



Lodz University
of Technology

Study programme

Faculty:	Faculty of Electrical, Electronic, Computer and Control Engineering
Major:	Electrical Engineering
Level of study:	first-cycle programme (inżynier)
Form of study:	part-time studies
Academic year:	2025/26

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Basic information

Name of the field of study:	Electrical Engineering
Level of study:	first-cycle programme (inżynier)
Study profile:	general academic
Form of studies:	part-time studies
Duration of studies (number of semesters):	8
The number of ECTS points required to complete studies:	210
Total number of hours of classes:	1554
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:	62
Professional title awarded to graduates:	inżynier
ISCED code:	0713
Language of study:	polish

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

Discipline	Percentage share
Automation, electronics and electrical engineering	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	1ELT1	Explains at an advanced level the issues in mathematics, physics, computer science and engineering necessary to describe and analyse the principles of operation and diagnostics of electrical circuits, machines, devices and systems and their control.	P6U_W	P6S_WG
2	1ELT2	Explains operation, design principles, and construction of complex electrical systems, including ethical and professional responsibilities in engineering practice, with life cycle analysis, standardization, OHS, project management, and IP protection in economic, environmental, and social contexts.	P6U_W, P6U_K	P6S_WK, P6S_KO, P6S_WG_inž, P6S_WK_inž
3	1ELT3	Is able to use advanced IT tools essential in engineering practice, especially in the area of electrical circuits, components, devices, and machines.	P6U_U	P6S_UW, P6S_UW_inž
4	1ELT4	Is able to operate, design, expand, and adapt complex electrical devices and systems considering real constraints, including economic, environmental, and occupational safety and health.	P6U_U	P6S_UW, P6S_UW_inž
5	1ELT5	Is able to conduct experimental and simulation research, analyze complex circuits, machines, and electrical systems, perform critical analysis of results, and prepare technical documentation.	P6U_U, P6U_K	P6S_UW, P6S_KK, P6S_UW_inž
6	1ELT6	Is able to plan, organize, and perform individual work and collaborate in a team with designated goals and tasks.	P6U_U	P6S_UO
7	1ELT7	Is capable of creative thinking and continuous acquisition of technical knowledge in electrical engineering and related fields using appropriate learning methods.	P6U_U	P6S_UW, P6S_UU, P6S_UW_inž
8	1ELT8	Is able to communicate effectively, present opinions, and construct arguments, including in foreign language at B2 level, using specialized electrical engineering terminology.	P6U_U	P6S_UK
9	1ELT9	Is ready to critically assess own knowledge and skills in operating and analyzing electrical systems and communicate with various audiences.	P6U_U, P6U_K	P6S_UK, P6S_KK, P6S_UW_inž
10	1ELT10	Is ready to take responsibility for tasks performed, follow professional ethics, and act in an economically justified manner.	P6U_K, P6U_U	P6S_KO, P6S_KR, P6S_UW_inž

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

No.	Course name	Program content	1ELT1	1ELT2	1ELT3	1ELT4	1ELT5	1ELT6	1ELT7	1ELT8	1ELT9	1ELT10
1	Mathematics I	Number sequences. Functions. Derivatives. Integrals. Vector calculus. Matrix calculus.	x									
2	Physics	Electric charge. Electrostatic field. Coulomb's law. Electric field intensity. Gauss's law. Conductors and dielectrics. Electric capacitance. Direct current. Magnetic field. Electromagnetic induction Maxwell's equations	x		x							
3	Electrical Safety	Ergonomics. Mental and physical workload. Workstation. Environmental factors and limitation. AC/DC impact on body. Shock protection, risk of electric shock. Protection methods, power disconnection. High-voltage networks. First aid.										
4	Preparation of Technical Documentation	Working with spreadsheets, data visualization, engineering graphics, 2D drawings, dimensioning, technical documentation, summaries, tool integration.	x		x		x					
5	Electrical Circuits 1	Electrical circuit elements. Phasor concept. Methods of analysis of linear DC and sinusoidal AC systems in steady state. Resonant circuits. Three-phase systems. Transient analysis. Measurement and simulation verification of fundamental phenomena in electrical circuits.	x		x		x			x		
6	English n. B2 module I	First part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
7	English n. B2+ module I	First part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
8	English n. C1 module I	First part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
9	Electrical and Electronic Metrology 1	Physical quantities, units, standards, measurement methods. Measuring instruments. Measurement errors and uncertainty. Analog-to-digital processing. Sensors of non-electrical quantities. Microprocessor and computer measurement systems. Statistical processing of data		x	x		x					x
10	Mathematics 2	Number and function series. Differential and integral calculus of functions of two variables. Implicit function. Ordinary differential equations: concepts, theorems, applications. Separable and first- and second-order linear equations. Laplace transform.	x									
11	Information Technology	Text editor, presentation, communication in IT systems, IT system architecture, AI solutions overview, safe data transfer, VPN, TOR, Firewall, OSI model, cybersecurity							x			

No.	Course name	Program content	1ELT1	1ELT2	1ELT3	1ELT4	1ELT5	1ELT6	1ELT7	1ELT8	1ELT9	1ELT10
12	Materials Physics	Structure of solids. Band theory and electrical conductivity. Classification of electrical and electronic materials. Aging of materials. Heat generation and transfer.	x				x			x		
13	Electrical Circuits 2	Analysis of linear circuits in a steady state using the classical, Laplace transform, and state equation methods. Two-ports. Fourier series. Basic information about non-linear elements and methods of analyzing non-linear circuits. Fundamentals of analyzing circuits with distributed parameters.	x							x		
14	English n. B2 module II	Second part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
15	English n. B2+ module II	Second part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
16	English n. C1 module II	Second part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
17	Programming in Electrical Engineering	Introduction to Python syntax, data structures, basic libraries, object-oriented programming, data acquisition and visualization.							x			
18	Electrical and Electronic Metrology 2	Digital measuring devices. Digital measurements of voltage, current, resistance, capacitance, inductance, frequency. Power and energy measurements in single- and three-phase systems. Measurement data recorders. Digital measurement of deformed signal parameters. Measurements of magnetic quantities and bridge measurements.		x	x							x
19	Materials Engineering	Superconducting materials. Cryogenic systems. Environmental protection methods for electrical device components. Material engineering technologies. Laser technologies. Energy storage. Thin-film conductors.	x		x		x					
20	Electromagnetic Field Theory	Vector analysis, Maxwell's equations, electrostatic field, magnetostatic field, magnetic circuits, electromagnetic induction, electromagnetic waves, numerical analysis, electromagnetic shielding, skin effect.	x		x		x					
21	Control and Regulation Systems	Differential and difference equations, Laplace transfer function, system responses. Control of open and closed-loop systems. Signals, errors, block diagrams and simplification. Control quality: steady-state and transient performance. Feedback, dynamics, stability margins. Tuning of basic controllers.	x				x				x	
22	Numerical Methods	Floating point arithmetic, errors in numerical analysis. Systems of linear equations. Interpolation and approximation. Richardson extrapolation, numerical differentiation and integration. Physical processes modelling using COMSOL environment.	x		x							

No.	Course name	Program content	1ELT1	1ELT2	1ELT3	1ELT4	1ELT5	1ELT6	1ELT7	1ELT8	1ELT9	1ELT10
23	English n.B2 module III	Third part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
24	English n. B2+ module III	Third part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
25	English n. C1 module III	Third part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
26	Electric Machines and Transformers 1	Transformers, energy conversion, DC machines, synchronous machines, asynchronous machines, parameter analysis, operational characteristics, technical calculations.		x		x	x					
27	Electrical Apparatus	Contact, switching, semiconductor, hybrid devices. Electromagnetic, electrodynamic and thermal phenomena in devices. Switching phenomena, short circuit breaking process. Construction, operation of selected electrical apparatus. Principles of selection and testing of electrical devices.	x							x		
28	Electronics	Electronic components and devices, semiconductors and their applications. Thermal sensitivity, cooling, power supply, load capacity, protections. Circuit analysis and design. Analog electronics. Digital circuits. Optoelectronics and its applications.	x			x	x					
29	Controllers and Microprocessor Technique	Structure of industrial controllers, microcontrollers and microprocessor systems and typical peripheral modules and their programming methods (C language, LabView). Practical hardware implementation of control algorithms.	x		x					x		
30	Programming and Data Processing	Application of artificial intelligence tools in data processing and analysis. Regression, classification, and clustering – data exploration methods used for value prediction, object grouping, and category assignment. Processing and interpretation of signals.										
31	English n. B2+ module IV	Fourth part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
32	English n. C1 module IV	Fourth part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		
33	English n. B2 module IV	Fourth part of a business language course with elements of industry-specific terminology; development of all language skills; development and improvement of soft skills oriented around the future working environment of the university graduate.								x		

No.	Course name	Program content	1ELT1	1ELT2	1ELT3	1ELT4	1ELT5	1ELT6	1ELT7	1ELT8	1ELT9	1ELT10
34	Electric Machines and Transformers 2	Transformers, single-phase, commutator, reluctance, stepper, and permanent magnet motors. Power electronics supply, characteristics and parameters, electrical and mechanical measurements. Instrument current and voltage transformers. Standardization.		x		x	x					
35	Entrepreneurship	Enterprise management, basic management functions, human resource management, sales and cost budgeting, business plan. Defining and managing resources.		x				x	x			x
36	Electricity Generation and Distribution 1	Power system. Classification of power plants. Thermodynamic cycles: Rankine, gas-steam combined. Cogeneration. Network structure. Equivalent circuits, power flow calculations, short-circuit currents. Power quality and reliability, reactive power compensation, voltage control, neutral point.		x								
37	Electric Drives and Industrial Controllers	Electric drive system operating modes. Drive system dynamics. Typical loads torque curves. Basic speed control methods for electric drive properties. Structure of PLC controllers. Basics of PLC programming.					x	x				x
38	Electricity Generation and Distribution 2	Power substations. Grounding and electric shock protection. Design principles. Selection of busbar components. Criteria for selecting conductor cross-section. Selectivity of protection.			x	x						
39	High Voltage Engineering with Elements of Statistics	Generation and measurement of high voltages. Insulation systems: homogeneous and layered. Complete and partial discharges in dielectrics. Corona, surface and creeping discharges, insulator chains. Overvoltage. High-voltage statistics.		x			x					
40	Competence Project	Analysis and solution of the presented problem, presentation of results, free selection of methods and tools. Project management issues: planning, monitoring, team coordination, resource management and communication.		x			x		x			x
41	Internship	Gaining practical knowledge and new professional competences in natural workplace conditions.		x				x				
42	Electrical Lighting	Photometric parameters and laws. Classification and characteristics of lighting systems. Design of electric lighting, standards, regulations, and criteria for lighting design. Measurement of electric lighting parameters.		x	x		x					
43	Testing Techniques and Protection in Electrical Power Engineering	Typical faults in power equipment. Fault detection criteria. Requirements for protection devices. Protection of medium and high voltage lines, transformers, generators, motors, earth-fault protection in networks with ineffectively grounded neutral points. SPZ, SZR, SCO automation. Construction of relays.										
44	Renewable and Distributed Energy	Renewable Energy Sources. Energy storage. Prosumer. Operation of the grid with distributed generation. Island operation of prosumer installations. Control of renewable energy sources operation. Priorities and legal regulations regarding RES development.		x	x	x						
45	Quality and Efficiency of Electricity Use	Electricity quality. Legal acts and standards. Measurements and assessment of power quality parameters. Reactive power compensation, reducing power and energy losses in the power system. Energy efficiency.		x	x		x					

No.	Course name	Program content	1ELT1	1ELT2	1ELT3	1ELT4	1ELT5	1ELT6	1ELT7	1ELT8	1ELT9	1ELT10
46	Energoelectronics and Electromagnetic Compatibility	Power converters for electric machines, DC-DC converters, inverters – simulation, measurements, diagnostics. EMC analysis: sensitivity, immunity, emissions, compatibility margin, compatibility level. Sources of electromagnetic disturbances, ESD.		x	x	x						
47	Engineering Project	Analysis and solution of the presented problem, presentation of results, free selection of methods and tools. Project management issues: planning, monitoring, team coordination, resource management and communication.		x			x	x	x	x	x	x
48	Smart Grid	Characteristics and requirements of Smart Grid. Trends in power grid development. Distributed generation as a key factor in SmartGrid development. Grid operation with distributed generation. Prosumer.		x						x		
49	Operational Measurements of Electric Vehicles	Data exchange buses. Operation of the OBD system, emission monitors, diagnostic and communication information, diagnostic tester, tester operating modes, fault codes. Characteristics of charging stations. Diagnostics and operation of electric vehicles and charging infrastructure.			x					x		x
50	Telecommunications Network Infrastructure	Basic elements of telecommunications networks, basics of digital transmission, ISO-OSI model of telecommunications systems, physical links in wireless and wired networks, legal conditions for the construction and operation of telecommunications networks.		x	x		x					
51	Mechatronic Systems	Mechatronic systems, electropneumatics, electrohydraulics, sensors, automation and digitalization of production processes, application of artificial intelligence in industry.				x	x			x		
52	Measurement Solutions for the Power Industry	Operating characteristics of inductive and unconventional transformers for distorted waveforms. Electrical shock and fire protection measurements and measurement protocol preparation.				x	x					
53	Electrical Devices in Industrial Applications	Presentation of a set of electrical devices that allow for increasing energy efficiency through the use of energy management modules and further optimization of production processes. Integration of various solutions used in switchboards.		x						x		
54	Diagnostics and High Voltage Technologies	Insulation systems of high-voltage devices. Modern technologies replacing SF6 in the area of high-voltage devices. HVDC technology. Applications of high-voltage technologies in industry. Electrostatic technologies. Technologies based on the corona discharges. Diagnostics of high-voltage devices based.		x			x			x		
55	Electrical Power Networks and Systems	Energy markets. Power transmission via direct current lines. Types and characteristics of customers. Electrical grids operation. Short circuits in the power system. Voltage and frequency regulation. Network neutral point operation.		x	x		x					
56	Industrial Control Systems Design	Design of an entire control system for an electric drive system, SCADA system, preparation of technical documentation.		x			x			x		
57	Vision Systems for Electrical Equipment Inspection	Basic methods of processing visual information. Image data structures. Digital filtering. Morphological operations. Segmentation of the scene image. Analysis of the shape and other features of electrical objects.			x		x	x				

No.	Course name	Program content	1ELT1	1ELT2	1ELT3	1ELT4	1ELT5	1ELT6	1ELT7	1ELT8	1ELT9	1ELT10
58	Service and Operational Measurements in Electrical Installations	Development of the concept of an LV and/or MV electrical installation. Selection of measurement and protection solutions - assessment of measurement uncertainty and cost estimation. Preparation of technical documentation.				x	x					x
59	Final Project	Preparation of an engineering thesis, including elements of a practical solution, in accordance with the guidelines adopted by the RKS.				x	x		x			x
60	Power Networks Design and Operation	Construction and structure of power networks. Types of power lines. Conductor stress, pole load. Conductor vibrations and anti-vibration protection. Breaking span, critical temperature, conductor distance. Cable construction and parameters of underground lines.		x		x	x					
61	Seminarium dyplomowe Elektroenergetyka	Methodology of research work, rules of writing a thesis and preparation for the presentation of its results, preparation for the defense of the thesis. A competency exam checking knowledge and aggregated skills.					x			x	x	
62	Design of Electrical Machines and Transformers	Magnetic circuits, windings, rated parameters, loss analysis, energy efficiency, dynamic strength, calculation methods, project optimization.		x	x	x	x					
63	Technical Electrodynamics	Technical electrodynamics, electromagnetic field simulation, field modeling of electric machines, application of numerical methods, optimization of electromagnetic designs.		x	x		x					
64	Industrial Applications Programming	Examples of industrial solutions using programmable controllers and frequency converters, configuration of electric drives, operator interfaces, diagnostics, and control optimization.		x	x	x						
65	Modeling of Electromechanical Systems	Circuit modeling, computer simulation in SPICE-type environments (Simulation Program with Integrated Circuit Emphasis), selection of power electronic components.		x	x	x	x					
66	Operation of Electrical Machines and Transformers	Operation of electric machines, transformer diagnostics, vibroacoustic analysis, thermal analysis, fault diagnostics, impact of operating conditions, optimization of machine performance.		x		x	x					
67	Seminarium dyplomowe Transformatory i maszyny elektryczne w przemyśle	Methodology of research work, rules of writing a thesis and preparation for the presentation of its results, preparation for the defense of the thesis. A competency exam checking knowledge and aggregated skills.					x			x	x	
68	Automotive Electromechanics	Vehicle design and dynamics. Combustion, hybrid and electric vehicles. Electronic and electromechanical components, internal communication systems in vehicles, communication between subsystems. Power supply system. Lighting.			x		x			x		
69	Car System Diagnostics	Requirements for limiting harmful emissions from combustion engines. Data exchange buses. Diagnostic protocols and the use of these protocols for diagnostic purposes. Operation of the OBD system.			x	x	x		x			
70	Vehicle-to-Network Cooperation	Legal and regulatory issues. Types of EVs and charging systems. Energy storage. EV integration with the grid, EV as a mobile energy storage.		x	x		x					

No.	Course name	Program content	1ELT1	1ELT2	1ELT3	1ELT4	1ELT5	1ELT6	1ELT7	1ELT8	1ELT9	1ELT10
71	Energy Exchange Systems for Electromobility	Measurements of electric vehicle charging stations. Diagnostics of vehicle-charging station communication systems. Operational measurements of electric vehicles and charging infrastructure.		x			x					x
72	Electric Motors in Vehicle Drives	Modern motor design technologies, energy efficiency, motor control, motor power supply, BMS systems, regenerative braking, fault diagnostics, control signal analysis, impact of operating conditions on motor performance.		x		x	x					
73	Seminarium dyplomowe Elektromobilność	Methodology of research work, rules of writing a thesis and preparation for the presentation of its results, preparation for the defense of the thesis. A competency exam checking knowledge and aggregated skills.					x			x	x	
74	Electrical Equipment in Industry	Vacuum properties, diffusion and constricted arc, contact materials - requirements and manufacturing technologies. SF6 properties and alternative solutions, magnetic blow-out switches. High-speed circuit breakers used in railway and tram traction.		x						x		
75	Smart Grid Switchboards	Electrical devices and low voltage equipment - selection methods, Building Management Systems, remote access, switchboard management, monitoring electrical quantities, communication protocols in electrical devices.		x		x						
76	Industrial Control Systems	Industrial control devices in building management systems. Programmable logic controllers, control equipment and inverters in HVAC systems, communication in industrial networks, visualization in smart building.		x					x	x		
77	Building Management Systems	Smart building automation systems, programming and integration methods, commercial and open source solutions.			x							x
78	Design and Measurement of Industrial Electrical Power Systems	Legal acts concerning electrical devices, switchboards and building management system. Project of a switchboard equipped with the Building Management System.		x		x	x					
79	Seminarium dyplomowe Inteligentne urządzenia elektryczne w przemyśle	Methodology of research work, rules of writing a thesis and preparation for the presentation of its results, preparation for the defense of the thesis. A competency exam checking knowledge and aggregated skills.					x			x	x	
80	Sensors in Electrical Engineering	Sensors of basic physical quantities and their design solutions. Elements of the Internet of Things, adaptation of sensors in microprocessor systems.			x					x		
81	Industrial Measurements	Industrial transducers of basic electrical and non-electrical quantities. Protection against electric shock, fire, industrial lighting. Rail circuits in transport.			x		x			x		
82	Computer Measurement Systems	Interfaces in measurement systems. Wireless transmission of measurement data. Measurement signal conditioning systems. Construction and operation of measurement cards. Interference in measurement systems and methods of protection against interference. Measurement of electrical quantities in 3 kV railway traction.		x	x							

No.	Course name	Program content	1ELT1	1ELT2	1ELT3	1ELT4	1ELT5	1ELT6	1ELT7	1ELT8	1ELT9	1ELT10
83	Industrial Processes Control	Plant identification process. Digital control system. Steady-state error in the presence of static or astatic regulators. Feedforward control systems using to override the reference or to compensate the disturbance. Observers and compensators. LQR controller.		x			x					x
84	Control Systems Implementation in Microprocessor Systems	Acquisition and processing of real measurement signals. Design and prototyping of the control system in the DSP environment. DSpace cards handling. Control algorithms testing. Matlab/LabVIEW programming.		x		x	x					
85	Seminarium dyplomowe Automatyczne systemy pomiarowo-kontrolne	Methodology of research work, rules of writing a thesis and preparation for the presentation of its results, preparation for the defense of the thesis. A competency exam checking knowledge and aggregated skills.					x			x	x	

ECTS - subjects

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
1	Mathematics I	8				
2	Physics	4				
3	Electrical Safety	4				
4	Preparation of Technical Documentation	4				
5	Electrical Circuits 1	6			6	
6	English n. B2 module I	2		2		
7	English n. B2+ module I	2		2		
8	English n. C1 module I	2		2		
9	Electrical and Electronic Metrology 1	4			4	
10	Mathematics 2	6				
11	Information Technology	4				
12	Materials Physics	6			6	
13	Electrical Circuits 2	4			4	
14	English n. B2 module II	2		2		
15	English n. B2+ module II	2		2		
16	English n. C1 module II	2		2		
17	Programming in Electrical Engineering	4				
18	Electrical and Electronic Metrology 2	4			4	
19	Materials Engineering	4			4	
20	Electromagnetic Field Theory	5			5	

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
21	Control and Regulation Systems	5			5	
22	Numerical Methods	4			4	
23	English n.B2 module III	2		2		
24	English n. B2+ module III	2		2		
25	English n. C1 module III	2		2		
26	Electric Machines and Transformers 1	5			5	
27	Electrical Apparatus	5			5	
28	Electronics	4			4	
29	Controllers and Microprocessor Technique	4			4	
30	Programming and Data Processing	4				
31	English n. B2+ module IV	3		3		
32	English n. C1 module IV	3		3		
33	English n. B2 module IV	3		3		
34	Electric Machines and Transformers 2	6			6	
35	Entrepreneurship	5	5			
36	Electricity Generation and Distribution 1	5			5	
37	Electric Drives and Industrial Controllers	6			6	
38	Electricity Generation and Distribution 2	6			6	
39	High Voltage Engineering with Elements of Statistics	6			6	
40	Competence Project	5		5		
41	Internship	6				

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
42	Electrical Lighting	4		4	4	
43	Testing Techniques and Protection in Electrical Power Engineering	4		4	4	
44	Renewable and Distributed Energy	4		4	4	
45	Quality and Efficiency of Electricity Use	4		4	4	
46	Energoelectronics and Electromagnetic Compatibility	4			4	
47	Engineering Project	8		8		
48	Smart Grid	2			2	2
49	Operational Measurements of Electric Vehicles	6		6	6	
50	Telecommunications Network Infrastructure	6		6	6	
51	Mechatronic Systems	6		6	6	
52	Measurement Solutions for the Power Industry	6		6	6	
53	Electrical Devices in Industrial Applications	6		6	6	
54	Diagnostics and High Voltage Technologies	6		6	6	
55	Electrical Power Networks and Systems	6		6	6	
56	Industrial Control Systems Design	6		6	6	
57	Vision Systems for Electrical Equipment Inspection	6		6	6	
58	Service and Operational Measurements in Electrical Installations	6		6	6	
59	Final Project	15		15		
60	Power Networks Design and Operation	4		4	4	
61	Seminarium dyplomowe Elektroenergetyka	3		3		
62	Design of Electrical Machines and Transformers	4		4	4	

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
63	Technical Electrodynamics	4		4	4	
64	Industrial Applications Programming	4		4	4	
65	Modeling of Electromechanical Systems	4		4	4	
66	Operation of Electrical Machines and Transformers	4		4	4	
67	Seminarium dyplomowe Transformatory i maszyny elektryczne w przemyśle	3		3		
68	Automotive Electromechanics	4		4	4	
69	Car System Diagnostics	4		4	4	
70	Vehicle-to-Network Cooperation	4		4	4	
71	Energy Exchange Systems for Electromobility	4		4	4	
72	Electric Motors in Vehicle Drives	4		4	4	
73	Seminarium dyplomowe Elektromobilność	3		3		
74	Electrical Equipment in Industry	4		4	4	
75	Smart Grid Switchboards	4		4	4	
76	Industrial Control Systems	4		4	4	
77	Building Management Systems	4		4	4	
78	Design and Measurement of Industrial Electrical Power Systems	4		4	4	
79	Seminarium dyplomowe Inteligentne urządzenia elektryczne w przemyśle	3		3		
80	Sensors in Electrical Engineering	4		4	4	
81	Industrial Measurements	4		4	4	
82	Computer Measurement Systems	4		4	4	
83	Industrial Processes Control	4		4	4	

No.	Course name	ECTS	Subjects in the field of humanities and social sciences	Elective subjects	Profile items	Classes in a foreign language
84	Control Systems Implementation in Microprocessor Systems	4		4	4	
85	Seminarium dyplomowe Automatyczne systemy pomiarowo-kontrolne	3		3		

ECTS indicators

Name	brak	brak	brak	brak	brak
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).	66/210 (31.43%)	66/210 (31.43%)	66/210 (31.43%)	66/210 (31.43%)	66/210 (31.43%)
The total number of ECTS credits to be earned by a student through courses in the fields of humanities or social sciences	5	5	5	5	5
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	121/210 (57.62%)	121/210 (57.62%)	121/210 (57.62%)	121/210 (57.62%)	121/210 (57.62%)

Methods of verifying and assessing learning outcomes

Verification of the achieved learning outcomes requires the application of diverse forms of student assessment, appropriate to the categories of knowledge, skills, and social competences to which these outcomes relate. The selection of appropriate tools also depends on the specifics of the course and the form of instruction, and is specified in the syllabi of individual courses. The achievement of the required learning outcomes is verified through:

1. written assignments (exams, quizzes, reports, essays, projects, posters, thesis, etc.);
2. oral responses (oral knowledge tests, public speaking assignments such as delivering a paper, presentation, etc.);
3. practical and/or project-based tasks (team-based or individual);
4. observation and assessment of student activity during classes;
5. self-assessment and peer assessment (especially in the case of group projects);
6. a competency exam and a diploma examination.

Verification may be formative (conducted partially and repeatedly during the course) and/or summative (final assessment). The final result of the verification is expressed using the currently applicable grading scale.

The course coordinator or instructor is obliged, during the first class, to discuss the course syllabus and to define and formally communicate to students the methods of verification and the conditions under which learning outcomes will be assessed.

Professional internships

Duration: 6 weeks

ECTS credits awarded: 6

The internship is carried out in accordance with the study program, in a form adapted to the profile and specific nature of the field of study, and in line with the regulations established by the faculty and the University.

Specializations/degree paths offered within the study program

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Characteristics of the course

Graduate profile

Graduates of Electrical Engineering have extensive knowledge and skills in the design, analysis and operation of electrical systems and control and power systems. They are prepared to work in industry, in the design and implementation services sector, as well as in the research and development sector, combining technical, analytical and managerial competences with consideration of the challenges related to sustainable development and the green and digital transformation of the economy.

Demonstrates knowledge of the theory of electrical circuits, including methods of analysis of linear systems, three-phase systems and resonant circuits. Knows the principles of analysis of dynamic systems. Has skills in modelling and simulation of electrical systems and numerical analysis.

Can use metrological tools to measure electrical and non-electrical quantities, operate multimeters, digital oscilloscopes, analog-to-digital converters and microprocessor measurement systems. Knows the methods of developing measurement data.

Can select materials for applications in electrical systems and has knowledge of material technologies. Able to analyze, design and select power converters, inverters, and power electronics systems used in power and drive systems. Also has knowledge of electromagnetic compatibility.

Knows the principles of operation of transformers and electrical machines. Able to analyze their operating parameters, conduct technical calculations and perform electrical and mechanical measurements. Also knows the construction and operation of contact, switching and semiconductor devices and the processes of their selection and operation.

Has competences in the analysis of power systems, their reliability, performing measurements of power and electrical energy, reactive power compensation and methods of voltage regulation. Able to analyze the quality of electrical energy and select appropriate measurement systems and their operating conditions. Knows the construction and principles of design and operation of power stations and lines, protection against electric shock and the principles of selection and coordination of power automation protection devices.

Knows the principles of programming. Has the ability to integrate various engineering tools, work with spreadsheets and create technical documentation.

In the field of cybersecurity, he knows the principles of secure data exchange and data protection. He can use network firewalls and analyze threats in electrical engineering systems.

Graduates of Electrical Engineering have skills in project management, planning, monitoring and coordination of team activities. He can work in interdisciplinary teams, implement engineering projects, and communicate with representatives of industry and public administration.

Thanks to his knowledge of English at B2 level, the graduate can freely participate in international projects and conferences, as well as analyze the content contained in industry literature.

A graduate of Electrical Engineering will be a specialist ready to take on challenges in the dynamically developing electrical industry in the following areas:

- Power and electrical power companies for all voltage levels,
- Design offices and construction companies working for the needs of professional electrical power, industrial networks and electrical installations,
- Consulting companies in the area of electrical power and green transformation,
- Manufacturing and processing industry,
- Renewable energy sources, energy storage, intelligent installations, electrical networks and systems,
- Industrial automation companies,
- Automotive companies, especially in the area of electromobility,
- Companies dealing with the design and production of railway and tram equipment,
- Scientific and research units,
- Public administration in the area of electrical engineering.

A graduate of Electrical Engineering is also prepared to run their own business and to continue their education at second-cycle or postgraduate studies, expanding their professional competences.

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

Electrical Engineering as a field of study implemented at the Lodz University of Technology fully takes into account the provisions resulting from the Statute of the Lodz University of Technology (Senate Resolution No. 88/2019 of July 10, 2019) and implements the goals specified in the Development Strategy of the Lodz University of Technology.

In accordance with the Annex to Resolution No. 39/2024 of the Senate of the Lodz University of Technology of June 26, 2024 on the adoption of the Strategy of the Lodz University of Technology for the years 2025-2030 - "Development Strategy of the Lodz University of Technology for the years 2025-2030", the mission of the university is: "Building a sustainable research university with a strong academic community, ensuring freedom of research and discussion and modern education, developing local and global cooperation, innovations for the good of society, the economy and the world." The vision of Lodz University of Technology is to strive to become: "A distinguished research university that focuses and develops talents, competences and technologies, operating on a friendly, green campus, being a valued partner for the economy, acting for the benefit of society, which will ensure its leading place on the academic map of the country and the world." The strategy for 2025-2030 identifies the key challenges facing the university and sets development goals organized around eleven strategic areas, creating the acronym COOPERATION. This structure includes, among others, the issues of leadership, internationalization, innovation, social responsibility, sustainable development and student engagement. The new concept is a continuation of previous activities, while taking into account current social, environmental and economic needs. Its aim is to further strengthen the position of Lodz University of Technology as a modern, responsible and globally recognizable research university.

The key priority of the development strategy of Lodz University of Technology is to ensure a high level of education. For this purpose, modern teaching methods, innovative study programs and flexible education paths will be implemented. Traditional education methods will be increasingly supported by methods based on the principle of creative learning and independent acquisition of knowledge, as well as tutoring and mentoring. Continuous improvement and wider use of new education methods must be combined with regular monitoring of the needs of the socio-economic environment. Universities support the creation of interdisciplinary and inter-university programs. An important direction of development will be the improvement of education programs in foreign languages, as well as obtaining national and international accreditation of education programs for individual fields of study. The university's distinguishing feature is the possibility of individualizing the education process, which will allow students to take full advantage of the university's wide educational offer and individualize the graduate's competence profile. The task of the Electrical Engineering major is to educate technical and administrative staff for key sectors of the economy (electric power engineering, electrical machinery industry, construction, transport), staff for research and development centers and the education sector, conducting scientific research in the above-mentioned areas and disseminating knowledge, scientific achievements and practical skills. The education of students in the field of Electrical Engineering is to support the sustainable development and technological transformation of the country and to support the increase in the efficiency and competitiveness of the national economy. According to the Development Strategy of the Lodz University of Technology, the study program for the field of Electrical Engineering uses modern teaching methods, allows a wide selection of specialization and elective subjects, supporting flexible education paths and individualization of the process of shaping the graduate's competences. The field of study of Electrical Engineering will develop the possibility of studying in foreign languages, internationalization of the education process, mobility of students and employees.

Educational objectives and employment and continuing education opportunities

The aim of the studies is to provide general knowledge and basic knowledge in the field of electrical engineering necessary to perform the profession of an electrical engineer and to develop skills that will enable independent solving of engineering problems. The acquired knowledge and skills will allow the graduate of the Electrical Engineering major to understand and analyze physical processes occurring in electrical devices and systems, as well as to formulate and solve complex engineering problems using appropriate methods and tools, taking into account economic, ethical and environmental aspects. The graduate is prepared for professional work in the field of electrical engineering and related sciences. He has the knowledge and skills required in professional electrical power engineering, as well as in design offices and industrial plants operating in the area of production or application of electrical machines and devices. He is able to cooperate in large teams and independently carry out tasks in positions requiring work organization. He also has the knowledge and skills that allow him to solve problems related to the supply and measurement of electricity, occurring in the area of responsibility of local government units (municipality, district, province). He knows the basics of economics to the extent necessary to start his own business. Is prepared to continue education at second-cycle level.

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

The program of the Electrical Engineering major was consulted in 2024 - 2025 with the following business entities:

- Apator- Elcomtech,
- ZREW Transformatory S.A.,
- Elektromonter sp. z o.o.,
- ABB Sp. z o.o. - oddział w Aleksandrowie Łódzkim,
- Fabryka Transformatörów Mocy w Łodzi Hitachi Energy Poland Sp. z o.o.,
- SESTO Sp. z o.o.,
- PGE Dystrybucja S.A. Oddział Łódź,
- Newag Inteco DS S.A.,
- PGE Energetyka Kolejowa Obsługa sp. z o. o. Obszar Serwisowy Centralny.

The study program received a positive written review from the company SESTO Sp. z o.o. and Newag Inteco Inteco DS. S.A.

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

Not applicable.

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
Mathematics I	Tutorials: 36 Lecture: 10	8	Exam	Obligatory
Physics	Tutorials: 8 Laboratory classes: 18 Lecture: 10	4	Exam	Obligatory
Electrical Safety	Seminar: 18 Lecture: 10	4	Graded assignment	Obligatory
Preparation of Technical Documentation	Laboratory classes: 28 Project work: 8	4	Graded assignment	Obligatory
Electrical Circuits 1	Tutorials: 26 Laboratory classes: 10 Lecture: 18	6	Graded assignment	Obligatory
Sum	200	26		

Semester 2

Course	Number of hours	ECTS points	Form of verification	Obligatory
Electrical and Electronic Metrology 1	Laboratory classes: 16 Lecture: 16	4	Graded assignment	Obligatory
Mathematics 2	Tutorials: 36 Lecture: 8	6	Graded assignment	Obligatory
Information Technology	Laboratory classes: 16 Lecture: 8	4	Graded assignment	Obligatory
Materials Physics	Laboratory classes: 32 Lecture: 16	6	Graded assignment	Obligatory

Course	Number of hours	ECTS points	Form of verification	Obligatory
Electrical Circuits 2	Tutorials: 16 Lecture: 16	4	Exam	Obligatory
Foreign Language n. module 1		2	Graded assignment	Obligatory group
The student chooses one module from the group.				
English n. B2 module I	Tutorials: 20	2	Graded assignment	Optional
English n. B2+ module I	Tutorials: 20	2	Graded assignment	Optional
English n. C1 module I	Tutorials: 20	2	Graded assignment	Optional
Sum	200	26		

Semester 3

Course	Number of hours	ECTS points	Form of verification	Obligatory
Programming in Electrical Engineering	Laboratory classes: 16 Lecture: 16	4	Graded assignment	Obligatory
Electrical and Electronic Metrology 2	Laboratory classes: 18 Lecture: 8	4	Exam	Obligatory
Materials Engineering	Laboratory classes: 16 Lecture: 8	4	Graded assignment	Obligatory
Electromagnetic Field Theory	Laboratory classes: 18 Lecture: 16	5	Graded assignment	Obligatory
Control and Regulation Systems	Tutorials: 8 Project work: 8 Lecture: 24	5	Exam	Obligatory
Numerical Methods	Laboratory classes: 16 Lecture: 8	4	Graded assignment	Obligatory
Foreign Language n. module 2		2	Graded assignment	Obligatory group
The student chooses one module from the group.				

Course	Number of hours	ECTS points	Form of verification	Obligatory
English n. B2 module II	Tutorials: 20	2	Graded assignment	Optional
English n. B2+ module II	Tutorials: 20	2	Graded assignment	Optional
English n. C1 module II	Tutorials: 20	2	Graded assignment	Optional
Sum	200	28		

Semester 4

Course	Number of hours	ECTS points	Form of verification	Obligatory
Electric Machines and Transformers 1	Project work: 18 Lecture: 18	5	Graded assignment	Obligatory
Electrical Apparatus	Laboratory classes: 28 Lecture: 18	5	Exam	Obligatory
Electronics	Laboratory classes: 18 Lecture: 18	4	Graded assignment	Obligatory
Controllers and Microprocessor Technique	Laboratory classes: 26 Lecture: 10	4	Graded assignment	Obligatory
Programming and Data Processing	Laboratory classes: 10 Project work: 8 Lecture: 8	4	Graded assignment	Obligatory
Foreign Language n. module 3		2	Graded assignment	Obligatory group
The student chooses one module from the group.				
English n.B2 module III	Tutorials: 20	2	Graded assignment	Optional
English n. B2+ module III	Tutorials: 20	2	Graded assignment	Optional
English n. C1 module III	Tutorials: 20	2	Graded assignment	Optional
Sum	200	24		

Semester 5

Course	Number of hours	ECTS points	Form of verification	Obligatory
Electric Machines and Transformers 2	Laboratory classes: 36 Lecture: 18	6	Exam	Obligatory
Entrepreneurship	Seminar: 10 Project work: 18 Lecture: 8	5	Graded assignment	Obligatory
Electricity Generation and Distribution 1	Tutorials: 18 Lecture: 28	5	Exam	Obligatory
Electric Drives and Industrial Controllers	Laboratory classes: 26 Lecture: 18	6	Graded assignment	Obligatory
Foreign Language n. module 4		3	Exam	Obligatory group
The student chooses one module from the group.				
English n. B2+ module IV	Tutorials: 20	3	Exam	Optional
English n. C1 module IV	Tutorials: 20	3	Exam	Optional
English n. B2 module IV	Tutorials: 20	3	Exam	Optional
Sum	200	25		

Semester 6

Course	Number of hours	ECTS points	Form of verification	Obligatory
Electricity Generation and Distribution 2	Laboratory classes: 8 Project work: 18 Lecture: 18	6	Graded assignment	Obligatory
High Voltage Engineering with Elements of Statistics	Laboratory classes: 26 Lecture: 26	6	Exam	Obligatory

Course	Number of hours	ECTS points	Form of verification	Obligatory
Competence Project	Project work: 26	5	Graded assignment	Obligatory subjects to choose from
Internship	Internship: 0	6	Pass	Obligatory
Sum	122	23		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Sensors in Electrical Engineering	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Sum	36	4		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Design of Electrical Machines and Transformers	Project work: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Sum	36	4		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Automotive Electromechanics	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Sum	36	4		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Electrical Equipment in Industry	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Sum	36	4		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Electrical Lighting	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Sum	36	4		

Semester 7

Course	Number of hours	ECTS points	Form of verification	Obligatory
Energoelectronics and Electromagnetic Compatybility	Laboratory classes: 8 Project work: 18 Lecture: 18	4	Graded assignment	Obligatory
Engineering Project	Laboratory classes: 8 Project work: 22	8	Graded assignment	Obligatory subjects to choose from
Smart Grid	Seminar: 18	2	Graded assignment	Obligatory
Sum	92	14		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Industrial Measurements	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Computer Measurement Systems	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Industrial Processes Control	Laboratory classes: 18 Lecture: 18	4	Exam	Obligatory specialization courses
Sum	108	12		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Technical Electrodynamics	Laboratory classes: 18 Project work: 9 Lecture: 9	4	Exam	Obligatory specialization courses
Industrial Applications Programming	Laboratory classes: 18 Project work: 9 Lecture: 9	4	Exam	Obligatory specialization courses
Modeling of Electromechanical Systems	Laboratory classes: 18 Project work: 9 Lecture: 9	4	Exam	Obligatory specialization courses
Sum	108	12		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Car System Diagnostics	Laboratory classes: 18 Project work: 9 Lecture: 9	4	Exam	Obligatory specialization courses

Course	Number of hours	ECTS points	Form of verification	Obligatory
Vehicle-to-Network Cooperation	Laboratory classes: 18 Lecture: 18	4	Exam	Obligatory specialization courses
Energy Exchange Systems for Electromobility	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Sum	108	12		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Smart Grid Switchboards	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Industrial Control Systems	Laboratory classes: 18 Project work: 9 Lecture: 9	4	Exam	Obligatory specialization courses
Building Management Systems	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Sum	108	12		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Testing Techniques and Protection in Electrical Power Engineering	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses
Renewable and Distributed Energy	Laboratory classes: 27 Lecture: 9	4	Exam	Obligatory specialization courses

Course	Number of hours	ECTS points	Form of verification	Obligatory
Quality and Efficiency of Electricity Use	Tutorials: 9 Laboratory classes: 18 Lecture: 9	4	Exam	Obligatory specialization courses
Sum	108	12		

Semester 8

Course	Number of hours	ECTS points	Form of verification	Obligatory
Elective Courses 1		6	Graded assignment	Obligatory group
Student choose 1 subject				
Operational Measurements of Electric Vehicles	Laboratory classes: 18 Project work: 18 Lecture: 18	6	Graded assignment	Optional
Telecommunications Network Infrastructure	Laboratory classes: 18 Project work: 18 Lecture: 18	6	Graded assignment	Optional
Mechatronic Systems	Laboratory classes: 18 Project work: 18 Lecture: 18	6	Graded assignment	Optional
Measurement Solutions for the Power Industry	Laboratory classes: 18 Project work: 18 Lecture: 18	6	Graded assignment	Optional
Electrical Devices in Industrial Applications	Laboratory classes: 18 Project work: 18 Lecture: 18	6	Graded assignment	Optional
Diagnostics and High Voltage Technologies	Laboratory classes: 18 Project work: 18 Lecture: 18	6	Graded assignment	Optional
Electrical Power Networks and Systems	Laboratory classes: 18 Project work: 18 Lecture: 18	6	Graded assignment	Optional

Course	Number of hours	ECTS points	Form of verification	Obligatory
Industrial Control Systems Design	Laboratory classes: 18 Project work: 18 Lecture: 18	6	Graded assignment	Optional
Vision Systems for Electrical Equipment Inspection	Laboratory classes: 18 Project work: 18 Lecture: 18	6	Graded assignment	Optional
Service and Operational Measurements in Electrical Installations	Project work: 36 Lecture: 18	6	Graded assignment	Optional
Final Project	Diploma Thesis: 0	15	Pass	Obligatory subjects to choose from
Sum	54	21		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Control Systems Implementation in Microprocessor Systems	Project work: 27 Lecture: 9	4	Graded assignment	Obligatory specialization courses
Seminarium dyplomowe Automatyczne systemy pomiarowo-kontrolne	Seminar: 20	3	Graded assignment + exam	Obligatory specialization courses
Sum	56	7		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Operation of Electrical Machines and Transformers	Laboratory classes: 18 Lecture: 18	4	Graded assignment	Obligatory specialization courses

Course	Number of hours	ECTS points	Form of verification	Obligatory
Seminarium dyplomowe Transformatory i maszyny elektryczne w przemyśle	Seminar: 20	3	Graded assignment + exam	Obligatory specialization courses
Sum	56	7		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Electric Motors in Vehicle Drives	Laboratory classes: 18 Project work: 9 Lecture: 9	4	Graded assignment	Obligatory specialization courses
Seminarium dyplomowe Elektromobilność	Seminar: 20	3	Graded assignment + exam	Obligatory specialization courses
Sum	56	7		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Design and Measurement of Industrial Electrical Power Systems	Project work: 27 Lecture: 9	4	Graded assignment	Obligatory specialization courses
Seminarium dyplomowe Inteligentne urządzenia elektryczne w przemyśle	Seminar: 20	3	Graded assignment + exam	Obligatory specialization courses
Sum	56	7		

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Course	Number of hours	ECTS points	Form of verification	Obligatory
Power Networks Design and Operation	Project work: 18 Lecture: 9	4	Graded assignment	Obligatory specialization courses
Seminarium dyplomowe Elektroenergetyka	Seminar: 20	3	Graded assignment + exam	Obligatory specialization courses
Sum	47	7		