



Lodz University
of Technology

Study programme

Faculty:	Faculty of Technical Physics, Information Technology and Applied Mathematics
Major:	Modelling and Data Science (in English)
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:	Modelling and Data Science (in English)
Level of study:	first-cycle programme (inżynier)
Study profile:	general academic
Form of studies:	full-time studies
Duration of studies (number of semesters):	8
The number of ECTS points required to complete studies:	240
Total number of hours of classes:	3008
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:	120
Professional title awarded to graduates:	inżynier
ISCED code:	0588
Language of study:	English

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

Discipline	Percentage share
Physical sciences	70%
Informatics	30%

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	1MDS1	Knows and understands fundamental principles, laws, and models describing physical phenomena and processes in selected engineering applications.	P6U_W	P6S_WG
2	1MDS2	Knows and understands mathematical and computer toolset (including algorithms and software tools) for analysis in physical phenomena and processes.	P6U_W	P6S_WG
3	1MDS3	Knows and understands basic processes observed in the lifetime of physical, technical, and business systems, with particular attention to the modelling stage.	P6U_W	P6S_WK
4	1MDS4	Knows and understands requirements and limitations of modelling tools and has knowledge on modern computational techniques, computer simulations, machine learning, and data analysis.	P6U_W	P6S_WG, P6S_WK
5	1MDS5	Knows and understands application of modelling and data analysis in modern society, related legal and economic issues including basics of normalization, intellectual property protection, and entrepreneurship.	P6U_W	P6S_WK
6	1MDS6	Can conduct physical experiments, compare their results with predictions based on theoretical models and computer simulations, and use experimental data to improve predictive methods.	P6U_U	P6S_UW
7	1MDS7	Can draw conclusions basing on known rules and gained data and assess and optimize a device, process, or system using computer modeling.	P6U_U	P6S_UW
8	1MDS8	Can write computer programs and apply algorithms and modern computer tools to solve given problem on data analysis and computer modelling.	P6U_U	P6S_UW
9	1MDS9	Can work in a team (also as its leader), which members are professionals in various fields and can efficiently and professionally communicate orally and in writing with other team members, experts, and wide audience in foreign languages, including English at a minimum C1 level according to the Common European Framework of Reference for Languages.	P6U_U, P6U_K	P6S_UK, P6S_UO, P6S_KK
10	1MDS10	Can demonstrate creative thinking, critical analysis of arguments and evaluation of an argument's major assertions, its background assumptions, the evidence used to support its assertions, and its explanatory utility.	P6U_K	P6S_KK
11	1MDS11	Is ready to demonstrate understanding of major findings and ideas in a variety of disciplines beyond the major.	P6U_K	P6S_KO

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
12	1MDS12	Is ready to perform tasks and solve problems basing on the most current scientific knowledge and according to the professional ethics rules.	P6U_U, P6U_K	P6S_UK, P6S_UO, P6S_KK, P6S_KR
13	1MDS13	Is ready to understand and articulate the importance and influence of diversity through active involvement with diverse communities and real-world challenges within and among cultures and societies.	P6U_K	P6S_KO

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

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
1	Mathematics 1	Elementary functions with the application of logical laws and set theory to analyze function properties and solve equations and inequalities; differential and integral calculus of functions of one real variable and their applications. Complex numbers, their Cartesian, trigonometric and polar form, powers and roots of complex numbers, upper and lower triangular equations, Gaussian elimination, determinant and its geometric interpretation, vector spaces, basis and dimensions of vector spaces, linear maps, rank of a matrix and Kronecker-Capelli theorem.		x					x						
2	Physics	Methods for calculating derivatives of one and several variables. Methods for determining antiderivatives and the connection with the Riemann definite integral. Physical quantities and units, measurement in physics, coordinate systems, linear motion, motion in two and three dimensions, Newton's laws of dynamics, work, energy, power, linear momentum and collisions, rotation about a fixed axis, oscillations, waves, gravitation, electric charges and electric fields, electric potential, capacitance and capacitors, electric current and resistance, direct current circuits.	x	x				x							
3	Fundamentals of Experimental Data Analysis	Notions of measurement and experiment, rules for planning scientific research, logics of experiment and reasoning, basics of statistics, data analysis and data presentation.				x		x							
4	Programming for Modelling and Data Analysis	Introduction to programming and algorithmics; formulation of algorithms and writing numerical algorithms for engineering problems in the form of code in a selected programming language; familiarisation with a selected programming environment, running and diagnosing programmes; basic elements of a selected programming language; application of the acquired skills to independently perform engineering calculations using self-written programmes.		x		x				x					
5	Information Technology	Modern information technologies, which are essential both in everyday life in a digital society and in solving engineering problems; working with office software (e.g. word processor, spreadsheet, virtual teamwork organisation) and LaTeX, data security, cybersecurity, and secure Internet connections.								x					
6	Engineering Drawing	Elements of universal design, sketching principles, preparation of drawings in isometric projection, oblique projection, European and American rectangular projection, section drawing, dimensioning principles and the concept of tolerances and fits.									x				
7	Study Skills for University	Organisation of studies at the IFE, familiarising students with the basic tools and techniques necessary in the study process and the principles of academic culture. Presenting of general educational concept of the programme of study.									x			x	

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
8	C1 Business Communication for Engineers 1	Selected lexical and grammatical structures at C1 or C2 level; topics relevant to the academic and professional environments of university graduates; improving all language skills; developing key interpersonal skills required in the workplace.									x				
9	C2 Business Communication for Engineers 1	Selected lexical and grammatical structures; topics relevant to the academic and professional environments of university graduates; improving receptive and productive language skills; developing essential soft skills required in the workplace.									x				
10	Mathematics 2	Fundamental concepts and methods related to the following areas: differential and integral calculus of multivariable functions and their applications; elements of field theory. Inner product, examples of noneuclidean Hilbert spaces, Gram-Schmidt orthonormalization, orthogonal projection, eigenvectors and eigenvalues, spectral theorem for symmetric matrices, power iteration and Rayleigh quotients, principal component analysis.		x					x						
11	Mathematical Methods 1	Elements of abstract algebra: groups, rings, fields. Elements of cryptography.		x					x						
12	Modern Physics	Phenomena underlying modern physics; light as a wave or particle; basics of quantum mechanics (Schrödinger equation, energy levels, potential well and barrier), atomic structure, nuclear physics (radioactivity, radiocarbon dating, fission and fusion, chain reaction), special theory of relativity (simultaneity, time dilation, length contraction, mass-energy equivalence), cosmology (background radiation, Hubble's constant, Big Bang theory, nucleosynthesis).	x					x							
13	General-purpose Programming	Advanced topics in imperative and structural programming. Students will explore software development techniques and develop skills in problem algorithmization. The curriculum covers the implementation of solutions using direct memory management and dynamic data structures.		x						x					
14	Computer Aided Design	Computer-aided design and its role in manufacturing and production systems. Familiarization with software for generating technical documentation. Ability to use CAD tools at a basic level.								x		x		x	
15	Algorithms and Data Structures	Fundamental algorithmic techniques and data structures. Introduction to computational complexity concepts and notation, with reference to the adopted computational model. Topics include (i.a.) sorting, lists, stacks, dictionaries, priority queues, selected graph, string, and data compression algorithms. The presentation of algorithms and data structures is supplemented by an overview of selected real-world applications.							x	x					
16	Civic Knowledge and Engagement I	The development of social competences that go beyond the extra-curricular learning outcomes necessary for an informed and educated citizen of Poland, Europe and the world. To carry out various activities for the development of themselves and the University.											x	x	x

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
17	C1 Business Communication for Engineers 2	Selected lexical and grammatical structures; topics relevant to the academic and professional environments of university graduates; improving receptive and productive language skills; developing essential soft skills required in the workplace.									x				
18	C2 Business Communication for Engineers 2	Selected lexical and grammatical structures; topics relevant to the academic and professional environments of university graduates; improving receptive and productive language skills; developing essential soft skills required in the workplace.									x				
19	Mathematics 3	Combinatorics. Probability space. Random variables and random vectors. Central limit theorems. Point and interval estimation. Parametric and nonparametric hypothesis testing.		x					x						
20	Mathematical Methods 2	Ordinary Differential Equations (ODEs) — key theorems, the most important types of equations in physics and modeling, and practical approaches to finding solutions.		x					x						
21	Electrodynamics and Optics	Basic concepts of classical electrodynamics; quantities characterizing the electromagnetic field and methods of its determination; motion of charged particles in an electromagnetic field; electromagnetic waves; geometric optics (thin and thick lenses, optical systems, aberrations), wave optics (diffraction, interference, near and far field, coherence), nonlinear phenomena in optics.	x					x							
22	Numerical Methods	Writing simple programs in a selected programming language; using the procedures and methods of the chosen programming language to numerically solve selected physical problems; visualization and analysis of results.			x	x				x					
23	Databases	The architecture and processing principles in modern commercial database servers with a relational structure. Storing data in a relational structure, as well as acquiring data from this structure using language appropriate for the server. Different methods of accessing data and the resulting consequences for processing methods.					x			x					
24	Interdisciplinary Problem-Based Learning Project	Implementation of a problem-based project during workshop classes. Teams of 4-5 people — students from different fields of study. Project topics — practical, not strictly related to a specific field of study. The classes develop students' soft skills (including creativity, teamwork, time management, problem solving) as well as the ability to use tools that support project work.									x	x	x		
25	Civic Knowledge and Engagement II	The development of social competences that go beyond the extra-curricular learning outcomes necessary for an informed and educated citizen of Poland, Europe and the world. To carry out various activities for the development of themselves and the University.											x	x	x
26	German A2 block I	The first part of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
27	German B1 block I	The first part of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
28	German B2 block I	The first part of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
29	Spanish A2 block I	The first part of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
30	Spanish B1 block I	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
31	Spanish B2 block I	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
32	French A2 block I	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
33	French B1 block I	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
34	French B2 block I	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
35	Italian A1 block I	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
36	Italian A2 block I	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
37	German A1 block I	The first part of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
38	Spanish A1 block I	The first part of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
39	French A1 block I	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
40	Polish A1 block I	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
41	Polish A2 block I	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
42	Mathematical Methods 3	Partial differential equations of the 1st and 2nd order and their applications, mainly in physics.		x					x						
43	Quantum Systems and Quantum Computing	Mathematical foundations of quantum mechanics in the Hilbert space formulation and elementary physical examples, especially related to phenomena involving spin. Description of a qubit using the wave function and the density matrix, basic operations and quantum gates acting on qubits, the EPR paradox and its significance for quantum mechanics, entangled states, as well as the fundamentals of constructing algorithms for quantum computers (numerical methods, running simulations on a quantum computer, and analysis of results).	x	x		x									
44	Computer Simulations	Solving differential equations with specified initial conditions. Solving partial differential equations with boundary conditions of the first kind. Optionally: solving partial differential equations with periodic boundary conditions. Applying numerical methods to simulate problems described by differential equations. Deepening skills in writing programs in a chosen programming language.			x	x			x	x					

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
45	Data Warehousing	Presentation principles of construction and creation of multidimensional data warehouse structures and principles of initial preparation and presentation of results obtained from them. Principles and methods for creating elements that define multidimensional structures. Methods for creating elements that support processing. Methods for querying these structures using the appropriate embedded language.		x		x				x					
46	Data Storytelling	Data import and export. Data visualization techniques, selected data reporting tools, creating a clear and convincing data presentation.				x		x							
47	Team Project	Carrying out a project in a 4-5 person team under a supervision of a teacher. Developing an innovative solution of an engineering problem within the problem based learning (PBL) framework using tools obtained in the previous semesters.									x	x	x	x	
48	Civic Knowledge and Engagement III	The development of social competences that go beyond the extra-curricular learning outcomes necessary for an informed and educated citizen of Poland, Europe and the world. To carry out various activities for the development of themselves and the University.											x	x	x
49	German A2 block II	Continuation of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
50	German B1 block II	Continuation of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
51	German B2 block II	Continuation of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
52	Spanish A2 block II	Continuation of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
53	Spanish B1 block II	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
54	Spanish B2 block II	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
55	French A2 block II	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
56	French B1 block II	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
57	French B2 block II	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
58	Italian A1 block II	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
59	Italian A2 block II	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
60	Polish A1 block II	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
61	Polish A2 block II	Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal competences required in an international environment.									x				
62	German A1 block II	Continuation of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
63	Spanish A1 block II	Continuation of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
64	French A1 block II	Continuation of the second foreign language course. Selected lexical and grammatical structures at different levels; topics relevant to academic mobility within the Erasmus+ programme; improvement of all language skills; development of the necessary interpersonal skills required in an international environment.									x				
65	Modelling of Physical Fields	The course focuses on the finite element method (FEM) as the primary numerical method for solving differential equations. Different formulations of FEM, shape functions, the treatment of boundary conditions, and the discretization of the domain into finite elements are discussed. The principles of determining local matrices and vectors, assembling the global matrix and global vector, and applying FEM to selected problems are presented.	x						x						
66	Statistical Mechanics and Stochastic Processes	Random walk, entropy. Foundations of Hamilton mechanics. The Liouville theorem. The Poincare theorem. The density operator. Identical particles. The Bose-Einstein, the Fermi-Dirac and the Maxwell-Boltzmann distribution functions. Basic concepts of the theory of stochastic processes with examples. Markov chains. Poisson processes. Brownian motion. Selected applications of stochastic processes in the modeling of physical processes.	x	x								x			
67	Properties of Matter	Quantum description of the structure of matter at the atomic scale, elements of atomic, molecular, and solid-state physics, electromagnetic radiation-matter interaction.	x			x		x							
68	Introduction to Machine Learning	Basic methods of machine learning and their classification according to how knowledge is acquired from data. Solving practical machine learning problems, including data preparation, model selection, hyperparameter tuning, training, and model evaluation.			x	x				x					
69	Data Exploration	Statistical inference encompassing the description, visualisation, and exploration of collected data without the need to predefine research hypotheses. Methods for exploring data, examining relationships between attributes, identifying interesting subsets of observations, and formulating preliminary conclusions regarding patterns present in the analysed data.		x		x				x					
70	Electronics	Signals — basic concepts; RC, RL, and RLC circuits; block diagrams of electronic systems; properties of electronic components over a wide frequency range; amplifier properties; basic field-effect transistor (FET) circuits; basic bipolar transistor circuits; operational amplifiers and their applications; power supply systems. Fundamentals of semiconductor devices and selected electronic circuits. Students will develop skills in using electronic measuring instruments. Students will develop practical skills in building, testing, and analyzing the operation of selected electronic circuits.	x		x			x	x						
71	Process Modelling for Industry 4.0	The issue of Industry 4.0 and intelligent systems used in the broadly defined industrial sector; topics related to modern technologies and the principles of the Fourth Industrial Revolution. Modern methods of data analysis used in machine and process condition monitoring, as well as concepts such as "Digital Twin," "Predictive Maintenance," "Cyber-Physical Systems," and "Smart Factory."			x		x		x			x			

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
72	Mobility Semester	Students go to a selected university and study according to an individually prepared course program. The semester develops students' soft skills and their individual interests.													
73	Artificial Intelligence Essentials	Basic methods of inference in crisp logic and fuzzy logic. Planning algorithms based on searching the solution space, both in conditions without guidance (blind algorithms) and with guidance (heuristic algorithms) for decision-making. Artificial neural networks — artificial intelligence algorithms inspired by biological knowledge, used for recognizing patterns in data: fully connected and convolutional architectures, network operation and learning. Commonly used deep network models.				x				x					
74	Big Data	Principles of processing big data sets in highly scalable distributed storage systems using modern environments dedicated to these purposes. Fundamentals of data analysis in heterogeneous environments; issues of building, training, and deploying machine learning models in Big Data environments; tools dedicated to this purpose and their practical application.		x			x			x					
75	Optimization Theory	Selected elements of unconstrained and constrained optimization. Selected elements of convex optimization.		x					x						
76	Optoelectronics and Photonics	Physical phenomena behind laser action. Analysis of the phenomena of stimulated emission and optical resonance leading to laser action. Phenomena related to methods of spatial confinement of light. Structure of lasers and their main applications.	x					x							
77	Professional Design Project 1 - Capstone Module	Formulating, planning, and controlling the process of solving an engineering or scientific problem by a project team. Applications of management tools in project management. Knowledge of national and international standards systems and requirements for product and process certification. Foundations of life cycle analysis of devices, products, or processes. Elements of industrial property protection and copyright and management of intellectual property resources. Systemic management of occupational health and safety. Foundations of conducting business activities. Analysis and presentation of the obtained results of teamwork.			x	x	x				x		x	x	
78	Diploma Proseminar	Developing skills in using electronic sources of scientific information. Learning the rules for using scientific literature in accordance with its legal and copyright status. Rules and good practices for writing scientific texts. Learning using case study method and preparing for the competency exam.					x				x	x			
79	Human Being and Values - Human Aspects of Management	The main areas of research and the main problems of ethics. The conceptions of moral development. Economics and ethics. Humanistic aspects of work. Corporate Social Responsibility. Professional Ethics.											x		
80	Aesthetics	The subject of aesthetics as a field of philosophy. Aesthetics as the study of beauty and the philosophy of art. Aesthetics and its relations to axiology, epistemology, ontology, psychology, and ethics. Artistic value and aesthetic value. Types of definitions of art. Closed and open concepts of art. Analysis of a work of art.											x		

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
81	Ethics in Management	1. Areas of research and the main problem of philosophical ethics. 2. Conception of moral development. 3. Economics and ethics. 4. Work: moral value of work. 5. Corporate Social Responsibility. 6. Professional ethics: the employment codes and ethical standards. 7. Ethical standards of good management. 8. Creating a Company Image.											x		
82	Philosophy - in the Pursuit of Wisdom	Introduction to philosophy: notions, currents and philosophical trends. Modern moral philosophy.											x		
83	Philosophy	Introduction to philosophy: basic concepts, philosophical trends, directions and subdisciplines. Ethical dilemmas of postmodernity.											x		
84	Human Development History	Emotions as a product of evolution. Individual differences. Intelligence. Theories of personality. Individual in society. Activities, contacts and social interactions. Social roles, interpersonal relations and functioning in organizations social. The role of the field of consciousness in the accurate reading of the message. Emotional intelligence. Techniques increasing submission in terms of defence against manipulation. Cognitive styles and optimism and pessimism.											x		
85	Logical Basis of Thinking and Communication	Language: notion and functions. Structure of expressions. The geography of thinking. Errors in verbal expression of thoughts. Recognition and justification. Cultural influence on the perception of the world. Structures, types, and practical issues of questions and answers.											x		
86	Legal and Social Issues of the Engineering	The discussion of the intellectual property protection meaning in the international, European and national law. International agreements and European conventions in the industrial property. Fundamentals of the patent system. Rules of using creative thinking. Social roles, interpersonal relations and social organizations. Social intelligence on the example of self-esteem, self-control and self consciousness. Manipulation and how to defend against it.											x		
87	Professional Design Project 2	Continuation of work on projects developed within the Capstone Module or implementation of a new project, employing the skills acquired in Capstone Module.									x	x			
88	Diploma Seminar	Preparation of a presentation showing the results obtained during the thesis. Conducting a critical analysis of the results obtained. Participation in a discussion on the literature used, the method of presentation and the use of the results.									x	x			
89	Diploma Thesis	Preparation of the student to integrate the knowledge, skills, and competences acquired during their studies in a comprehensive manner through an engineering diploma thesis, involving the individual and comprehensive solution of an engineering task, including analytical or research components.								x	x			x	

No.	Course name	Program content	1MDS1	1MDS2	1MDS3	1MDS4	1MDS5	1MDS6	1MDS7	1MDS8	1MDS9	1MDS10	1MDS11	1MDS12	1MDS13
90	Internship	Introducing students to the requirements of their future professional work and confronting the knowledge acquired during their studies with the competencies necessary in a professional environment. During the internship, the student develops skills in data analysis for technical and business decision-making, teamwork in defined project roles, teamwork organization, and identifying and assessing the consequences of violations of ethical standards. The student is familiarized with the safety regulations applicable to the given position. The detailed substantive content depends on the individual internship program.					x				x			x	
91	Elective Course 2	The student selects a course, offered in any language, from the first-cycle study programme that further develops the knowledge, skills, and competences acquired in the project as part of the Capstone Module, worth 3 ECTS credits and comprising 45 contact hours.													

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	Mathematics 1	7				7
2	Physics	6			6	6
3	Fundamentals of Experimental Data Analysis	3				3
4	Programming for Modelling and Data Analysis	5			5	5
5	Information Technology	3				3
6	Engineering Drawing	2				2
7	Study Skills for University	1	1			1
8	C1 Business Communication for Engineers 1	3		3		3
9	C2 Business Communication for Engineers 1	3		3		3
10	Mathematics 2	7				7
11	Mathematical Methods 1	2			2	2
12	Modern Physics	5			5	5
13	General-purpose Programming	4			4	4
14	Computer Aided Design	3				3
15	Algorithms and Data Structures	6			6	6
16	Civic Knowledge and Engagement I	1	1			1
17	C1 Business Communication for Engineers 2	2		2		2
18	C2 Business Communication for Engineers 2	2		2		2
19	Mathematics 3	4				4
20	Mathematical Methods 2	3			3	3

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
21	Electrodynamics and Optics	6			6	6
22	Numerical Methods	3			3	3
23	Databases	5			5	5
24	Interdisciplinary Problem-Based Learning Project	5		5		5
25	Civic Knowledge and Engagement II	1	1			1
26	German A2 block I	3		3		3
27	German B1 block I	3		3		3
28	German B2 block I	3		3		3
29	Spanish A2 block I	3		3		3
30	Spanish B1 block I	3		3		3
31	Spanish B2 block I	3		3		3
32	French A2 block I	3		3		3
33	French B1 block I	3		3		3
34	French B2 block I	3		3		3
35	Italian A1 block I	3		3		3
36	Italian A2 block I	3		3		3
37	German A1 block I	3		3		3
38	Spanish A1 block I	3		3		3
39	French A1 block I	3		3		3
40	Polish A1 block I	3		3		3
41	Polish A2 block I	3		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	Mathematical Methods 3	5			5	5
43	Quantum Systems and Quantum Computing	7			7	7
44	Computer Simulations	4			4	4
45	Data Warehousing	2			2	2
46	Data Storytelling	2			2	2
47	Team Project	6		6	6	6
48	Civic Knowledge and Engagement III	1	1			1
49	German A2 block II	3		3		3
50	German B1 block II	3		3		3
51	German B2 block II	3		3		3
52	Spanish A2 block II	3		3		3
53	Spanish B1 block II	3		3		3
54	Spanish B2 block II	3		3		3
55	French A2 block II	3		3		3
56	French B1 block II	3		3		3
57	French B2 block II	3		3		3
58	Italian A1 block II	3		3		3
59	Italian A2 block II	3		3		3
60	Polish A1 block II	3		3		3
61	Polish A2 block II	3		3		3
62	German A1 block II	3		3		3

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
63	Spanish A1 block II	3		3		3
64	French A1 block II	3		3		3
65	Modelling of Physical Fields	4			4	4
66	Statistical Mechanics and Stochastic Processes	4			4	4
67	Properties of Matter	4			4	4
68	Introduction to Machine Learning	4			4	4
69	Data Exploration	4			4	4
70	Electronics	5			5	5
71	Process Modelling for Industry 4.0	5			5	5
72	Mobility Semester	30		30	30	30
73	Artificial Intelligence Essentials	4			4	4
74	Big Data	3			3	3
75	Optimization Theory	4			4	4
76	Optoelectronics and Photonics	6			6	6
77	Professional Design Project 1 - Capstone Module	9		9	9	9
78	Diploma Proseminar	2				2
79	Human Being and Values - Human Aspects of Management	2	2	2		2
80	Aesthetics	2	2	2		2
81	Ethics in Management	2	2	2		2
82	Philosophy - in the Pursuit of Wisdom	2	2	2		2
83	Philosophy	2	2	2		2

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
84	Human Development History	2	2	2		2
85	Logical Basis of Thinking and Communication	2	2	2		2
86	Legal and Social Issues of the Engineering	2	2	2		2
87	Professional Design Project 2	3		3	3	3
88	Diploma Seminar	3				3
89	Diploma Thesis	15		15	15	15
90	Internship	6				6
91	Elective Course 2	3		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)	84/240 (35%)
The total number of ECTS credits to be earned by a student through courses in the fields of humanities or social sciences	6
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	175/240 (72.92%)

Methods of verifying and assessing learning outcomes

The verification and assessment of the learning outcomes achieved by a student require the use of diverse assessment methods. This is because each outcome is assigned to one of three categories: knowledge, skills, or social competencies. In addition, when selecting a method for verifying a given learning outcome and assessing it, the specificity of the course and the form of teaching must be taken into account. Therefore, the methods of verification and assessment are listed in the syllabi of individual courses. The achievement of the required learning outcomes is verified through:

1. written work (written knowledge tests such as exams and quizzes, reports, projects, thesis, etc.),
2. oral forms (oral exams and quizzes, presenting a talk, delivering a presentation, etc.),
3. practical or project-based tasks (both individual and group work),
4. observation and assessment of students' activity during classes,
5. self-assessment and peer assessment (in the case of group projects),
6. a competency exam,
7. the diploma examination.

The verification of learning outcomes may be formative (partial, conducted repeatedly during classes) and/or summative (final assessment). The final result of the verification is presented using the grading scale specified in the Study Regulations of Lodz University of Technology.

Professional internships

The internship in the Modelling and Data Science programme lasts 6 weeks. The rules and forms of completing the internship are regulated by the Rector's Ordinance of Lodz University of Technology applicable in this area. (The currently binding document is Ordinance No. 66/2021 of 29 October 2021 on the Regulations for Student Internships at Lodz University of Technology.) Upon completing the internship, the student receives 6 ECTS credits.

Characteristics of the course

Graduate profile

A graduate of the Modelling and Data Science programme is prepared to work with advanced technologies in international teams carrying out projects on a European and global scale. They possess knowledge and skills in modelling processes based on the fundamental rules that govern them (especially the laws of physics in the case of modelling in science and technology), data analysis, computer simulations, as well as the basics of machine learning and artificial intelligence. This allows them to use modern analytical and modelling tools effectively.

In addition to technical competencies, the graduate has broad perspectives gained through courses in fields where data analysis and modelling play a key role, such as the physics of modern materials, nanotechnology, optoelectronics, and photonics. They also develop soft skills, including effective communication and teamwork.

The competencies acquired during the programme enable the graduate to continue their education at the master's level or to work as a data analyst, modelling specialist, or data engineer. A distinctive feature of graduates of the Modelling and Data Science programme is their ability to combine fundamental laws and models with data-driven methods in hybrid modelling, which is becoming increasingly popular in scientific, industrial, financial and IT sectors.

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

The Modelling and Data Science programme consistently supports the strategic goals of Lodz University of Technology (TUL) as outlined in the TUL 2025–2030 Strategy. It addresses the university's key development areas: interdisciplinarity, cooperation with industry, innovation, internationalisation, and the individualisation of the learning process.

The interdisciplinary nature of the programme, combining physical sciences (the leading discipline) with computer science, supports the university's strategic aim of integrating different fields of knowledge to develop modern engineering and digital competencies.

The curriculum is closely linked to the research carried out in the units responsible for the programme. Courses such as “Modelling of Physics Fields”, “Properties of Matter”, and “Optoelectronics and Photonics” allow students to take an active part in research and development projects. This supports the strategic goal of increasing student participation in scientific activity and helps build an academic environment based on innovation and the creation of new technologies.

A particularly important element aligned with the university's strategy is the individualisation of the learning process. The curriculum includes a “mobility semester”, during which students can complete part of their studies at a selected university abroad, independently composing their study plan. This solution supports the development of competences and international educational experience, which corresponds to the university's strategic priorities related to internationalisation and flexible education. Additionally, the opportunity to choose elective courses offered by TUL enhances the personalisation of the academic development path.

The programme supports strategic goals linked to strengthening cooperation with business and developing synergy between science and the economy. The curriculum and its foundations were consulted with companies from the ICT Cluster and other enterprises in the Lodz region, which allowed for tailoring the content to the needs of the job market and the R&D sector. Designing the programme so that the eighth semester is not overloaded with classes helps students find high-quality internships and smoothly transition from studies to professional life (for those finishing at the first cycle level) or to the next stage of education combined with scientific work (for those continuing their studies).

All these elements show that Modelling and Data Science is a programme fully aligned with the development directions of Lodz University of Technology and supports the implementation of the key goals defined in the university's strategy.

Educational objectives and employment and continuing education opportunities

The main educational goals of the Modelling and Data Science programme are:

- Preparing students to model complex phenomena and processes,
- Developing competencies in data analysis and data mining,
- Preparing students to work in international environments,

- Developing soft skills and teamwork skills,
- Integrating mathematical, physical, and computer science knowledge.

Examples of employment sectors include:

- Energy sector (modelling of physical phenomena),
- Scientific research centres and universities (hybrid modelling, analysis of experimental data, simulations),
- IT sector (machine learning),
- Financial sector (banks, financial consulting, audits),
- Medical sector (image analysis using machine learning).

Examples of job positions:

- Data Analyst
- Quantitative Analyst
- Modelling Specialist
- Data Scientist
- Data Engineer
- Machine Learning and Artificial Intelligence Specialist
- Data Analysis and Decision-Making Consultant

Possibilities for continuing education:

A graduate of the Modelling and Data Science programme possesses interdisciplinary competencies in process modelling, data analysis, computer simulations, and the fundamentals of machine learning and artificial intelligence. They are prepared to continue their studies at the master's level in fields such as computer science, mathematics, physics, and interdisciplinary programmes, including areas such as Data Science, Software Engineering, Computer Science, Information Technology, AI/ML, quantitative analytics, and computational physics. The skills gained also enable further development in research and development projects as well as scientific work, both in Poland and abroad.

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

As part of developing cooperation with industry partners, the programme and concept of the Modelling and Data Science field of study were consulted with companies from the ICT Cluster and other appropriately profiled firms in the Lodz region. The curriculum was designed so that the eighth semester is not overloaded with classes. This helps students find high-quality internships and smoothly transition from studies to professional work (for those finishing their education at the first-cycle level) or to the next stage of education combined with research activity (for those continuing their studies).

An analysis of the job market (job advertisements and employment trends among graduates of related fields) showed that, in recent years, skills such as large-scale data analysis, data-driven mathematical modelling, as well as modelling based on general principles governing specific groups of phenomena, have become highly valued. Other important competencies include knowledge of programming languages, numerical methods, foreign languages, and soft skills such as communication and teamwork.

A third source of information was an employer survey conducted in 2019 by the TUL Career Office among companies from the Lodz region. Among the three most important professional competencies of a Lodz University of Technology graduate, which are particularly useful in the companies surveyed, employers most often indicated: sector-specific and specialised knowledge relevant to current industry needs, foreign language skills, and the ability to use IT tools. General and broadly professional knowledge was also considered important. In the group of the three most frequently mentioned social competences, respondents highlighted independence, teamwork skills, and the ability to learn. Employers' comments and suggestions regarding changes to existing curricula pointed to the need for more advanced practical classes, longer internships, stronger emphasis on cooperation with business, and further development of

interpersonal skills.

The final form of cooperation with external stakeholders consisted of consultations with companies from the Lodz region with a suitable profile (meetings and email correspondence). Some companies expressed interest in the graduates and had no comments. Those who provided suggestions saw these incorporated into the programme, as described below.

- 1) Programming skills, especially object-oriented programming, were indicated as essential. These are addressed through courses such as "Programming for Modelling and Data Analysis", "General-purpose Programming", "Algorithms and Data Structures", and, to a lesser extent, other Computer Science courses.
- 2) Working with databases was also emphasised as an important skill. This is covered by the courses "Databases", "Data Warehousing", "Data Exploration", "Big Data", and "Data Storytelling".
- 3) Knowledge of machine learning: we included the course "Introduction to Machine Learning" and, for a broader perspective, "Artificial Intelligence Essentials".
- 4) Project and teamwork skills were highlighted as important — as in all programmes taught within IFE, students participate in numerous project-based courses, including group projects.
- 5) The ability to work with "noisy" datasets — the course "Fundamentals of Experimental Data Analysis" introduces topics such as random uncertainty, result variability, and outliers. Later laboratory courses ("Physics", "Modern Physics", "Electrodynamics and Optics", "Electronics") require students to collect their own data, which is often noisy and affected by systematic and random errors.
- 6) Soft skills, especially intra- and inter-team communication, were also noted as crucial. Students develop these skills in most team-based projects, and particularly during "Team Project" and "Interdisciplinary Problem-Based Learning Project" courses.
- 7) Some companies additionally pointed to the value of basic 3D graphics knowledge (covered in "Computer Aided Design"), process modelling (addressed in courses such as "Process Modelling for Industry 4.0" and "Modelling of Physical Fields"), and the importance of critical thinking. Many companies stressed that this last competency — often distinguishing physicists from computer scientists — results from frequent exposure to real-world problems in laboratory work.

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

In accordance with the applicable Recruitment Resolution at Lodz University of Technology

The unit organizing education

Faculty of Technical Physics, Information Technology and Applied Mathematics/CKM

Education program

Semester 1

Course	Number of hours	ECTS points	Form of verification	Obligatory
Mathematics 1	Tutorials: 45 Lecture: 45	7	Exam	Obligatory
Physics	Tutorials: 40 Laboratory classes: 30 Lecture: 25	6	Exam	Obligatory
Fundamentals of Experimental Data Analysis	Tutorials: 15 Laboratory classes: 15 E-learning: 10	3	Graded assignment	Obligatory
Programming for Modelling and Data Analysis	Tutorials: 40 Project work: 15 E-learning: 5	5	Graded assignment	Obligatory
Information Technology	Laboratory classes: 45	3	Graded assignment	Obligatory
Engineering Drawing	Tutorials: 20 Lecture: 10	2	Graded assignment	Obligatory
Study Skills for University	Tutorials: 30	1	Graded assignment	Obligatory
Business Communication for Engineers 1		3	Graded assignment	Obligatory group
The student chooses one module from the group.				
C1 Business Communication for Engineers 1	Tutorials: 60	3	Graded assignment	Optional
C2 Business Communication for Engineers 1	Tutorials: 60	3	Graded assignment	Optional
Sum	450	30		

Semester 2

Course	Number of hours	ECTS points	Form of verification	Obligatory
Mathematics 2	Tutorials: 45 Lecture: 45	7	Exam	Obligatory
Mathematical Methods 1	Tutorials: 20 Lecture: 10	2	Graded assignment	Obligatory
Modern Physics	Tutorials: 30 Laboratory classes: 20 Lecture: 30	5	Graded assignment	Obligatory
General-purpose Programming	Laboratory classes: 30 Lecture: 30	4	Graded assignment	Obligatory
Computer Aided Design	Laboratory classes: 45	3	Graded assignment	Obligatory
Algorithms and Data Structures	Tutorials: 15 Laboratory classes: 15 Lecture: 30	6	Exam	Obligatory
Civic Knowledge and Engagement I	Seminar: 3 Lecture: 3	1	Graded assignment	Obligatory
Business Communication for Engineers 2		2	Exam	Obligatory group
The student chooses one module from the group.				
C1 Business Communication for Engineers 2	Tutorials: 30	2	Exam	Optional
C2 Business Communication for Engineers 2	Tutorials: 30	2	Exam	Optional
Physical Education 1	Tutorials: 30	0	Pass	Obligatory
Sum	431	30		

Semester 3

Course	Number of hours	ECTS points	Form of verification	Obligatory
Mathematics 3	Tutorials: 30 Lecture: 30	4	Exam	Obligatory

Course	Number of hours	ECTS points	Form of verification	Obligatory
Mathematical Methods 2	Tutorials: 30 Lecture: 15	3	Graded assignment	Obligatory
Electrodynamics and Optics	Tutorials: 30 Laboratory classes: 20 Lecture: 30	6	Graded assignment	Obligatory
Numerical Methods	Laboratory classes: 15 Project work: 15 Lecture: 15	3	Graded assignment	Obligatory
Databases	Laboratory classes: 30 Lecture: 30	5	Exam	Obligatory
Interdisciplinary Problem-Based Learning Project	Project work: 30	5	Graded assignment	Obligatory subjects to choose from
Civic Knowledge and Engagement II	Seminar: 3 Lecture: 3	1	Graded assignment	Obligatory
Foreign Language Block I		3	Graded assignment	Obligatory group
The student chooses one module from the group.				
German A2 block I	Tutorials: 60	3	Graded assignment	Optional
German B1 block I	Tutorials: 60	3	Graded assignment	Optional
German B2 block I	Tutorials: 60	3	Graded assignment	Optional
Spanish A2 block I	Tutorials: 60	3	Graded assignment	Optional
Spanish B1 block I	Tutorials: 60	3	Graded assignment	Optional
Spanish B2 block I	Tutorials: 60	3	Graded assignment	Optional
French A2 block I	Tutorials: 60	3	Graded assignment	Optional
French B1 block I	Tutorials: 60	3	Graded assignment	Optional
French B2 block I	Tutorials: 60	3	Graded assignment	Optional
Italian A1 block I	Tutorials: 60	3	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
Italian A2 block I	Tutorials: 60	3	Graded assignment	Optional
German A1 block I	Tutorials: 60	3	Graded assignment	Optional
Spanish A1 block I	Tutorials: 60	3	Graded assignment	Optional
French A1 block I	Tutorials: 60	3	Graded assignment	Optional
Polish A1 block I	Tutorials: 60	3	Graded assignment	Optional
Polish A2 block I	Tutorials: 60	3	Graded assignment	Optional
Physical Education 2	Tutorials: 30	0	Pass	Obligatory
Sum	416	30		

Semester 4

Course	Number of hours	ECTS points	Form of verification	Obligatory
Mathematical Methods 3	Tutorials: 30 Lecture: 30	5	Exam	Obligatory
Quantum Systems and Quantum Computing	Tutorials: 30 Project work: 15 Lecture: 45	7	Exam	Obligatory
Computer Simulations	Laboratory classes: 15 Project work: 30 Lecture: 15	4	Graded assignment	Obligatory
Data Warehousing	Laboratory classes: 25 Lecture: 5	2	Graded assignment	Obligatory
Data Storytelling	Laboratory classes: 15 Project work: 15	2	Graded assignment	Obligatory
Team Project	Project work: 40	6	Graded assignment	Obligatory subjects to choose from

Course	Number of hours	ECTS points	Form of verification	Obligatory
Civic Knowledge and Engagement III	Seminar: 3 Lecture: 3	1	Graded assignment	Obligatory
Foreign Language Block II		3	Graded assignment	Obligatory group
The student chooses one module from the group.				
German A2 block II	Tutorials: 60	3	Graded assignment	Optional
German B1 block II	Tutorials: 60	3	Graded assignment	Optional
German B2 block II	Tutorials: 60	3	Graded assignment	Optional
Spanish A2 block II	Tutorials: 60	3	Graded assignment	Optional
Spanish B1 block II	Tutorials: 60	3	Graded assignment	Optional
Spanish B2 block II	Tutorials: 60	3	Graded assignment	Optional
French A2 block II	Tutorials: 60	3	Graded assignment	Optional
French B1 block II	Tutorials: 60	3	Graded assignment	Optional
French B2 block II	Tutorials: 60	3	Graded assignment	Optional
Italian A1 block II	Tutorials: 60	3	Graded assignment	Optional
Italian A2 block II	Tutorials: 60	3	Graded assignment	Optional
Polish A1 block II	Tutorials: 60	3	Graded assignment	Optional
Polish A2 block II	Tutorials: 60	3	Graded assignment	Optional
German A1 block II	Tutorials: 60	3	Graded assignment	Optional
Spanish A1 block II	Tutorials: 60	3	Graded assignment	Optional
French A1 block II	Tutorials: 60	3	Graded assignment	Optional
Physical Education 3	Tutorials: 30	0	Pass	Obligatory
Sum	406	30		

Semester 5

Course	Number of hours	ECTS points	Form of verification	Obligatory
Modelling of Physical Fields	Tutorials: 15 Project work: 30 Lecture: 5	4	Exam	Obligatory
Statistical Mechanics and Stochastic Processes	Tutorials: 30 Lecture: 30	4	Graded assignment	Obligatory
Properties of Matter	Laboratory classes: 15 Lecture: 30	4	Graded assignment	Obligatory
Introduction to Machine Learning	Project work: 30 Lecture: 15	4	Graded assignment	Obligatory
Data Exploration	Laboratory classes: 30 Lecture: 15	4	Graded assignment	Obligatory
Electronics	Tutorials: 15 Laboratory classes: 30 Lecture: 15	5	Graded assignment	Obligatory
Process Modelling for Industry 4.0	Project work: 45 Lecture: 15	5	Graded assignment	Obligatory
Sum	365	30		

Semester 6

Students go to a selected university and study according to an individually prepared course program. The semester develops students' soft skills and their individual interests.

Course	Number of hours	ECTS points	Form of verification	Obligatory
Mobility Semester	Total number of contact hours: 375	30	Graded assignment	Obligatory subjects to choose from
Sum	375	30		

Semester 7

Course	Number of hours	ECTS points	Form of verification	Obligatory
Artificial Intelligence Essentials	Laboratory classes: 30 Lecture: 20	4	Exam	Obligatory
Big Data	Laboratory classes: 30	3	Graded assignment	Obligatory
Optimization Theory	Tutorials: 30 Lecture: 30	4	Graded assignment	Obligatory
Optoelectronics and Photonics	Project work: 30 Lecture: 30	6	Graded assignment	Obligatory
Professional Design Project 1 - Capstone Module	Project work: 90	9	Graded assignment	Obligatory subjects to choose from
Diploma Proseminar	Seminar: 15	2	Graded assignment	Obligatory
Elective Course 1		2	Graded assignment	Obligatory group
The student chooses one course from the group.				
Human Being and Values - Human Aspects of Management	Lecture: 30	2	Graded assignment	Optional
Aesthetics	Lecture: 30	2	Graded assignment	Optional
Ethics in Management	Tutorials: 15 Lecture: 15	2	Graded assignment	Optional
Philosophy - in the Pursuit of Wisdom	Tutorials: 15 Lecture: 15	2	Graded assignment	Optional
Philosophy	Tutorials: 15 Lecture: 15	2	Graded assignment	Optional
Human Development History	Tutorials: 15 Lecture: 15	2	Graded assignment	Optional
Logical Basis of Thinking and Communication	Seminar: 15 Lecture: 15	2	Graded assignment	Optional
Legal and Social Issues of the Engineering	Lecture: 30	2	Graded assignment	Optional
Sum	335	30		

Semester 8

The student selects a course, offered in any language, from the first-cycle study programme that further develops the knowledge, skills, and competences acquired in the project as part of the Capstone Module, worth 3 ECTS credits and comprising 45 contact hours.

Course	Number of hours	ECTS points	Form of verification	Obligatory
Professional Design Project 2	Project work: 45	3	Graded assignment	Obligatory subjects to choose from
Diploma Seminar	Seminar: 30	3	Graded assignment + exam	Obligatory
Diploma Thesis	Diploma Thesis: 0	15	Pass	Obligatory subjects to choose from
Internship	Internship: 0	6	Pass	Obligatory
Elective Course 2	Total number of contact hours: 45	3	Graded assignment	Obligatory subjects to choose from
Sum	120	30		