



Lodz University
of Technology

Study programme

Faculty:	Faculty of Electrical, Electronic, Computer and Control Engineering
Major:	Computer Science and Information Technology (in English)
Level of study:	second-cycle programme (magister inżynier)
Form of study:	full-time studies
Academic year:	2026/27

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Basic information

Name of the field of study:	Computer Science and Information Technology (in English)
Level of study:	second-cycle programme (magister inżynier)
Study profile:	general academic
Form of studies:	full-time studies
Duration of studies (number of semesters):	4
The number of ECTS points required to complete studies:	120
Total number of hours of classes:	1510
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:	60
Professional title awarded to graduates:	magister inżynier
ISCED code:	0613
Language of study:	English

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	2CIT1	Has in-depth knowledge of advanced theories, models and methods in computer science, especially in algorithms, artificial intelligence, data science and software engineering, and understands complex interrelationships between them and their applications in solving complex research and engineering problems.	P7U_W	P7S_WG, P7S_WG_inž
2	2CIT2	Has in-depth knowledge and understanding of current trends and advanced technologies in computer science, especially in intelligent systems and data processing, including their social, economic and environmental conditions.	P7U_W	P7S_WG, P7S_WG_inž
3	2CIT3	The graduate knows the social, economic, legal, and ethical conditions of IT activities, including data protection and professional responsibility.	P7U_W	P7S_WK, P7S_WK_inž
4	2CIT4	Can design, implement using modern tools and technologies, integrate and optimise complex IT systems, considering requirements, security and user needs.	P7U_U	P7S_UW, P7S_UW_inž
5	2CIT5	Can design, implement using modern tools and technologies, integrate and optimise complex IT systems, considering functional and non-functional requirements, security and user needs.	P7U_U	P7S_UW, P7S_UW_inž
6	2CIT6	Can critically search for and select information sources, conduct their in-depth analysis and creative synthesis, and apply the derived conclusions to solving complex research and design problems.	P7U_U	P7S_UW, P7S_UW_inž
7	2CIT7	Can communicate effectively in speech and writing with various audiences, including scientists and researchers, applying appropriate techniques, methods and tools, and using specialist terminology, also in English at a level of at least B2+.	P7U_U	P7S_UK, P7S_UO, P7S_UU
8	2CIT8	Is ready to critically evaluate their knowledge, independently plan and pursue lifelong learning and seek expert advice in solving complex problems.	P7U_K	P7S_KK
9	2CIT9	Is ready to perform professional roles responsibly, adhere to ethical principles and take actions considering the public interest and social impact of IT projects.	P7U_K	P7S_KO, P7S_KR

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

No.	Course name	Program content	2CIT1	2CIT2	2CIT3	2CIT4	2CIT5	2CIT6	2CIT7	2CIT8	2CIT9
1	Introduction to Artificial Intelligence	Fundamental concepts and paradigms of artificial intelligence and typical classes of problems addressed with AI methods. Knowledge representation. Reasoning mechanisms, and state-space search using heuristics. Planning and decision making. Introduction to rule-based/expert systems and to machine learning. Overview of application areas.	x				x				
2	Introduction to Data Science and Software Engineering	Fundamentals of data science and software engineering from a process perspective. Preparing data for analysis and basics of exploration and inference. Statistical data analysis. Principles of software solution design. Quality assurance.	x				x				
3	Research Based Workshop	Conducting a research-based project in computer science leading to measurable outcomes. Literature review and critical analysis, including identification of a research gap or application need. Formulating the problem, research questions or hypotheses, and evaluation criteria. Method selection, experimental design, data/environment preparation, implementation, and reproducible runs. Result analysis.				x		x			
4	English for Science Communication	Development of scientific and professional communication skills in English. Structure and style of scientific and technical texts. Writing practice. Preparing and delivering presentations, participating in discussion, answering questions, and arguing positions using specialist terminology. Activities aligned with communication in an international environment.							x		
5	Machine Learning	Core concepts and assumptions of machine learning and the relationships between data, models, and objective functions. Supervised and unsupervised learning: regression, classification, clustering, and elements of feature preparation. Training and validation workflow: data splitting, cross-validation, hyperparameter tuning, and overfitting prevention. Ensemble methods and fundamentals of error analysis and result interpretation. Model evaluation using appropriate metrics and fair comparison principles, including handling imbalanced data. Good experimental practices: reproducibility, documentation, and awareness of model limitations.	x			x					
6	Deep Learning	Principles of deep neural networks and training via backpropagation and optimization methods. Convolutional, sequential, and attention-based neural networks. Training process design. Transfer learning and adapting models to new tasks. Model diagnostics and evaluation. Computational requirements and practical deployment considerations.	x	x		x	x				
7	Bayesian Methods	Bayesian inference as a formal mechanism for combining prior knowledge with observations. Probabilistic modelling and parameter estimation, prediction with uncertainty, and interpretation of posterior distributions. Model comparison and complexity control, including hierarchical and regularization perspectives. Graphical models for representing dependencies and inference. Applications in data analysis and AI, and practical aspects of assumptions and assessing the credibility of conclusions.	x			x					
8	Intelligent Systems	Design of intelligent systems that make decisions using data, rules, or hybrid approaches. Mechanisms of adaptation and autonomy: perception, environment modelling, action planning, and execution. Integration of AI components into system architecture, including monitoring, exception handling, and model updates. Non-functional requirements: performance, reliability, security, and robustness to changing environments. Evaluation in application scenarios, analysis of risks and limitations, and basic ethical considerations.		x			x				

No.	Course name	Program content	2CIT1	2CIT2	2CIT3	2CIT4	2CIT5	2CIT6	2CIT7	2CIT8	2CIT9
9	Modern Programming Techniques	Advanced programming paradigms and their impact on code structure and maintainability. Design patterns and software design principles. Concurrent and asynchronous programming. Quality techniques. API design, modularity, and practices for documenting and versioning components.		x			x				
10	Learning from Data	Fundamentals of learning from data with a focus on generalization: bias-variance trade-off, overfitting/underfitting, and the role of dataset size and sampling. Data representation and feature engineering as key factors in model effectiveness. Model and training procedure selection: validation, tuning, comparison criteria, and avoiding information leakage. Interpreting learning outcomes with respect to application goals and error analysis. Elements of assessing prediction stability and uncertainty, and communicating model limitations. Good data practices.	x			x					
11	Multi-Sensor Data Analysis	Characteristics of multi-sensor data: different sampling rates, noise, missing data, and heterogeneous sources. Synchronization and temporal alignment, filtering, and signal preprocessing. Data fusion at feature, decision, or model level and state estimation under uncertainty. Event and anomaly detection in data streams and evaluation of processing quality. Applications in intelligent systems and IoT, including practical aspects of building analytics pipelines.		x		x					
12	Soft Computing for Data Science	Soft computing paradigms for solving problems with imprecise data and incomplete knowledge. Fuzzy logic: fuzzy sets, rules, inference, and fuzzy system design. Evolutionary algorithms: solution encoding, operators, selection strategies, and stopping criteria, with an optimization perspective. Hybrid approaches, including neuro-fuzzy systems combining learning with interpretability. Parameter tuning, quality and robustness assessment, and application areas in data analysis.		x		x					
13	Web Programming Frameworks and Tools	Web application architecture and client-server design principles, including layered and component-based approaches. The role of frameworks in code organization, routing, data access, and authentication/authorization mechanisms. API design, documentation, versioning, and data exchange contracts. Application security. Scalability and reliability.	x				x				
14	User Interface Programming	Design and implementation of user interfaces with attention to interaction models and UI-layer architecture. State management, event handling, and integration of UI with application logic and services (APIs). Usability and accessibility. User flow design, feedback, error handling, and visual consistency. UI quality assurance.									
15	Advanced Programming Platforms	Runtime environments and application platforms: configuration, dependency and resource management, and monitoring. Containerization and orchestration as approaches to portability and scalable deployments. Cloud computing fundamentals: service models, service integration, and managing data and secrets. System integration: synchronous and asynchronous communication, queuing mechanisms, and fault tolerance. Designing for performance, reliability, and security, and automating deployment processes.		x			x				
16	Data Warehousing	Data warehousing concepts and their role in organizational analytics. Multidimensional modelling, fact and dimension schemas, and fundamentals of semantic layer design. ETL/ELT processes, data quality, validation, and metadata management. Analytical queries, aggregations, and an introduction to reporting and dashboards. Performance topics , security, and access control.	x				x				

No.	Course name	Program content	2CIT1	2CIT2	2CIT3	2CIT4	2CIT5	2CIT6	2CIT7	2CIT8	2CIT9
17	Internet Applications Programming	Design and implementation of internet applications including presentation, business logic, and data access layers. Client-server communication, request handling, API usage, and integration with external services. Session and state management, data validation, and error/exception handling. Testing and fundamentals of deployment automation. Maintenance practices.		x			x				
18	Computer Systems of Recognition	Fundamentals of pattern recognition. Classification and identification methods, including statistical approaches and machine learning. Designing a recognition pipeline: data preparation, training, validation, threshold selection, and error analysis. Evaluation of recognition systems. Data quality, privacy, and ethics of identification applications.	x				x				
19	Artificial Intelligence in Software Design	Application of AI methods across selected stages of software development. Automation and decision support. Predictive models for risk and cost. Integrating AI tools into engineering processes while considering data quality, reliability, and explainability. Responsible use aspects.					x				
20	Sound Data Processing	Fundamentals of digital audio signal processing. Acoustic feature extraction and its use in speech and environmental sound recognition tasks. Analysis and modelling methods. Segmentation, event detection, and basics of noise reduction and signal enhancement. Evaluation of audio systems and practical issues of data preparation and recording privacy.	x			x					
21	Control of Autonomous Mobile Robots	Fundamentals of mobile robot control. Localization and mapping. Motion planning and navigation. Autonomous system architecture. Validation in simulation and real-world settings, safety and reliability metrics, and practical deployment constraints.					x				
22	Entrepreneurship	Technology entrepreneurship models and commercialisation of innovative IT solutions. Market risk analysis. Intellectual property protection and corporate social responsibility.								x	x
23	Research Project	Independent research project preparing for the master's thesis: from problem formulation to data-supported conclusions. Literature review and gap identification, defining objectives and research questions/hypotheses. Methodology design: selecting data, tools, and experimental procedures, plus a results analysis plan. Implementing a solution/artifact, running experiments, and documenting the process for reproducibility. Reporting results, discussing limitations, and preparing materials for thesis chapters.				x	x	x	x		x
24	Industrial Project	Project carried out with an industrial partner, focused on solving a practical problem under given constraints. Requirements and stakeholder analysis, defining success criteria, assumptions, and risks. Designing and implementing a solution including integration with existing systems or data. Quality assurance: testing, reviews, technical and user documentation, and security aspects. Evaluating results, preparing recommendations for further development, and building teamwork and progress reporting skills.				x	x	x	x		x
25	Pervasive Computing	Pervasive systems as an integration of devices, services, and data operating in distributed environments. Internet of Things fundamentals: architectures, communication, device management, and data acquisition. Context-aware computing: context models, information acquisition, inference, and adaptive system behaviour. Edge and cloud processing considering resource constraints and latency. Security and privacy in distributed systems and fundamentals of designing for reliability and fault tolerance.		x		x					

No.	Course name	Program content	2CIT1	2CIT2	2CIT3	2CIT4	2CIT5	2CIT6	2CIT7	2CIT8	2CIT9
26	Advanced Algorithms	Advanced algorithm and data structure design techniques and their use in solving computational problems. Time and memory complexity analysis, selecting algorithms under constraints, and assessing correctness. . Building skills in critically evaluating design trade-offs between solution quality and computational costs.		x		x					
27	Semistructural Data Processing	Characteristics of semi-structured and document data and their role in modern information systems. Data models and document/graph approaches. Query languages, transformations, and multi-source data integration, including structure mapping. Indexing and basics of access optimization, design of document and graph stores. Data quality, access security, and building pipelines for processing and analysing semi-structured data.			x		x				
28	Contemporary Data Processing Systems	Architectures of contemporary data processing systems: centralized, distributed, and hybrid solutions and their place in analytics ecosystems. Fundamentals of parallel and distributed processing: partitioning, replication, consistency, and fault tolerance. Batch and stream processing models, time windows, delivery semantics, and state management. Scaling, job scheduling, monitoring, and system observability. Practical issues: integrating data sources, data quality, security, cost control, and architectural trade-offs.	x			x					
29	Security of Information Systems	Information security concepts and models. Applied cryptography basics. System and application security. Data protection and privacy. Operational security.			x		x				
30	Problem-Solving Workshop	Workshop-based solving of complex computer science problems with emphasis on analysis, design, and justification. Problem decomposition, selecting algorithms and data structures, and designing correctness verification. Case studies involving performance. Presenting solutions, critically evaluating alternatives, and reflecting on design trade-offs.				x				x	
31	Diploma Seminar	Monitoring of diploma projects, and the relevant knowledge and skills required for preparing and presenting the results of the diploma thesis. Competency examination.									
32	Diploma Thesis	Independent preparation of the master's thesis under supervisor guidance, addressing a complex engineering or research problem. Developing the concept and justifying method choices based on literature and problem requirements. Implementing the solution or conducting research, analysing results, and drawing conclusions with limitations considered. Producing the thesis document in line with editorial and ethical standards and presenting outcomes during the defence.		x		x		x	x	x	
33	Diploma Research Laboratory	Research and experimental work supporting the thesis. Implementing prototypes and solution variants and planning/executing comparative tests. Collecting, organizing, and analysing results to derive thesis conclusions. Documenting procedures and configurations to enable reproducibility and ensuring artifact quality.				x		x			
34	Social and Economic Impact of Digital Revolution	Social, economic, and cultural consequences of the digital revolution and the role of information and communication technologies in transformations of the labour market and business models. Digital transformation Ethics and responsibility of digital system developers.									

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	Introduction to Artificial Intelligence	9			9	9
2	Introduction to Data Science and Software Engineering	9			9	9
3	Research Based Workshop	10			10	10
4	English for Science Communication	2		2		2
5	Machine Learning	5			5	5
6	Deep Learning	5			5	5
7	Bayesian Methods	5			5	5
8	Intelligent Systems	5			5	5
9	Modern Programming Techniques	5			5	5
10	Learning from Data	5			5	5
11	Multi-Sensor Data Analysis	5			5	5
12	Soft Computing for Data Science	5			5	5
13	Web Programming Frameworks and Tools	5		5	5	5
14	User Interface Programming	5		5	5	5
15	Advanced Programming Platforms	5		5	5	5
16	Data Warehousing	5		5	5	5
17	Internet Applications Programming	5		5	5	5
18	Computer Systems of Recognition	5		5	5	5
19	Artificial Intelligence in Software Design	5		5	5	5
20	Sound Data Processing	5		5	5	5
21	Control of Autonomous Mobile Robots	5		5	5	5

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
22	Entrepreneurship	2				2
23	Research Project	12		12	12	12
24	Industrial Project	12		12	12	12
25	Pervasive Computing	4		4	4	4
26	Advanced Algorithms	4		4	4	4
27	Semistructural Data Processing	4		4	4	4
28	Contemporary Data Processing Systems	4		4	4	4
29	Security of Information Systems	4		4	4	4
30	Problem-Solving Workshop	4		4	4	4
31	Diploma Seminar	3			3	3
32	Diploma Thesis	20			20	20
33	Diploma Research Laboratory	4			4	4
34	Social and Economic Impact of Digital Revolution	3				3

ECTS indicators

Name	Value
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)	60/120 (50%)
The total number of ECTS credits to be earned by a student through courses in the fields of humanities or social sciences	0
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	113/120 (94.17%)

Methods of verifying and assessing learning outcomes

Verification of achieved learning outcomes requires the use of diverse forms of student assessment, appropriate to the categories of knowledge, skills, and social competencies to which these outcomes relate. The selection of suitable tools also depends on the specifics of the subject and the form of classes, and is described in the syllabi of individual courses. The achievement of the required learning outcomes is verified through:

1. Written work (exams, tests, reports, essays, projects, posters, thesis, etc.);
2. Oral statements (oral knowledge checks, public presentations such as delivering a paper, presentation, etc.);
3. Practical and/or project tasks (both group and individual);
4. Observation and evaluation of student activity during classes;
5. Self-assessment and peer assessment (especially in the case of group projects);
6. Competency exam and diploma exam.

Verification may be formative (partial, repeated during classes) and/or summative (final assessment). The final verification result is given according to the currently applicable grading scale.

The course coordinator or instructor is obliged, during the first class, to discuss the course syllabus and to formulate and provide documented information to students regarding the methods of verification and the conditions for conducting assessments of learning outcomes.

Professional internships

Not applicable.

Specializations/degree paths offered within the study program

Characteristics of the course

Graduate profile

Graduates of the second-cycle degree programme in Computer Science and Information Technology possess knowledge and skills in the field of computer science, particularly in algorithms, artificial intelligence, data analysis, machine learning, and software engineering. They are able to design, implement, and integrate complex IT systems, as well as solve research and engineering problems using modern IT methods and tools.

Graduates are prepared to work in an international environment and communicate in English at a level of at least B2+, using specialist terminology in computer science. They possess competences in the analysis of scientific literature, conducting research, teamwork, critical self-assessment of their own knowledge, and continuous professional development. They are aware of the social, economic, legal, and ethical determinants of IT-related activity, as well as professional responsibility.

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

The Computer Science and Information Technology degree programme is aligned with the Lodz University of Technology development strategy, particularly in the areas of modern digital technologies, scientific research, and the internationalisation of education. The study programme supports the development of key competences for the knowledge-based economy and strengthens the University's research and development potential in the discipline of information and communication technology.

Educational objectives and employment and continuing education opportunities

The aim of the programme is to prepare graduates for individual and team-based research and engineering work in the field of modern information technologies, with particular emphasis on artificial intelligence, data analysis, and advanced IT systems.

Graduates may pursue employment in positions such as:

- artificial intelligence and machine learning specialist,
- data scientist / data analyst,
- software engineer,
- IT systems architect,
- IT systems analyst,
- researcher in R&D teams.

Graduates are also prepared to continue their education in third-cycle degree programmes (doctoral school) and to participate in research and development projects carried out both in Poland and abroad.

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

The study programme was developed in consultation with representatives of industry, research institutions, and graduates of computer science programmes. These consultations concerned, in particular, the scope of competences expected from graduates, current technological trends, and labour market needs.

As a result of these consultations, the study programme includes, among other things, an increased emphasis on:

- artificial intelligence and data analysis,
- research and team-based projects,
- the practical application of modern information technologies,
- communication and social competences.

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

In accordance with the recruitment resolution in force for a given academic year.

The unit organizing education

Faculty of Electrical, Electronic, Computer and Control Engineering

Education program

Semester 1

Course	Number of hours	ECTS points	Form of verification	Obligatory
Introduction to Artificial Intelligence	Laboratory classes: 45 Lecture: 30	9	Exam	Obligatory
Introduction to Data Science and Software Engineering	Laboratory classes: 45 Lecture: 30	9	Graded assignment	Obligatory
Research Based Workshop	Project work: 90	10	Graded assignment	Obligatory
English for Science Communication	Tutorials: 45	2	Graded assignment	Obligatory subjects to choose from
Sum	285	30		

Semester 2

Course	Number of hours	ECTS points	Form of verification	Obligatory
Elective Block		20	Exam	Obligatory group
Student chooses 1 block				
Block 1.1 Artificial Intelligence		20	Exam	Optional
Machine Learning	Laboratory classes: 45 Lecture: 15	5	Exam	Obowiązkowe w bloku
Deep Learning	Laboratory classes: 45 Lecture: 15	5	Exam	Obowiązkowe w bloku
Bayesian Methods	Laboratory classes: 45 Lecture: 15	5	Exam	Obowiązkowe w bloku

Course	Number of hours	ECTS points	Form of verification	Obligatory
Intelligent Systems	Laboratory classes: 45 Lecture: 15	5	Exam	Obowiązkowe w bloku
Block 1.2 Data Science and Software Engineering		20	Exam	Optional
Modern Programming Techniques	Laboratory classes: 45 Lecture: 15	5	Exam	Obowiązkowe w bloku
Learning from Data	Laboratory classes: 45 Lecture: 15	5	Exam	Obowiązkowe w bloku
Multi-Sensor Data Analysis	Laboratory classes: 45 Lecture: 15	5	Exam	Obowiązkowe w bloku
Soft Computing for Data Science	Laboratory classes: 45 Lecture: 15	5	Exam	Obowiązkowe w bloku
Elective Courses 1		10	Graded assignment	Obligatory group
Student chooses 2 subjects				
Web Programming Frameworks and Tools	Laboratory classes: 30 Lecture: 15	5	Graded assignment	Optional
User Interface Programming	Laboratory classes: 30 Lecture: 15	5	Graded assignment	Optional
Advanced Programming Platforms	Laboratory classes: 30 Lecture: 15	5	Graded assignment	Optional
Data Warehousing	Laboratory classes: 30 Lecture: 15	5	Graded assignment	Optional
Internet Applications Programming	Laboratory classes: 30 Lecture: 15	5	Graded assignment	Optional
Computer Systems of Recognition	Laboratory classes: 30 Lecture: 15	5	Graded assignment	Optional
Artificial Intelligence in Software Design	Project work: 45	5	Graded assignment	Optional
Sound Data Processing	Laboratory classes: 30 Lecture: 15	5	Graded assignment	Optional
Control of Autonomous Mobile Robots	Project work: 45	5	Graded assignment	Optional
Sum	330	30		

Semester 3

Course	Number of hours	ECTS points	Form of verification	Obligatory
Entrepreneurship	Seminar: 30	2	Graded assignment	Obligatory
Elective Courses 2		12	Graded assignment	Obligatory group
Student chooses 1 subject				
Research Project	Project work: 120	12	Graded assignment	Optional
Industrial Project	Project work: 120	12	Graded assignment	Optional
Elective Courses 3		16	Graded assignment	Obligatory group
Student chooses 2 subjects				
Pervasive Computing	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Optional
Advanced Algorithms	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Optional
Semistructural Data Processing	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Optional
Contemporary Data Processing Systems	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Optional
Security of Information Systems	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Optional
Problem-Solving Workshop	Laboratory classes: 45	4	Graded assignment	Optional
Sum	330	30		

Semester 4

Course	Number of hours	ECTS points	Form of verification	Obligatory
Diploma Seminar	Seminar: 30	3	Graded assignment + exam	Obligatory

Course	Number of hours	ECTS points	Form of verification	Obligatory
Diploma Thesis	Diploma Thesis: 0	20	Pass	Obligatory
Diploma Research Laboratory	Project work: 45	4	Graded assignment	Obligatory
Social and Economic Impact of Digital Revolution	Seminar: 20	3	Graded assignment	Obligatory
Sum	95	30		