent). Advanced data structures and algorithms. Metaprogramming and code performance optimization. Refactoring and software quality analysis.					x	x				
133	Security in Modern Software	Threat identification and attack models. Application vulnerabilities (including OWASP), code security analysis and penetration testing. Authentication and authorization mechanisms. Secure-by-design development principles and system resilience against attacks.						x				
134	Modern Software Development Environments	Tooling supporting collaborative software development: version control systems, CI/CD pipelines and automated builds/testing. Containerization and service orchestration. DevOps practices and continuous integration. Repository organization and dependency management.						x				
135	Intelligent Data Analysis Techniques	AI/ML techniques for structured and unstructured data analysis. Feature extraction and selection, classification, clustering and sequence models. Model evaluation and interpretation of results. Practical use of analytical toolsets.			x	x						
136	Computer Recognition Systems	Image processing, object detection and segmentation, scene analysis and feature extraction. Convolutional neural networks (CNN) models. Applications in robotics, autonomous systems and visual monitoring.			x	x						
137	Problem Workshop in Software Engineering	Workshop based on real software projects including problem identification, task management, iterative design, prototyping, testing, documentation and teamwork in near-commercial conditions.						x		x		
138	Software Quality in the Software Development Process	Installation, deployment and update processes. Production environment configuration and monitoring. Rollout and rollback strategies, SLA and service continuity. Integration of deployment processes with DevOps practices and cloud environments.			x			x				
139	Graphics Programming	Real-time computer graphics programming. Rendering pipeline, geometry processing and programmable shading. Lighting models and rasterization techniques. GPU performance optimization and graphics resource management. Implementation of selected graphics algorithms.						x				
140	2D Computer Games	Design of 2D game mechanics, collision systems and interaction models. Implementation of 2D rendering, sprite animation and UI systems. Game logic, state management and event handling. Prototyping in 2D engines and gameplay testing. Performance analysis and optimization.							x	x		

No.	Course name	Program content	1INS1	1INS2	1INS3	1INS4	1INS5	1INS6	1INS7	1INS8	1INS9	1INS10
141	Artificial Intelligence in Computer Games	AI algorithms in games: pathfinding (A*), behavior systems, decision trees and action planning. Agent control and opponent modeling. Adaptive strategies and learning in interactive environments. Integration of AI with game engines. Balancing intelligence and performance constraints.						x				
142	Computer Games Fundamentals	Fundamentals of game design: mechanics, dynamics and aesthetics. Gameplay systems design and balancing. Production pipelines, team roles and engine environments. Game market analysis and business models. Critical evaluation of existing games.					x			x		
143	Narrative-Based Concept Design	Concept development for narrative-driven games. Story structure design and world-building. Character creation, dialogue systems and player motivation. Integration of narrative with gameplay mechanics. Preparation of concept documentation and narrative prototypes.							x	x		
144	Game Design and Programming	Game mechanics and systems design. Implementation of game logic, physics, rendering and UI. Integration of multimedia assets. Iterative prototyping and testing. Performance and player experience evaluation.						x		x		
145	Game Engine Programming	Game engine architectures and component systems. Asset management, rendering, physics and audio subsystems. Modular engine design. Performance optimization and memory management. Development of tools supporting game production.					x	x				
146	Real-Time Rendering	Rendering pipeline for interactive applications. Rasterization, shading and physically based rendering (PBR). Buffering, anti-aliasing and GPU optimization. Graphics resource management. Implementation of rendering techniques in game engines.					x	x				
147	Game Narrative Design	Narrative structures and pacing in games. Integration of dramaturgy with gameplay mechanics. Dialogue systems and character relationships. Analysis of player narrative experience. Creation of narrative documentation and interactive scripts.							x	x		

ECTS - subjects

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
1	Algebra	4			4	
2	Mathematical Analysis 1	5			5	
3	Physics 1	4				
4	Artificial Intelligence Tools	4			4	
5	Algorithms and Programming Fundamentals	7			7	
6	Introduction to Operating Systems	4			4	
7	Computer Aided Design	2			2	
8	English B2 module I	2		2		
9	English B2+ module I	2		2		
10	English C1 module I	2		2		
11	German B2 module I	2		2		
12	Physics 2	4				
13	Mathematical Analysis 2	5			5	
14	Discrete Mathematics with Elements of Cryptography	4			4	
15	High Level Programming	4			4	
16	Operating Systems	4			4	
17	Fundamentals of Electronics	3			3	
18	Object Oriented Programming	4			4	
19	English B2 module II	2		2		
20	English B2+ module II	2		2		

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
21	English C1 module II	2		2		
22	German B2 module II	2		2		
23	Computer Networks	4			4	
24	Component Programming	5			5	
25	Database Fundamentals	4			4	
26	Data Exchange Standards	3			3	
27	Numerical Methods	4			4	
28	Computer Architecture and GPU Programming	4			4	
29	Concurrent Programming	4			4	
30	English B2 module III	2		2		
31	English B2+ module III	2		2		
32	English C1 module III	2		2		
33	German B2 module III	2		2		
34	Fundamentals of Computer Graphics	4			4	
35	Digital Communication and Signal Processing	4			4	
36	Embedded Systems	4			4	
37	Fundamentals of Software Engineering	5			5	
38	Artificial Intelligence Algorithms	6			6	
39	Data Science Fundamentals	5			5	
40	English B2 module IV	3		3		
41	English B2+ module IV	3		3		

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
42	English C1 module IV	3		3		
43	German B2 module IV	3		3		
44	Cybersecurity Fundamentals	3				
45	Secure Applications in Secure Networks	5				
46	Data Science Design and Practice	4				
47	Data Visualization and Reporting	4				
48	Computer Modeling and Animation	5				
49	Mathematics for Computer Graphics	3				
50	High-Availability and Automated Infrastructures	4				
51	Web Applications and Network Services	4				
52	Security in Modern Software	4				
53	Modern Software Development Environments	4				
54	Image Processing and Analysis	4				
55	Statistics and Probability Theory	4				
56	Computer Games Fundamentals	5				
57	Narrative-Based Concept Design	3				
58	Data Mining Methods for Data Science	4		4	4	4
59	Data Engineering for Data Science	4		4	4	
60	Feature Engineering and Data Preparation	3		3	3	
61	Data Science Design and Practice	4		4	4	
62	Data Visualization and Reporting	4		4	4	

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
63	Engineering Competency Project	7		7	7	
64	Internship	6			6	
65	Diploma Proseminar	1			1	
66	Digital Forensics	4				
67	Data Scalability and Big Data Techniques	4				
68	Game Level Design	4				
69	Networked Database Systems	4				
70	Software Quality in the Software Development Process	4				
71	High-Performance Computing	4				
72	Game Narrative Design	4				
73	Artificial Intelligence in Data Science	3		3		
74	Intelligent Business Analytics Systems	3		3		
75	NoSQL Databases	2		2		
76	Data Scalability and Big Data Techniques	4		4		
77	Diploma Seminar	3			3	
78	Final Project	15		15	15	
79	Social Aspects of Engineering	2	2			
80	Entrepreneurship in IT Sector	3	3		3	
81	Security of Containerized Applications	4				
82	Open Source Intelligence Techniques	3				
83	Data Ethics and Storytelling	3				

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
84	Multicriteria Analysis and Decision Making	4				
85	Visual Identity Design	3				
86	Computer Visual Effects	4				
87	Application Maintenance Techniques	4				
88	Software Deployment and Maintenance Processes	3				
89	IT Project Management Methods	4				
90	Applications of Machine Learning	4				
91	Reasoning Under Uncertainty	3				
92	Computer Simulation Technologies	3				
93	Interface Design	4				
94	Operating Systems and Service Hardening	3		3	3	
95	Mobile Applications	4		4	4	
96	Distributed Applications and Services	4		4	4	
97	Cybersecurity Fundamentals	3		3	3	
98	Secure Applications in Secure Networks	5		5	5	
99	Artificial Intelligence in Cybersecurity	3		3		3
100	NoSQL Databases	2		2		
101	Fundamentals of Virtual Systems	3		3		
102	Digital Forensics	4		4		
103	Advanced Programming	3		3	3	
104	Mobile Applications	4		4	4	

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
105	Distributed Applications and Services	4		4	4	
106	High-Availability and Automated Infrastructures	4		4	4	
107	Web Applications and Network Services	4		4	4	
108	Selected Aspects of Network Applications	3		3		3
109	NoSQL Databases	2		2		
110	Fundamentals of Virtual Systems	3		3		
111	Networked Database Systems	4		4		
112	Graphics Programming	4		4	4	4
113	Graphic Design	2		2	2	
114	Selected Problems in Art History, Aesthetics and Composition	5		5	5	
115	Computer Modeling and Animation	5		5	5	
116	Mathematics for Computer Graphics	3		3	3	
117	Digital Sculpting and Painting	2		2		
118	Animated Film	3		3		
119	Foundations of Film and TV Production	3		3		
120	Game Level Design	4		4		
121	Advanced Optimization Methods	3		3	3	
122	Artificial Intelligence Fundamentals	4		4	4	4
123	Machine Learning	4		4	4	
124	Image Processing and Analysis	4		4	4	
125	Statistics and Probability Theory	4		4	4	

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
126	Explainable Artificial Intelligence	3		3		
127	Introduction to Deep Learning	3		3		
128	Data and Knowledge Acquisition	2		2		
129	High-Performance Computing	4		4		
130	Requirements Engineering in IT Projects	5		5	5	
131	Metaheuristics and Their Applications	3		3	3	
132	Advanced Programming	3		3	3	
133	Security in Modern Software	4		4	4	
134	Modern Software Development Environments	4		4	4	
135	Intelligent Data Analysis Techniques	3		3		
136	Computer Recognition Systems	3		3		
137	Problem Workshop in Software Engineering	2		2		2
138	Software Quality in the Software Development Process	4		4		
139	Graphics Programming	4		4	4	4
140	2D Computer Games	3		3	3	
141	Artificial Intelligence in Computer Games	4		4	4	
142	Computer Games Fundamentals	5		5	5	
143	Narrative-Based Concept Design	3		3	3	
144	Game Design and Programming	3		3		
145	Game Engine Programming	3		3		
146	Real-Time Rendering	2		2		

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
147	Game Narrative Design	4		4		

ECTS indicators

Name	Diploma Path: Data Science	Diploma Path: Cybersecurity	Diploma Path: Network Infrastructure and Applications	Diploma Path: Computer Graphics and Multimedia	Diploma Path: Artificial Intelligence	Diploma Path: Software Engineering and Data Analysis	Diploma Path: Computer Games
The total number of ECTS credits that a student must obtain through elective courses (amounting to no less than 30% of the total ECTS credits required to obtain the qualification corresponding to the given level of study)	81/210 (38.57%)	81/210 (38.57%)	81/210 (38.57%)	81/210 (38.57%)	81/210 (38.57%)	81/210 (38.57%)	81/210 (38.57%)
The total number of ECTS credits to be earned by a student through courses in the fields of humanities or social sciences	5	5	5	5	5	5	5
The total number of ECTS credits that a student must obtain from courses related to research conducted at the university, amounting to more than 50% of the total ECTS credits required to graduate from a given level of study	160/210 (76.19%)	160/210 (76.19%)	160/210 (76.19%)	160/210 (76.19%)	160/210 (76.19%)	160/210 (76.19%)	160/210 (76.19%)

Methods of verifying and assessing learning outcomes

The verification and assessment of learning outcomes in the Applied Computer Science program are carried out systematically and by means appropriate to the intended knowledge, skills, and social competences, as well as to the nature and level of the studies. The methods used are adapted to individual courses and teaching formats and ensure reliable assessment of learning outcomes.

Knowledge outcomes are verified primarily through written and oral examinations, quizzes, tests, and course assessments covering theoretical content, as well as assessments of students' activity during classes and preparation for discussions. These methods enable assessment of the student's understanding of theoretical foundations, concepts, methods, and tools in the context of technical and research issues.

Skills outcomes are verified primarily through practical and project-based methods, including programming and computational tasks, individual and team projects, reports, presentations, case studies, and tasks that require independent selection of methods, tools, and technologies. Assessment takes into account the correctness of solutions, the quality of methods used, problem analysis, independence, and interpretation of results.

Social competencies are verified through assessment of teamwork, observation of the student's attitude during classes, evaluation of communication and presentation skills, and assessment of responsibility for assigned tasks and compliance with academic and professional ethics. This allows evaluation of readiness for cooperation, self-directed learning, critical self-assessment, and responsible functioning in academic and professional environments.

Achievement of learning outcomes across the study cycle is confirmed through the engineering diploma project, the diploma thesis and its defense, participation in the diploma seminar, the competency examination, and completion of all courses included in the study program. The diploma thesis and its defense constitute the final stage of learning outcome verification.

The methods of verification and assessment are assigned to individual courses and forms of classes in course descriptions and remain consistent with the intended learning outcomes, the level of the Polish Qualifications Framework, and the general academic profile of the program. The system ensures comparability of grades, transparency of criteria, and the ability to monitor and improve the quality of education.

Professional internships

The professional internship in the Applied Computer Science program is compulsory and constitutes an integral part of the study program. It lasts a minimum of 6 weeks, that is, at least 240 hours, and is carried out in enterprises, institutions, or organizations whose activities are related to computer science, information technologies, data analysis, cybersecurity, artificial intelligence, or related engineering areas. The internship is intended to enable students to apply the knowledge and skills acquired during their studies in real working conditions, become familiar with the professional environment of a computer engineer, and develop professional, social, and organizational competencies. Completion of the internship is awarded 6 ECTS credits.

Specializations/degree paths offered within the study program

Diploma Path: Data Science

Diploma Path: Cybersecurity

Diploma Path: Network Infrastructure and Applications

Diploma Path: Computer Graphics and Multimedia

Diploma Path: Artificial Intelligence

Diploma Path: Software Engineering and Data Analysis

Diploma Path: Computer Games

Characteristics of the course

Graduate profile

A graduate of the Applied Computer Science program has a solid theoretical background and practical skills in computer science, its mathematical foundations, and related fields, enabling them to analyze, design, implement, and evaluate IT solutions. The graduate understands the principles of operation of modern computer systems, software, networks, and data processing systems.

The graduate is able to apply algorithmic, programming, and analytical methods to solving computer science problems, including research- and project-oriented problems. They possess competences in teamwork, specialist communication (also in a foreign language at a level of at least B2), as well as awareness of the professional, ethical, and social responsibility of a computer engineer. They are prepared to continue their education in second-cycle studies and to adapt to a dynamically changing technological environment.

The relationship between the field of study and the university's strategy

The objective of education in the Applied Computer Science program is to prepare engineers to design and implement modern IT solutions and to solve engineering and research problems independently. The program emphasizes theoretical foundations in computer science and related sciences, the development of analytical thinking, and the ability to critically assess the methods and technologies used. Great importance is attached to the practical application of acquired knowledge, project work, and the development of competences enabling further self-directed learning and adaptation to new technologies.

The Applied Computer Science program is consistent with the University's strategy to develop academic education grounded in scientific research and to educate highly qualified personnel for the knowledge-based economy. The program supports the implementation of the University's strategic objectives through the development of students' analytical, research, and engineering competencies, as well as through the integration of education with scientific activity conducted in the discipline of information and communication technology.

The program also aligns with the University's internationalization strategy by developing language competencies, using English-language literature, and preparing graduates to function in international academic and professional environments.

Educational objectives and employment and continuing education opportunities

The objective of education in the Applied Computer Science program is to prepare engineers to design and implement modern IT solutions and to solve engineering and research problems independently. The program emphasizes theoretical foundations in computer science and related sciences, the development of analytical thinking, and the ability to critically assess the methods and technologies used. Great importance is attached to the practical application of acquired knowledge, project work, and the development of competences enabling further self-directed learning and adaptation to new technologies.

Graduates are prepared to take up employment, among others, as programmers, IT systems analysts, software engineers, data specialists, information systems security specialists, and computer systems engineers, as well as to work in project, research, and development teams. The qualifications obtained also enable them to continue their education in second-cycle studies, both in computer science programs and in other technical or interdisciplinary programs.

Description of the process and outcome of consultations on the proposed study program with the socio-economic environment

The Applied Computer Science study program was developed and updated, taking into account the opinions of external stakeholders, including representatives from the IT sector, research and development institutions, and program graduates. The consultations covered the analysis of current technological trends, labor market expectations, and the competencies required from first-cycle graduates.

As a result of these consultations, the study program strengthened its content in modern data analysis methods, artificial intelligence, information systems security, computer graphics, and software engineering, while maintaining the program's general academic profile.

Description of competencies expected from a candidate applying for admission to studies

In accordance with the legal acts in force in a given academic year concerning the rules for admission to first-cycle studies at Lodz

University of Technology.

The unit organizing education

Faculty of Technical Physics, Information Technology and Applied Mathematics

Education program

Semester 1

Course	Number of hours	ECTS points	Form of verification	Obligatory
Algebra	Tutorials: 30 Lecture: 30	4	Graded assignment	Obligatory
Mathematical Analysis 1	Tutorials: 30 Lecture: 30	5	Exam	Obligatory
Physics 1	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obligatory
Artificial Intelligence Tools	Tutorials: 30 E-learning: 15	4	Graded assignment	Obligatory
Algorithms and Programming Fundamentals	Laboratory classes: 45 Lecture: 45	7	Exam	Obligatory
Introduction to Operating Systems	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory
Computer Aided Design	Laboratory classes: 30	2	Graded assignment	Obligatory
Sum	390	30		

Semester 2

Course	Number of hours	ECTS points	Form of verification	Obligatory
Foreign Language Module 1		2	Graded assignment	Obligatory group
The student chooses one module from the group.				
English B2 module I	Tutorials: 30	2	Graded assignment	Optional
English B2+ module I	Tutorials: 30	2	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
English C1 module I	Tutorials: 30	2	Graded assignment	Optional
German B2 module I	Tutorials: 30	2	Graded assignment	Optional
Physical Education 1	Tutorials: 30	0	Pass	Obligatory
Physics 2	Tutorials: 30 Lecture: 30	4	Exam	Obligatory
Mathematical Analysis 2	Tutorials: 30 Lecture: 30	5	Exam	Obligatory
Discrete Mathematics with Elements of Cryptography	Tutorials: 15 Laboratory classes: 15 Lecture: 30	4	Graded assignment	Obligatory
High Level Programming	Laboratory classes: 25 Lecture: 20	4	Graded assignment	Obligatory
Operating Systems	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory
Fundamentals of Electronics	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obligatory
Object Oriented Programming	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory
Sum	420	30		

Semester 3

Course	Number of hours	ECTS points	Form of verification	Obligatory
Foreign Language Module 2		2	Graded assignment	Obligatory group
The student chooses one module from the group.				
English B2 module II	Tutorials: 30	2	Graded assignment	Optional
English B2+ module II	Tutorials: 30	2	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
English C1 module II	Tutorials: 30	2	Graded assignment	Optional
German B2 module II	Tutorials: 30	2	Graded assignment	Optional
Physical Education 2	Tutorials: 30	0	Pass	Obligatory
Computer Networks	Laboratory classes: 30 Lecture: 15	4	Exam	Obligatory
Component Programming	Laboratory classes: 30 Lecture: 30	5	Exam	Obligatory
Database Fundamentals	Laboratory classes: 30 Lecture: 20	4	Graded assignment	Obligatory
Data Exchange Standards	Laboratory classes: 15 Lecture: 15 E-learning: 15	3	Graded assignment	Obligatory
Numerical Methods	Laboratory classes: 30 Lecture: 20	4	Graded assignment	Obligatory
Computer Architecture and GPU Programming	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obligatory
Concurrent Programming	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory
Sum	415	30		

Semester 4

Course	Number of hours	ECTS points	Form of verification	Obligatory
Foreign Language Module 3		2	Graded assignment	Obligatory group
The student chooses one module from the group.				
English B2 module III	Tutorials: 30	2	Graded assignment	Optional
English B2+ module III	Tutorials: 30	2	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
English C1 module III	Tutorials: 30	2	Graded assignment	Optional
German B2 module III	Tutorials: 30	2	Graded assignment	Optional
Physical Education 3	Tutorials: 30	0	Pass	Obligatory
Fundamentals of Computer Graphics	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory
Digital Communication and Signal Processing	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory
Embedded Systems	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory
Fundamentals of Software Engineering	Project work: 30 Lecture: 15	5	Exam	Obligatory
Artificial Intelligence Algorithms	Laboratory classes: 30 Lecture: 30	6	Exam	Obligatory
Data Science Fundamentals	Tutorials: 45 Lecture: 15	5	Graded assignment	Obligatory
Sum	360	30		

Semester 5

Course	Number of hours	ECTS points	Form of verification	Obligatory
Foreign Language Module 4		3	Exam	Obligatory group
The student chooses one module from the group.				
English B2 module IV	Tutorials: 30	3	Exam	Optional
English B2+ module IV	Tutorials: 30	3	Exam	Optional
English C1 module IV	Tutorials: 30	3	Exam	Optional
German B2 module IV	Tutorials: 30	3	Exam	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
Elective Course Block 5C		8	Graded assignment	Obligatory group
The student chooses one block.				
Elective Block 5C: Cybersecurity		8	Graded assignment	Optional
Cybersecurity Fundamentals	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obowiązkowe w bloku
Secure Applications in Secure Networks	Laboratory classes: 45	5	Graded assignment	Obowiązkowe w bloku
Elective Block 5C: Data Science		8	Graded assignment	Optional
Data Science Design and Practice	Tutorials: 30 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Data Visualization and Reporting	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Elective Block 5C: Computer Graphics and Multimedia		8	Graded assignment	Optional
Computer Modeling and Animation	Laboratory classes: 55	5	Graded assignment	Obowiązkowe w bloku
Mathematics for Computer Graphics	Laboratory classes: 15 Lecture: 20	3	Graded assignment	Obowiązkowe w bloku
Elective Block 5C: Network Infrastructure and Applications		8	Graded assignment	Optional
High-Availability and Automated Infrastructures	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Web Applications and Network Services	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Elective Block 5C: Software Engineering and Data Analysis		8	Graded assignment	Optional
Security in Modern Software	Project work: 30 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Modern Software Development Environments	Project work: 30 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Elective Block 5C: Artificial Intelligence		8	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
Image Processing and Analysis	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obowiązkowe w bloku
Statistics and Probability Theory	Laboratory classes: 15 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Elective Block 5C: Computer Games		8	Graded assignment	Optional
Computer Games Fundamentals	Laboratory classes: 35 Lecture: 25	5	Graded assignment	Obowiązkowe w bloku
Narrative-Based Concept Design	Project work: 30	3	Graded assignment	Obowiązkowe w bloku
Sum	120	11		

Diploma Path: Cybersecurity

Course	Number of hours	ECTS points	Form of verification	Obligatory
Operating Systems and Service Hardening	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obligatory specialization courses
Mobile Applications	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Distributed Applications and Services	Laboratory classes: 45 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Cybersecurity Fundamentals	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obligatory specialization courses
Secure Applications in Secure Networks	Laboratory classes: 45	5	Graded assignment	Obligatory specialization courses
Sum	240	19		

Diploma Path: Data Science

Course	Number of hours	ECTS points	Form of verification	Obligatory
Data Mining Methods for Data Science	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Data Engineering for Data Science	Project work: 45 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Feature Engineering and Data Preparation	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obligatory specialization courses
Data Science Design and Practice	Tutorials: 30 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Data Visualization and Reporting	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Sum	240	19		

Diploma Path: Computer Graphics and Multimedia

Course	Number of hours	ECTS points	Form of verification	Obligatory
Graphics Programming	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obligatory specialization courses
Graphic Design	Project work: 30	2	Graded assignment	Obligatory specialization courses
Selected Problems in Art History, Aesthetics and Composition	Project work: 30 Lecture: 30	5	Graded assignment	Obligatory specialization courses

Course	Number of hours	ECTS points	Form of verification	Obligatory
Computer Modeling and Animation	Laboratory classes: 55	5	Graded assignment	Obligatory specialization courses
Mathematics for Computer Graphics	Laboratory classes: 15 Lecture: 20	3	Graded assignment	Obligatory specialization courses
Sum	240	19		

Diploma Path: Network Infrastructure and Applications

Course	Number of hours	ECTS points	Form of verification	Obligatory
Advanced Programming	Laboratory classes: 45	3	Graded assignment	Obligatory specialization courses
Mobile Applications	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Distributed Applications and Services	Laboratory classes: 45 Lecture: 15	4	Graded assignment	Obligatory specialization courses
High-Availability and Automated Infrastructures	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Web Applications and Network Services	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Sum	240	19		

Diploma Path: Software Engineering and Data Analysis

Course	Number of hours	ECTS points	Form of verification	Obligatory
Requirements Engineering in IT Projects	Project work: 30 Lecture: 30	5	Graded assignment	Obligatory specialization courses
Metaheuristics and Their Applications	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obligatory specialization courses
Advanced Programming	Laboratory classes: 45	3	Graded assignment	Obligatory specialization courses
Security in Modern Software	Project work: 30 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Modern Software Development Environments	Project work: 30 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Sum	240	19		

Diploma Path: Artificial Intelligence

Course	Number of hours	ECTS points	Form of verification	Obligatory
Advanced Optimization Methods	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obligatory specialization courses
Artificial Intelligence Fundamentals	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Machine Learning	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obligatory specialization courses
Image Processing and Analysis	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obligatory specialization courses

Course	Number of hours	ECTS points	Form of verification	Obligatory
Statistics and Probability Theory	Laboratory classes: 15 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Sum	240	19		

Diploma Path: Computer Games

Course	Number of hours	ECTS points	Form of verification	Obligatory
Graphics Programming	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obligatory specialization courses
2D Computer Games	Laboratory classes: 40 Lecture: 10	3	Graded assignment	Obligatory specialization courses
Artificial Intelligence in Computer Games	Laboratory classes: 30 Lecture: 10	4	Graded assignment	Obligatory specialization courses
Computer Games Fundamentals	Laboratory classes: 35 Lecture: 25	5	Graded assignment	Obligatory specialization courses
Narrative-Based Concept Design	Project work: 30	3	Graded assignment	Obligatory specialization courses
Sum	240	19		

Semester 6

Course	Number of hours	ECTS points	Form of verification	Obligatory
Engineering Competency Project	Project work: 90	7	Graded assignment	Obligatory subjects to choose from

Course	Number of hours	ECTS points	Form of verification	Obligatory
Internship	Internship: 0	6	Pass	Obligatory
Diploma Proseminar	Seminar: 15	1	Graded assignment	Obligatory
Elective Course Block 6C		4	Graded assignment	Obligatory group
The student chooses one block.				
Elective Block 6C: Cybersecurity		4	Graded assignment	Optional
Digital Forensics	Laboratory classes: 45 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Elective Block 6C: Data Science		4	Graded assignment	Optional
Data Scalability and Big Data Techniques	Project work: 45 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Elective Block 6C: Computer Graphics and Multimedia		4	Graded assignment	Optional
Game Level Design	Project work: 45 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Elective Block 6C: Network Infrastructure and Applications		4	Graded assignment	Optional
Networked Database Systems	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obowiązkowe w bloku
Elective Block 6C: Software Engineering and Data Analysis		4	Graded assignment	Optional
Software Quality in the Software Development Process	Laboratory classes: 45 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Elective Block 6C: Artificial Intelligence		4	Graded assignment	Optional
High-Performance Computing	Laboratory classes: 45 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Elective Block 5C: Computer Games		4	Graded assignment	Optional
Game Narrative Design	Project work: 60	4	Graded assignment	Obowiązkowe w bloku
Sum	165	18		

Diploma Path: Cybersecurity

Course	Number of hours	ECTS points	Form of verification	Obligatory
Artificial Intelligence in Cybersecurity	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obligatory specialization courses
NoSQL Databases	Laboratory classes: 30 Lecture: 15	2	Graded assignment	Obligatory specialization courses
Fundamentals of Virtual Systems	Laboratory classes: 30 Lecture: 15 E-learning: 15	3	Graded assignment	Obligatory specialization courses
Digital Forensics	Laboratory classes: 45 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Sum	210	12		

Diploma Path: Data Science

Course	Number of hours	ECTS points	Form of verification	Obligatory
Artificial Intelligence in Data Science	Project work: 30 Lecture: 30	3	Graded assignment	Obligatory specialization courses
Intelligent Business Analytics Systems	Project work: 30 Lecture: 15	3	Graded assignment	Obligatory specialization courses
NoSQL Databases	Laboratory classes: 30 Lecture: 15	2	Graded assignment	Obligatory specialization courses
Data Scalability and Big Data Techniques	Project work: 45 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Sum	210	12		

Diploma Path: Computer Graphics and Multimedia

Course	Number of hours	ECTS points	Form of verification	Obligatory
Digital Sculpting and Painting	Project work: 45	2	Graded assignment	Obligatory specialization courses
Animated Film	Project work: 45 Lecture: 15	3	Graded assignment	Obligatory specialization courses
Foundations of Film and TV Production	Project work: 30 Lecture: 15	3	Graded assignment	Obligatory specialization courses
Game Level Design	Project work: 45 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Sum	210	12		

Diploma Path: Network Infrastructure and Applications

Course	Number of hours	ECTS points	Form of verification	Obligatory
Selected Aspects of Network Applications	Project work: 45	3	Graded assignment	Obligatory specialization courses
NoSQL Databases	Laboratory classes: 30 Lecture: 15	2	Graded assignment	Obligatory specialization courses
Fundamentals of Virtual Systems	Laboratory classes: 30 Lecture: 15 E-learning: 15	3	Graded assignment	Obligatory specialization courses
Networked Database Systems	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obligatory specialization courses
Sum	210	12		

Diploma Path: Software Engineering and Data Analysis

Course	Number of hours	ECTS points	Form of verification	Obligatory
Intelligent Data Analysis Techniques	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obligatory specialization courses
Computer Recognition Systems	Laboratory classes: 30 Lecture: 30	3	Graded assignment	Obligatory specialization courses
Problem Workshop in Software Engineering	Project work: 45	2	Graded assignment	Obligatory specialization courses
Software Quality in the Software Development Process	Laboratory classes: 45 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Sum	210	12		

Diploma Path: Artificial Intelligence

Course	Number of hours	ECTS points	Form of verification	Obligatory
Explainable Artificial Intelligence	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obligatory specialization courses
Introduction to Deep Learning	Laboratory classes: 45 Lecture: 15	3	Graded assignment	Obligatory specialization courses
Data and Knowledge Acquisition	Project work: 45	2	Graded assignment	Obligatory specialization courses
High-Performance Computing	Laboratory classes: 45 Lecture: 15	4	Graded assignment	Obligatory specialization courses
Sum	210	12		

Diploma Path: Computer Games

Course	Number of hours	ECTS points	Form of verification	Obligatory
Game Design and Programming	Laboratory classes: 30 Lecture: 20	3	Graded assignment	Obligatory specialization courses
Game Engine Programming	Laboratory classes: 30 Lecture: 25	3	Graded assignment	Obligatory specialization courses
Real-Time Rendering	Project work: 30 Lecture: 15	2	Graded assignment	Obligatory specialization courses
Game Narrative Design	Project work: 60	4	Graded assignment	Obligatory specialization courses
Sum	210	12		

Semester 7

Course	Number of hours	ECTS points	Form of verification	Obligatory
Diploma Seminar	Seminar: 30	3	Graded assignment + exam	Obligatory
Final Project	Diploma Thesis: 0	15	Pass	Obligatory subjects to choose from
Social Aspects of Engineering	Lecture: 15	2	Graded assignment	Obligatory
Entrepreneurship in IT Sector	Seminar: 30	3	Graded assignment	Obligatory
Elective Course Block 7C		7	Graded assignment	Obligatory group
The student chooses one block.				
Elective Block 7C: Cybersecurity		7	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
Security of Containerized Applications	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Open Source Intelligence Techniques	Laboratory classes: 30 E-learning: 15	3	Graded assignment	Obowiązkowe w bloku
Elective Block 7C: Data Science		7	Graded assignment	Optional
Data Ethics and Storytelling	Seminar: 45	3	Graded assignment	Obowiązkowe w bloku
Multicriteria Analysis and Decision Making	Project work: 45	4	Graded assignment	Obowiązkowe w bloku
Elective Block 7C: Computer Graphics and Multimedia		7	Graded assignment	Optional
Visual Identity Design	Project work: 40	3	Graded assignment	Obowiązkowe w bloku
Computer Visual Effects	Project work: 40 Lecture: 10	4	Graded assignment	Obowiązkowe w bloku
Elective Block 7C: Network Infrastructure and Applications		7	Graded assignment	Optional
Application Maintenance Techniques	Laboratory classes: 30 E-learning: 15	4	Graded assignment	Obowiązkowe w bloku
Open Source Intelligence Techniques	Laboratory classes: 30 E-learning: 15	3	Graded assignment	Obowiązkowe w bloku
Elective Block 7C: Software Engineering and Data Analysis		7	Graded assignment	Optional
Software Deployment and Maintenance Processes	Project work: 45	3	Graded assignment	Obowiązkowe w bloku
IT Project Management Methods	Project work: 30 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Elective Block 7C: Artificial Intelligence		7	Graded assignment	Optional
Applications of Machine Learning	Project work: 45	4	Graded assignment	Obowiązkowe w bloku
Reasoning Under Uncertainty	Laboratory classes: 30 Lecture: 15	3	Graded assignment	Obowiązkowe w bloku

Course	Number of hours	ECTS points	Form of verification	Obligatory
Elective Block 7C: Computer Games		7	Graded assignment	Optional
Computer Simulation Technologies	Laboratory classes: 30 Lecture: 10	3	Graded assignment	Obowiązkowe w bloku
Interface Design	Project work: 35 Lecture: 15	4	Graded assignment	Obowiązkowe w bloku
Sum	165	30		