ASSUMED LEARNING OUTCOMES

FACULTY: **Electrical Engineering**

MAIN FIELD OF STUDY: **Electrical Engineering**

EDUCATION LEVEL: first-level (licencjat/inżynier) studies / ~~second-level studies / magister uniform studies~~*

PROFILE: general academic / ~~practical~~ *

Location of the main-field-of study:

Branch of science: Engineering and technology

Discipline / disciplines (for several disciplines, please indicate the major discipline)

automation, electronics and electrical engineering

Explanation of the markings:
P6U – universal first degree characteristics corresponding to education at the first-level studies - 6 PRK level *
P6S – second degree characteristics corresponding to education at the first-level studies - 6 PRK level *

W - category "knowledge"
U - category "skills"
K - category "social competences"
K1ETK_W1, K1ETK_W2, K1ETK_W3… - main-field-of study learning outcomes related to the category "knowledge"
K1ETK _U1, K1ETK_U2, K1ETK _U3, … - main-field-of study learning outcomes related to the category "skills"
K1ETK _K1, K1ETK _K2, K1ETK _K3, … - main-field-of study learning outcomes related to the category "social competences"

Main field of study learning outcomes for the optional courses block: Electrical Power Engineering:
K1ETK_EEN_W1, K1ETK_EEN_W2, K1ETK_EEN_W3,…- efekty kierunkowe dot. kategorii „wiedza" –
K1ETK_EEN_U1, K1ETK_EEN__U2, K1ETK_EEN__U3, …- efekty kierunkowe dot. kategorii „umiejętności"
_inż. – learning outcomes related to the engineer competences

Main field of study learning outcomes for the optional courses block: Industrial Electrical Engineering:
K1ETK_ETP_W1, K1ETK_ETP_W2, K1ETK_ETP_W3,…- efekty kierunkowe dot. kategorii „wiedza" –
K1ETK_ETP_U1, K1ETK_ETP_U2, K1ETK_ETP_U3, …- efekty kierunkowe dot. kategorii „umiejętności"
… _inż. – learning outcomes related to the engineer competences

* delete as applicable

Main field of study learning outcomes	Description of learning outcomes for the main-field-of study **Electrical Engineering**	Reference to PRK characteristics		
		Universal first degree characteristics (U)	Second degree characteristics typical for qualifications obtained in higher education (S)	
			Characteristics for qualifications on 6 / ~~7*~~ levels of PRK	Characteristics for qualifications on 6 ~~and 7~~ levels of PRK, enabling acquiring engineering competences
KNOWLEDGE (W)				
K1ETK_W1	has the basic knowledge in the field of complex numbers, polynomials, matrix algebra with applications to linear equation systems, analytical geometry in 2D and 3D and cone-type curves	**P6U_W**		
K1ETK_W2	has the basic knowledge about function properties (trigonometric, exponential, logarithmic, cyclometric, and reverse) calculus elements – differentiation and integration of one variable function necessary for the understanding of mathematical aspects in engineering	**P6U_W**	**P6S_WG**	
K1ETK_W3	has the basic knowledge in the field of definite integrals, improper integrals, calculus of multivariable functions, double and triple integrals, number series, power series necessary for the understanding of mathematical aspects in engineering sciences	**P6U_W**	**P6S_WG**	
K1ETK_W4	has the basic knowledge in the field of curve integrals, area integrals and elements of vector analysis necessary for the understanding of mathematical aspects in engineering sciences	**P6U_W**	**P6S_WG**	
K1ETK_W5	has the basic knowledge in the field of ordinary differential equations, and linear differential equation systems (also the application of Lapace's transform and basics of stability theory) necessary for the understanding of mathematical aspects in engineering	**P6U_W**	**P6S_WG**	

	sciences			
K1ETK_W6	has the basic knowledge in the field of basic mathematical probabilistic models (random variables, quintile, moments, independence), statistical analysis methods of stochastic phenomena (estimation, statistical hypothesis testing, variance analysis, linear regression) necessary for the understanding of probabilistic and statistical aspects in engineering sciences	**P6U_W**	**P6S_WG**	
K1ETK_W7	has elementary knowledge about numerical methods necessary for the understanding of engineering problems in the field of data processing, monitoring, industrial processes control. Is able to propose an numerical algorithm to solve an problem related to electric al engineering	**P6U_W**	**P6S_WG**	
K1ETK_W8	has the basic knowledge in the field of classical mechanics, wave propagation, and phenomenological thermodynamics	**P6U_W**	**P6S_WG**	
K1ETK_W9	has the basic knowledge in the field of classical electrodynamics (electrostatics, electrical current, magneto statics, electromagnetic induction, electromagnetic waves, optics) selected topics of physics: quantum physics, solids physics, nuclei physics, and astrophysics	**P6U_W**		
K1ETK_W10	has the knowledge in the field of structure of matter and electrical phenomena in it, which is necessary for solving simple material problems in the field of electrical engineering he knows the basic properties of materials used in electrical engineering and methods of its research	**P6U_W**	**P6S_WG**	

		P6U_W	P6S_WG	P6S_WG_inż
K1ETK_W11	knows energy conversions specific for the production of heat, electricity and cold knows the energy production methods specific for fossil and sustainable sourcesknow the theoretical foundations of thermodynamics specific for cold, heat and electricity production knows the practical operational aspects of heat cold and electricity production installations including pollution emission			
K1ETK_W12	has the elementary knowledge in descriptive geometry in the field of 2D and 3D objects projections and technical drawing in CAD software he has the knowledge in composing and reading technical drawings of details and assembly drawings of electromechanical objects		P6S_WG	
K1ETK_W13	has the knowledge in the field of mechanics: statics, kinematics, dynamics and strength of materials	P6U_W	P6S_WG	
K1ETK_W14	knows the most important terms of informatics he knows the general principles of computers composition and operation, software, computer networks, especially internet. Understands the problems of computer system security he knows the basic rules for ergonomic work, health protection, countermeasures, and selected issues of legal aspects related to work with computers	P6U_W	P6S_WG P6S_WK	
K1ETK_W15	knows the principles of developing algorithms for solving an engineering task knows the rules of programming in C language	P6U_W	P6S_WG	

K1ETK_W16	has the basic knowledge about circuit theory has a structured knowledge about circuit elements, aspects of circuit topology knows and understands methods of linear circuit analysis with sinusoidal sources and in steady stats	**P6U_W**	**P6S_WG**	
K1ETK_W17	has the basic knowledge about transients analysis in electrical circuits knows the commutation laws and the time domain analysis method knows the fundamental theorems related to Laplace transformationh has knowledge about applications of operational calculus in circuit analysis and for transient signals description	**P6U_W**	**P6S_WG**	
K1ETK_W18	knows the basic rules and properties of electromagnetic field	**P6U_W**	**P6S_WG**	
K1ETK_W19	knows the general rules and technics for electrical circuit operation description defines structural matrices, knows and understands selected transformation, i.e. symmetrical components transformations is able to describe elements of electrical power system and represent them using models, e.g. two-port networks. Knows and understands the application of complex exponential functions applied to the Fourier series useful for the analysis of electrical circuits	**P6U_W**	**P6S_WG**	
K1ETK_W20	has knowledge about digital modelling of electrical circuits with elements of informatics, including building of discrete models of electrical network elements and the simulation methods of transients knows the mathematical and numerical one and three phase elements of electrical networks and power electronic circuits	**P6U_W**	**P6S_WG**	

	knows basic matrix and table operations knows how to build ordinary and function scripts in an interactive high order environment			
K1ETK_W21	has a basic knowledge in the field of electrical metrology and units of measure has a knowledge in the field of calculation methods uses in measurement results development	**P6U_W**	**P6S_WG**	
K1ETK_W22	has a knowledge in the field of a modern measurement technique knows metrological properties of basic measurement instruments, knows one-phase and three-phase circuits to measure active power knows high voltage and high current measurement circuits, measurement transducers, RMS value converters, resistance, reactance and impedance bridge measuring circuits, compensation systems for voltage measuring knows metrological properties of digital voltmeters		**P6S_WG**	**P6S_WG_inż**
K1ETK_W23	has a basic knowledge about high voltage insulation used in power engineering knows the basic topics about high voltage stress, electrical field in simple and complex insulation systems, dielectric strength, the strength of insolation HV systems, power system devices, knows the principles of overvoltage protection and HV measurement techniques		**P6S_WG**	**P6S_WG_inż**
K1ETK_W24	has the elementary knowledge about operation of electronic elements describes its functionality with a circuit model, differentiates and characterises simple analogue and discrete circuits he knows the rules for its cooperation and methods for its features analysis		**P6S_WG**	

			P6S_WG	P6S_WG_inż
K1ETK_W25	has knowledge about power electronic appliances, controlled rectifiers, cycloconverters, AC current controllers, DC-DC converters, voltage inverters knows the topology, properties and grind influence of power electronic converters knows the development tendencies in this fields			
K1ETK_W26	knows what a microprocessor is like, how to differentiate between various types of microprocessors knows how to select a proper one for the system and which tools help to program it		P6S_WG	
K1ETK_W27	has knowledge about dynamics, statics, control quality and stability of continuous, linear and nonlinear, discrete, control systems knows how to select a control system to obtain desired properties of the control system	P6U_W	P6S_WG	
K1ETK_W28	is able to differentiate low voltage and high voltage apparatus is able to select the parameter of apparatus, electrical devices, and installations to meet the criteria of normal and abnormal operation is able to point out and characterise the environment influence on electrical apparatus is able to explain phenomena related to the nominal and distorted current, including short circuit current, is able to explain the phenomena correlated to switching operations, including electrical arc and overvoltages		P6S_WG	P6S_WG_inż
K1ETK_W29	he has knowledge of the electrical installations and power systems of electricity consumers he knows the principles of selection of elements of the low-voltage electrical installations		P6S_WG	
K1ETK_W30	has knowledge in the field of construction and operation of transformers, AC and DC electric		P6S_WG	P6S_WG_inż

	machines, understands and can explain physical phenomena occurring in transformers, AC and DC electric machines			
K1ETK_W31	he has the knowledge of fundamental elements of a converter drive systems he knows its operating principles and its static characteristics he has the basic knowledge about description methods of a drive system and elementary methods of characteristic shaping of drive systems with DC and AC electric motors during the regulation and reduction of angular velocity		**P6S_WG**	**P6S_WG_inż**
K1ETK_W32	has the basic knowledge about electrical safety systems in low voltage appliances and the safety operational principles of electrical appliances including legal regulation and responsibility ranges		**P6S_WG** **P6S_WK**	
K1ETK_W33	knows the rules of power system operation, substation operation, knows the technologies for power production and transmission is able to select the circuit equivalents of overhead lines and cables, transformers, machines and generators and compute adequate parameters values. Is able to analyse the power flow in the networks, symmetrical and non-symmetrical faults is able to define the stability of a power system knows the rules for the frequency and voltage control in a power system		**P6S_WG**	**P6S_WG_inż**
K1ETK_W34	knows the basic methods of inference (induction, deduction, abductive reasoning) has the basic knowledge for the understanding of social and philosophical conditions for engineering activities		**P6S_WK**	

K1ETK_W35	has the basic knowledge about management processes he knows the functions, rules and instruments of management and is able to identify basic managements problems		**P6S_WK**	**P6S_WK_inż**
K1ETK_W36	has the basic knowledge for the understanding of the legal conditions of engineering activities he knows and understands the basic terms related to industrial property, and copy right knows the rules for the preparation of a patent description and the use of patent data bases		**P6S_WK**	
SKILLS (U)				
K1ETK_U1	is able to apply properly and effectively the knowledge about linear algebra and descriptive geometry to quantitative and qualitative analysis of mathematical issues connected to the studied engineering branch	**P6U_U**	**P6S_UW**	
K1ETK_U2	is able to apply properly and effectively the knowledge about calculus (one dimensional functions) to quantitative and qualitative analysis of mathematical issues connected to the studied engineering branch	**P6U_U**	**P6S_UW**	
K1ETK_U3	is able to apply properly and effectively the knowledge about calculus (multidimensional functions, number and power series) to quantitative and qualitative analysis of mathematical issues connected to the studied engineering branch	**P6U_U**	**P6S_UW**	
K1ETK_U4	is able to correctly and effectively apply curve and surface integral and vector analysis theorems to analysis of mathematical problems related to studied engineering field	**P6U_U**	**P6S_UW**	
K1ETK_U5	is able to get information from literature data bases and other sources about numerical methods and procedures needed for the solution of an elementary engineering problem, then to work out technical documentation concerning the solved problem, prepare a text including the description of reached results	**P6U_U**	**P6S_UW**	

K1ETK_U6	is able to apply properly and effectively the knowledge of physical laws to quantitative and qualitative analysis of physical issues connected to the studied engineering branch	**P6U_U**	**P6S_UW**	
K1ETK_U7	is able to plan and safely conduct measurements, elaborate results, estimate measurement errors	**P6U_U**	**P6S_UW**	
K1ETK_U8	is able to make measurement of selected properties of electro- technical materials, is able to formulate adequate conclusion based on measurement results	**P6U_U**	**P6S_UW**	
K1ETK_U9	is able to make technical drawings as a sketch or a CAD file. He is able to make and read technical documentation, especially assembly and working drawings of electro-mechanical appliances, in European projections and isometric projections with the help of views, cross-sections and examples including dimensions, tolerances and normalized connection elements		**P6S_UW**	
K1ETK_U10	is able to compute reactions and inner forces in simple examples of trusses and beams is able to compute reactions and inner forces in simple kinematic systems, movement parameters in simple dynamic tasks	**P6U_U**	**P6S_UW**	
K1ETK_U11	is able to use computers and basic software is able to create and edit texts on a basic level create spread sheets and utilise them for engineering computations create and manage simple databases work out presentations use computer networks	**P6U_U**	**P6S_UW**	**P6S_UW_inż**
K1ETK_U12	knows how to develop algorithms for solving an engineering task and write programs in C language	**P6U_U**	**P6S_UW**	
K1ETK_U13	is able to obtain information from the literature, media communications, and other sources in the organization of storage systems and data processing	**P6U_U**	**P6S_UW**	**P6S_UW_inż**

	has the ability to apply basic techniques in communication and programming tasks at the level of engineering			
K1ETK_U14	is able to utilise theoretical foundations to analyse linear electrical circuits with sinusoidal sources in steady state is able to correctly use the time approach and frequency approach in circuit analysis is able to use the impulse response, step response and transfer function for the assessment of system stability	**P6U_U**	**P6S_UW**	
K1ETK_U15	is able to apply known electromagnetic field theory for the qualitative and quantitative assessment of physical quantities of engineering character (e.g. parameters R, L, C, M)	**P6U_U**	**P6S_UW**	
K1ETK_U16	is able to utilise mathematical techniques for the formulation and solution of engineering tasks is able to solve problems regarded to the operation of a complex electrical circuit using structural matrices and to combine analytical solutions with numerical approaches with Matlab or MS Excel packages is able to build an electrical model of a given element of the power system, use the complex exponential functions to describe periodical nonsinusoidal waveforms also for the description of transients in circuits with sinusoidal sources is able to compute differential operators in given electrical problems	**P6U_U**	**P6S_UW**	**P6S_UW_inż**
K1ETK_U17	is able to model lumped linear LRC elements in the ATP/EMTP program. Then, using LRC elements he is able to model complex branches, is able to model one phase distributed parameters line, electrical network using state variables		**P6S_UW**	**P6S_UW_inż**
K1ETK_U18	has the abilities to create own programs in a an interactive environment for the purpose of analysis of linear and nonlinear electrical circuits in steady state and during transients		**P6S_UW**	**P6S_UW_inż**

	knows the rules for function files creation, nonlinear equation solution, and constrained optimisation knows the functions of statistical analysis			
K1ETK_U19	is able to realise measurements of electrical quantities using analogue and digital devices, also an oscilloscope is able to prepare characteristics of nonlinear elements based on measurement results is able to present reached results as numbers, graphs, tables including the measurement errors, interpret the results and formulate conclusion		**P6S_UW**	**P6S_UW_inż**
K1ETK_U20	has the basic skills necessary in electrical power engineering when working as an engineer operating high voltage equipment	**P6U_U**	**P6S_UW** **P6S_UK** **P6S_UO** **P6S_UU**	**P6S_UW_inż**
K1ETK_U21	is able to make an forecast about the functioning of a simple analogue or digital electronic circuit based on a prior analysis of its structure, properties and elements used is able to examine the properties of those systems. Is able to present the results of theoretical and experimental activities along a comparison between them in a numerical and graphical manner, finally formulate appropriate conclusion		**P6S_UW**	**P6S_UW_inż**
K1ETK_U22	is able to prepare an equivalent circuit with appropriate parameters for the computation of power flow and symmetrical, non-symmetrical faults is able to make an analysis of the functioning of a power system is able to compute the parameters of the system and devices in a given operational conditions using an integrated programming environment is able to make an stability analysis of the transmission system		**P6S_UW**	**P6S_UW_inż**

		P6U_U	P6S_UW	
K1ETK_U23	is able to use a microprocessor to solve a problem is able to write an application in a chosen language and developer environment, also is able to analyse the performance of the programmed processor using adequate tools	**P6U_U**	**P6S_UW**	
K1ETK_U24	is able to solve alone problems related to continuous automated control systems (statics, dynamics, control quality, stability) also apply mathematical apparatus for the analysis of control systems in time and frequency domain is able to build, operate and test simple control systems dedicated to continuous, discrete and nonlinear systems	**P6U_U**	**P6S_UW**	**P6S_UW_inż**
K1ETK_U25	is able to make research on basic physical phenomena typical for low voltage electrical equipment: electric arc, heating, electromagnetic forces, contact resistances and other is able to select, test and operate electrical power engineering apparatus used in electrical installations, including contactors, switchgears, control relays		**P6S_UW**	**P6S_UW_inż**
K1ETK_U26	is able to read planning assumptions and based on that plan low voltage electrical installations designed for the powering of various loads in industrial buildings, including selection of proper cross-sections of cables and select protection devices is able to work out technical documentation according to standards and legal regulations		**P6S_UW**	**P6S_UW_inż**
K1ETK_U27	is able to connect, operate and test a designed measurement system and make the measurement of transformers, machines and generators characteristics is able to compute the characteristics and parameters of transformers and electrical machines, is able to identify the type of a transformer or electrical machine based		**P6S_UW**	**P6S_UW_inż**

	upon its construction is able to implement in practice the H&S regulations while dealing with electrical machines under voltage is able to story measured values and prepare a measurement report			
K1ETK_U28	he is able to connect, launch and test designed drive system, make measurements of static and dynamic characteristics of drive systems with DC and AC machines		**P6S_UW**	**P6S_UW_inż**
K1ETK_U29	is able to check an electrical installation, conduct basic measurements for launch purposes and during operation in low voltage electrical installations		**P6S_UW**	**P6S_UW_inż**
K1ETK_U30	is able to plan an make research on power electronic systems, including thyristor and transistor based systems is able to use adequate measurement and recording devices, finally is able to summarise and conclude results		**P6S_UW**	**P6S_UW_inż**
K1ETK_U31	accordingly to the chosen level of the studied language: has the knowledge, skills and competence which comply with the requirements for level B2 ESOKJ; acquires, comprehends and interprets specialized texts; in speech and writing uses linguistic means specific for academic language and the working environment of an engineer or has the knowledge, skills and competence which comply with the requirements for level C1 ESOKJ; comprehends and formulates statements concerning topics related to the studied discipline and profession using measures appropriate to the situation; reads, interprets, evaluates and creates specialised texts; makes use of the language skills in interpersonal relations and communication in international academic and professional environment	**P6U_U**	**P6S_UK** **P6S_UU**	

K1ETK_U32	has the necessary abilities to work in industrial environment and knows the safety rules with regard to his working place		**P6S_UW** **P6S_UK** **P6S_UO**	**P6S_UW_inż**
K1ETK_U33	has the ability to prepare and present oral presentations in the field of scientific disciplines relevant to the studied faculty with the use of audio-visual tools and implementing the knowledge concerning psychological aspects of communication with other people	**P6U_U**	**P6S_UW** **P6S_UK**	
SOCIAL COMPETENCES (K)				
K1ETK_K1	is aware about the importance and non-technical aspects of an engineer activities, i.e. influence on environment, therefore takes responsible actions	**P6U_K**	**P6S_KO**	
K1ETK_K2	understands legal aspects and the results of engineering activities	**P6U_K**		
K1ETK_K3	is aware of the indispensability of individual and collective activities beyond engineering profession	**P6U_K**		
K1ETK_K4	understands the urgency and knows the possibilities for further education (2nd level studies, third level studies, studies for graduates, courses), rising the social, professional, and personal skills		**P6S_KK**	
K1ETK_K5	is aware about the responsibility for own work and is able to obey the rules of team work and take responsibility of collectively taken actions	**P6U_K**		
K1ETK_K6	is able to think and act in an enterprising manner		**P6S_KO**	
K1ETK_K7	has the awareness of the social role of an technical university alumnus understands the need of formulating and publishing, i.e. via mass media, information and opinions about technical achievements and other aspects of engineering is able to dissipate such an opinion in an comprehensive	**P6U_K**	**P6S_KO** **P6S_KR**	

	manner, justifying various viewpoints			
K1ETK_K8	correctly identifies and solves dilemmas related to profession		**P6S_KK**	
K1ETK_K9	is able to cooperate and work in a team, taking different roles in it and can think critically and support his/her own view, so he/she can select priorities properly and choose appropriate measures to achieve the tasks defined by himself/herself or other people	**P6U_K**		

*delete as applicable

Attachment no. 1

Optional courses block Electrical Power Engineering

Optional courses block learning outcomes	Description of learning outcomes for the for the optional courses block **Electrical Power Engineering**	Reference to PRK characteristics		
		Universal first degree characteristics (U)	Second degree characteristics typical for qualifications obtained in higher education (S)	
			Characteristics for qualifications on 6 / 7* levels of PRK	Characteristics for qualifications on 6 ~~and 7~~ levels of PRK, enabling acquiring engineering competences
KNOWLEDGE (W)				
K1ETK_EEN_W1	has elementary knowledge about physics, including optics and electromagnetic field theory necessary for the understanding of physical foundations of control and optic fibres telecommunication systems operation	**P6U_W**	**P6S_WG**	
K1ETK_EEN_W2	has a structured knowledge about most popular renewable energy sources, including physical basics of sources, conversion methods into electrical energy knows the advantages and disadvantages of renewable sources and the law regulations of their use	**P6U_W**	**P6S_WG** **P6S_WK**	
K1ETK_EEN_W3	has a structured knowledge about power quality and its parameters knows selected devices and systems used for power quality assessment	**P6U_W**	**P6S_WG**	
K1ETK_EEN_W4	has knowledge about methods and technics for protection of power system elements, including knowledge necessary for understanding and description of measurement transducers operational principles and protection relays with one and multiple inputs	**P6U_W**	**P6S_WG**	
K1ETK_EEN_W5	has knowledge about protection against electrical shock knows the safety regulations related to electrical equipment operation, including law regulations and		**P6S_WG** **P6S_WK**	

	responsibility areas knows the sources of electromagnetic fields in power engineering and industry knows standards and legal regulations related to protection against electromagnetic fields			
K1ETK_EEN_W6	knows the rules for economical and rational energy utilization in industry has the knowledge needed for load predictions and assessment of power quality influence on loads		**P6S_WG** **P6S_WK**	**P6S_WG_inż**
K1ETK_EEN_W7	has knowledge about basic methods used in power system control in normal and faulty conditions, including the knowledge necessary for: - understanding and functionality description of turbine control, generator control, transformer control, capacitor bank control - understanding and functionality description of frequency and power control in electrical power system - understanding and functionality description of reactive power and voltage regulation in electrical power system		**P6S_WG**	**P6S_WG_inż**
K1ETK_EEN_W8	understands basic terms related to intelligent buildings and to intelligent installation and differences between traditional and intelligent electrical installation knows building management systems: with analogue and digital control, operation and construction of system components, topology and logical structure, planning and operation rules		**P6S_WG**	**P6S_WG_inż**
K1ETK_EEN_W9	knows the operational principals of substations, including: connection schemes, typical switchgears topologies, construction solutions, power own consumptions can select apparatus in substations has knowledge about substation operation		**P6S_WG**	**P6S_WG_inż**

SKILLS (U)				
K1ETK_EEN_U1	is able to freely communicate and discuss within professional community on topics related to power quality is able to interpret power quality parameters is able to use selected applications of power quality recorders knows different methods for power quality assessment is able to prepare power quality reports for simulated and real systems	P6U_U	P6S_UW P6S_UK P6S_UO	P6S_UW_inż
K1ETK_EEN_U2	is able to connect, operate and coordinate measurement transducers with one and multiple inputs also power protection units installed in electrical power system, protecting the basic components: generators, transformers, high voltage machines, transmission and distribution grids	P6U_U	P6S_UW	P6S_UW_inż
K1ETK_EEN_U3	is able to measure and compute electric and magnetic field values and design systems mitigating the influence of electromagnetic fields on environment	P6U_U	P6S_UW	P6S_UW_inż
K1ETK_EEN_U4	is able to install, configure and make operational tests of basic automation and control systems used in power system automation	P6U_U	P6S_UW	P6S_UW_inż
K1ETK_EEN_U5	is able to create an simple design of intelligent installation in a preselected BMS system, program, launch and test the installation, introduce changes in operation		P6S_UW	P6S_UW_inż
K1ETK_EEN_U6	can configure, program in a selected programming language and practically use a programmable logic PLC and its peripherals		P6S_UW	P6S_UW_inż
K1ETK_EEN_U7	is able to prepare a presentation showing the results of diploma work, justify in a discussion his approach and reached results	P6U_U	P6S_UW P6S_UK P6S_UO	P6S_UW_inż

K1ETK_EEN_U8	s able to make an engineering diploma work related to the elective courses Electrical Power Engineering, including: -is able to get information from literature, data bases and other sources, -is able to use analytical, simulation and experimental methods for the formulation and solution of tasks, -is able to assess the usability and practical potential of new technical solutions and technologies, -is able to identify and specify tasks, also non typical tasks -is able to make a design and then build a device, object, system or process according to given specification	**P6U_U**	**P6S_UW** **P6S_UK** **P6S_UO**	**P6S_UW_inż**

*delete as applicable

Attachment no. 2

Optional courses block Industrial Electrical Engineering

Optional courses block learning outcomes	Description of learning outcomes for optional courses block **Industrial Electrical Engineering**	Reference to PRK characteristics		
		Universal first degree characteristics (U)	Second degree characteristics typical for qualifications obtained in higher education (S)	
			Characteristics for qualifications on 6 / ~~7~~* levels of PRK	Characteristics for qualifications on 6 ~~and 7~~ levels of PRK, enabling acquiring engineering competences
KNOWLEDGE (W)				
K1ETK_ETP_W1	has knowledge in the field of electrical phenomena physics useful in the formulation and solution of simple task of applied electrostatics (applications, protection, metrology)	**P6U_W**	**P6S_WG**	
K1ETK_ETP_W2	has knowledge related to power quality, indices used for power quality assessment, legal regulations limiting distortion levels is up to date with newest systems and devices used for power quality monitoring	**P6U_W**	**P6S_WG** **P6S_WK**	
K1ETK_ETP_W3	has knowledge about current diagnostic methods for assessment of materials and insulation systems condition and the physical processes occurring in them under the influence of operational exposures		**P6S_WG**	**P6S_WG_inż**
K1ETK_ETP_W4	has knowledge about electrical phenomena physics necessary for the solution of simple tasks related to power saving technologies, utilising strong electrical and electrostatic fields knows basic processes and devices used in those technologies	**P6U_W**	**P6S_WG**	
K1ETK_ETP_W5	knows the rules for economical and rational energy utilization in industry,		**P6S_WG**	**P6S_WG_inż**

	has the knowledge needed for load predictions and assessment of power quality influence on loads		**P6S_WK**	
K1ETK_ETP_W6	knows the physical phenomena typical for devices transforming electrical energy into useful forms of energy: heat and light	**P6U_W**	**P6S_WG**	
K1ETK_ETP_W7	has ordered basic knowledge about operation, construction and parameters of sensor and sensor systems, including intelligent systems and micro-sensors applied for various purposes (industrial measurements, monitoring, diagnostics, automotive industry, medicine, household appliances)		**P6S_WG**	
K1ETK_ETP_W8	has knowledge about diagnostic methods of electrical machines, also about used hardware and software solutions		**P6S_WG**	**P6S_WG_inż**
K1ETK_ETP_W9	has a structured knowledge about control systems for various industrial drives systems		**P6S_WG**	**P6S_WG_inż**
SKILLS (U)				
K1ETK_ETP_U1	is able to select a controller and belonging equipment according to design requirements, connect elements and install the controller on site is able to program the controller in a chosen programming language, launch and test written software	**P6U_U**	**P6S_UW**	**P6S_UW_inż**
K1ETK_ETP_U2	can properly use the diagnostic instruments for testing materials and insulation systems		**P6S_UW**	**P6S_UW_inż**
K1ETK_ETP_U3	is able to make measurement of chosen quantities characterising processes, devices and materials used in technologies utilising strong electric and electrostatic fields, formulate conclusion		**P6S_UW**	**P6S_UW_inż**

K1ETK_ETP_U4	is able to measure basic light sources parameters, and work out characteristics is able to make measurement based characteristics of loads, especially electro-thermic devices		**P6S_UW**	**P6S_UW_inż**
K1ETK_ETP_U5	is able to figure out basic characteristics of sensors and transducers is able to select and apply adequate sensors and transducers for the measurement of various physical quantities and use them in measurement systems, monitoring and control systems		**P6S_UW**	**P6S_UW_inż**
K1ETK_ETP_U6	is able to apply basic fault detection methods in electrical machines and drives using automated measurement diagnostic systems		**P6S_UW**	**P6S_UW_inż**
K1ETK_ETP_U7	is able to prepare a presentation showing the results of diploma work, justify in a discussion his approach and reached results	**P6U_U**	**P6S_UW** **P6S_UK** **P6S_UO**	**P6S_UW_inż**
K1ETK_ETP_U8	is able to make an engineering diploma work related to the elective courses Industrial Electrical Engineering, including: – -is able to get information from literature, data bases and other sources, – -is able to use analytical, simulation and experimental methods for the formulation and solution of tasks, – -is able to assess the usability and practical potential of new technical solutions and technologies, – -iIs able to identify and specify tasks, also non typical tasks – -is able to make a design and then build a device, object, system or process according to given specification	**P6U_U**	**P6S_UW** **P6S_UK** **P6S_UO**	**P6S_UW_inż**

*delete as applicable