MINISTRY OF SCIENCE AND HIGHER EDUCATION
REPUBLIC OF KAZAKHSTAN
Branch of Anhalt University of Applied Sciences
“Anhalt International University in Kazakhstan”

«PPROVED»
Branch director

_____ Siemens Eduard
«___»_____2025

PASSPORT OF THE EDUCATIONAL PROGRAM 6B07127 -"ELECTRICAL AND INFORMATION TECHNOLOGY"

Head of the educational program Siemens Eduard

Trajectories (specializations) of training:
• Automation,
• Embedded systems
• Telecommunication technologies

Almaty 2025

The OP has been developed on the basis of: laws of the Republic of Kazakhstan and its normative documents: State obligatory standard of higher education (Order of the Minister of Science and Higher Education of the Republic of Kazakhstan from 20.07.2022g. № 2), Framework documents of operations of the organisations of higher and postgraduate education (Order of the Minister of Education and Science of the Republic of Kazakhstan from 30.10.2018g. No. 595), Rules of organisation of credit-based educational process (Order of the Minister of Education and Science of the Republic of Kazakhstan from 20.04.2011 No. 152).

Educational program, accredited as “Electro-und Infomationstechnik” at University of Applied Sciences Anhalt (Germany) in Germany

Passport data of EP 6B07127 -" ELECTRICAL AND INFORMATION TECHNOLOGY "

Table 1

№	Field name	Remark
1	Registration number	6B07100359
2	Code and classification of the field of education	6B07 – Engineering. Manufacturing industries
3	Code and classification of training areas	6B071 – Engineering and Engineering
4	Educational programs group	B063 – Electrical engineering and automation
5	Name of the educational program	6B07127 – Electrical and information technology
6	Type of EP	New; (existing EP within the University of Applied Sciences Anhalt)
7	Goal of the EP	Training specialists with competencies in developing, operating, and optimizing electrical and IT systems, focusing on innovative technologies to enhance industrial efficiency and economic growth.
8	ISCED level	ISCED 6 bachelor's degree or its equivalent
9	НРК level	6
10	ОРК level	6
11	EP's specifications	Training in English; Upon completion of the training a diploma is awarded by the University of Applied Sciences Anhalt (Germany)
	Partner university (СОП)	Within the framework of the General Agreement between the University of Applied Sciences Anhalt (Germany) and Gumarbek Daukeev Almaty University of Power Engineering and Communications Non-Profit Joint Stock Company (Republic of Kazakhstan)
	Partner university (ДДОП)	No;
12	List of competences	1. To demonstrate the ability for critical thinking, independence, and responsible behavior, as well as an understanding of the importance of information and computer technology in human life, and the associated ethical considerations. 2. To analyze tasks, identify solutions, and implement them through appropriate methods while performing practical assignments in electrical engineering and programming. 3. To apply knowledge, methodological expertise, and professional skills while working with regulatory and methodological materials for designing, developing, and executing technological documentation, demonstrating an understanding of the principles of inclusion, sustainability, safety, ecological awareness, and anti-corruption. 4. To implement modern engineering technologies in professional activities, including machine learning and information security, demonstrating knowledge and practical skills in optimal organization of information processes and systems. 5. To demonstrate communicative competencies in linguistic and socio-cultural aspects to solve problems of
13	Learning outcomes	

		interpersonal and intercultural communication, as well as for successful implementation of professional activities in intercultural professional context. 6. To apply engineering modeling and optimization techniques, mathematical and physical models for solving technical problems in electrical engineering and IT, with the aim of improving technical processes in different operating modes. 7. To design and process diagnostic data of electrical, electronic, and information systems using modern technologies and technical tools in order to create mathematical models of automation and control processes and objects. 8. Carry out measurements, analyze and interpret the results to optimize electrical and electronic systems. Identify and eliminate technical malfunctions in hardware and software systems using professional diagnostic methods. Apply quality control measures and industry standards to meet technical requirements. 9. Develop software solutions for microcontrollers, embedded systems, and digital signal processing, as well as perform device assembly and assembly. Demonstrate programming in languages (Python, C, MATLAB) for automation, modeling, and algorithm creation. 10. Use mathematical modeling methods and tools, including the use of universal and specialized software and computing systems, automated design systems for planning and executing technical projects, taking into account economic and organizational requirements. 11. The application of modern technologies in professional activities related to the design of digital circuits and automated systems, in order to adapt to evolving technical challenges. Development of solutions in the fields of electrical engineering and information technology as well as artificial intelligence for industrial control systems. 12. Development, design, and maintenance of technical hardware and software systems, including computer networks, remote control, and data acquisition. Automation of processes using network technologies while ensuring security. 13. Making decisions at various stages of the project lifecycle, competent performance of project management functions. Conducting expertise on design solutions, quality assurance, application of security and encryption technologies in information technology and electrical engineering. Demonstrating competencies in economic and legal matters, entrepreneurship, and financial literacy. (Appendices No. 1 and No. 2)
14	Form of training	Daytime
15	Language of instruction	English
16	Volume of credits	240

17	Academic degree awarded	Bachelor of Engineering and Technology (Bachelor of Engineering)
18	Availability of an annex to the license for the direction of training	No;
19	Availability of accreditation of the OP	yes;
	Name of accreditation body	STIFTUNG Akkreditierungsrat (Foundation of the Accreditation Council) is the joint institute of the German federal states for quality assurance in teaching and learning at German universities and holds the exclusive right to issue accreditation certificates to German universities. It is a member of leading European and international quality assurance networks such as the European Association for Quality Assurance in Higher Education (ENQA) and the International Network of Quality Assurance Agencies in Higher Education (INQAAHE). It is also included in the European Quality Assurance Register in Higher Education (EQAR)) holding the exclusive right of accreditation certificates in Germany.
	Accreditation validity period	The accreditation is valid for the period 1 April 2021 to 31 March 2029.
20	Information about disciplines	Information on disciplines UC /EC, GED, BD, PD (Appendices No. 2)

1. The structure of the educational program of higher education

Bachelor's degree is a level of higher education aimed at training experts with the award of the academic degree of "Bachelor" within the relevant educational program, requiring the completion of no less than 240 academic credits.

The content of the higher education program consists of courses from three cycles: general education disciplines (hereinafter – GED), basic disciplines (hereinafter – BD), and major (profiling) disciplines (hereinafter – PD). The structure is detailed in Appendices No. 1.

The GED cycle includes compulsory components (hereinafter – CC), university components (hereinafter – UC), and/or elective components (hereinafter – EC). The BD and PD cycles include both UC and EC disciplines. Additionally, there is a cycle of disciplines for additional types of training (hereinafter – ATT).

The GED cycle includes mandatory disciplines required by the branch of the foreign higher educational institution (Anhalt University of Applied Sciences, Germany). The UC and EC are determined independently by the Branch, taking into account labor market demands, employer expectations, and the individual interests of students.

The credit load of the GED cycle at the Branch is no more than 10.4% of the total amount of the higher education program or 25 academic credits. Out of this, 20 academic credits are allocated, in accordance with clause 4 of article 65 of the Law of the Republic of Kazakhstan "On Education", to compulsory disciplines: "History of Kazakhstan", "Kazakh Language", and "Philosophy". Additionally, the GED cycle includes UC disciplines – Interdisciplinary Project.

The BD cycle includes the study of core academic disciplines and makes up no less than 47.9% of the total credit load of the higher education program, or no less than 115 academic credits.

The PD cycle includes core and profiling disciplines, as well as industrial practice, amounting to no less than 35.4% of the total volume of the higher education program, or no less than 85 academic credits.

Furthermore, an additional discipline is offered for those intending to undergo an internship and/or practical training at the main campus of Anhalt University of Applied Sciences (Germany): advanced study of technical German (formally 5 credits each semester outside the core curriculum).

The final certification (hereinafter – FC), including the preparation and defense of the bachelor's thesis, accounts for 6.3% or no less than 15 academic credits.

The modular curriculum complies with the requirements of the State Compulsory Standard of Higher Education and the structure of the higher education program includes all compulsory components and provides both university and elective components.

The modular program meets the minimum requirements for the number of credits in theoretical training – 210 credits, practice – 15 credits, and final attestation – 15 credits.

The educational program defines the timeframes and types of internships as follows: industrial practice in the 8th semester (15 credits). In addition, within the PD cycle, two practical modules are offered (a non-technical and an interdisciplinary project), and the EC list includes optional practical modules.

The EC includes a wide range of both technical and non-technical modules for students to choose from.

2. Catalog of elective disciplines

The Catalogue of Elective Disciplines (elective modules) is developed for the entire period of study, taking into account labor market needs and the specifics of the educational program. At the same time, the catalogue is not a static document — its content may be updated depending on:

- changes in the professional field and production demands;
- educational requests from students (initiated by a group of students, including at least one subgroup);
- implementation of academic mobility of the teaching staff;
- the opportunity to integrate modern professional courses into the curriculum, developed by leading specialists and professors from top universities worldwide.

The Catalogue of Elective Disciplines is developed and approved as an independent document regulating the selection and implementation of elective components of the curriculum (provided in Appendices No. 2).

3. Modular curriculum

The modular curriculum is presented in Appendices No. 2.

The effectiveness of learning outcomes is ensured through a comprehensive approach, where educational programs, curricula, and academic disciplines are all developed based on a modular principle.

The content and scope of each module vary depending on didactic objectives, the profile, and the level differentiation of students. The entire educational program is structured into autonomous organizational and methodological modules.

The formation and content of modules provide the necessary degree of flexibility and freedom for students in choosing their learning trajectory and acquiring specialized professional competencies that enhance their competitiveness in the labor market.

The modules of the educational program “Electrical Engineering and Information Technologies” are classified as either compulsory, university components, or electives, designed to develop professional competencies required by both universal electrical engineers and experts in a chosen trajectory (specialization).

4. Trajectory selection method

Up to the third year of study at the Branch, the modules are structured according to a “horizontal-vertical” scheme. The modules consist of compulsory, university, and elective components. The learning outcomes achieved after completing a module may vary depending on the chosen elective component within the module.

This scheme for forming the educational program provides students with the freedom to select disciplines listed in the Catalogue of Elective Disciplines and the modular curriculum. It ensures each student’s personal involvement in shaping their individual learning plan and includes the participation of academic advisors who assist students in choosing their educational trajectory.

As a result of implementing their chosen educational trajectory, students are expected to acquire the necessary competencies. The Individual Learning Trajectory (hereinafter – ILT) consists of compulsory (including the university component), elective, corrective, and organizational parts. The compulsory part includes core modules that align with the State Compulsory Standard of Higher Education. University components of the modules are mandatory regardless of the chosen trajectory and contribute to the development of fundamental "General Professional" and "Professional" competencies of future specialists.

The elective part consists of a selection of modules and their components that students choose for study according to their specific areas of interest. Both the compulsory and elective parts are aimed at defining the content of education.

The corrective part involves providing support to students in choosing disciplines within the elective modules, taking into account their individual characteristics, and in defining the organizational part. The organizational part includes the following system components: forms, methods, technologies, tools, and control over the study of the chosen content. Table 1 presents the organizational components of the ILT.

Table 4.1 - Organizational component of ILT training

Elements of asynchrony	Обеспечение асинхронности обучения	Средства, обеспечивающие асинхронность
1. Independent work of students/	Branch “Anhalt International	Working curriculum; Timetable of classes;

	University in Kazakhstan"	Timetable of consultations of SRSP teachers; Control over the fulfilment of the study plan
2. Choice of disciplines of the variable component	Advisors, Tutors	Student's individual study plan
3. Working on projects	Teachers	Individual study plan; Schedule of assignments, literature list, handouts, electronic resources
4. Selection of an additional training profile	Students	Library, media library, electronic publications, Internet, syllabuses

Table 4.2 shows the content component of learning, etc. The content component determines the options for the formation of individual educational technology. Within the framework of the educational program, it is possible to carry out academic mobility, receive additional education.

Table 4.2- The content component of ILT training

ILT Options	Ensuring asynchronous learning	Tools that ensure asynchrony
Individual set of competencies	Students, advisors	Individual student curriculum
	Branch "Anhalt International University in Kazakhstan"	A set of variable disciplines
		Working curriculum
Specification of the training profile (RGR, KR, research work, project work)	Students, advisors	Individual student curriculum
	Branch "Anhalt International University in Kazakhstan"	Approximate course work on the subject, calculation and graphic work on the subject, approximate research work on the subject
Individual level of discipline development (high, medium, low)	Students, advisors, teachers	Regulations on the point-rating system of assessment, schedule of tasks, research work
Professional adaptation to professional activity during the practice	Students, advisors, teachers, Branch "Anhalt International University in Kazakhstan"	Internship programs, contracts with enterprises on the bases of practices, the formation of individual assignments for practice, elements of dual training
Expanded set of professional competencies (selection of an additional training profile)	Students, advisors	Individual student plan
	Branch "Anhalt International University in Kazakhstan"	Non-linear schedule, the main educational program of additional training profile, professional training courses

Electrical Engineering and Information Technologies are key drivers of modern innovation processes. The development of technologies such as autonomous transportation systems, as well as the implementation of solutions aligned with the Fourth Industrial Revolution (Industry 4.0), has become possible due to advancements in electrical engineering and information technologies.

The rapid pace of technological change and the expanding scope of professional tasks and tools impose new requirements on the content of educational programs. Therefore, the planning of the curriculum is carried out with the need to develop universal competencies in graduates, ensuring their competitiveness in the global labor market.

The university adheres to the principle of training electrical engineers and IT specialists with broad professional qualifications, enabling them to work successfully in various fields. Accordingly, when forming the content of the educational program in Electrical Engineering and Information Technologies, the changing professional requirements and the content of modular components are taken into account.

The disciplines that form the foundation of engineering education and retain long-term relevance are included in the core part of the curriculum. Modules in later semesters, especially in students' chosen areas of specialization, may be adjusted according to current scientific-technological trends and employer demands.

The structure of the educational program Electrical Engineering and Information Technologies reflects this approach and consists of several sequential stages:

Semesters 1–3: Courses aimed at developing civic identity, critical and philosophical thinking, and communication competencies necessary for successful professional and social integration are taught. These include mandatory disciplines such as History of Kazakhstan, Philosophy, and Kazakh/Russian language. In parallel, students study mathematics, natural sciences, programming fundamentals, algorithmic thinking, and the basics of electrical engineering and electronics.

Semesters 4–6: In-depth study of core disciplines and the introduction of specialized subjects that develop the key competencies of electrical engineers and IT specialists, regardless of further specialization.

Semester 7: In addition to core specialization subjects, students may choose three elective modules corresponding to their professional interests and providing advanced specialization. Students may also participate in interdisciplinary projects and study non-technical elective modules to develop soft skills.

Depending on the chosen elective modules, students may specialize in the following areas:

- Automation of production processes
- Embedded Systems
- Telecommunication Technologies

The first year is characterized by a significant number of compulsory and university component disciplines within the modular curriculum. During the first three years, elective component courses are not included. However, the professional foundation is established from the first year, with a significant portion of the subjects dedicated to the theoretical foundations of electrical engineering and electronics. Scientific/technical English and German languages are intensively studied within the compulsory cycle. Upon completion of the first and second semesters, students will have earned 60 credits.

The second year continues the study of general education and basic disciplines. Students deepen their knowledge in their future professional field, complete 60 credits, and take an additional advanced German course in preparation for internships at the main campus of Anhalt University of Applied Sciences in Germany starting from the 5th semester and/or internships with the university's industrial partners in Germany.

The third year continues the study of basic disciplines, with an emphasis on the block of specialized disciplines of the university component. Students are also encouraged to participate in a non-technical elective module (5 credits). At the end of the third year, students complete 60 credits and continue their advanced German language course.

In the seventh semester, students complete the core specialization subjects and clarify their specific field of professional training. They undertake an interdisciplinary project and select three elective modules, including both specialized technical and non-technical modules (such as Business Administration, Law, Quality Management, etc.). After completing the seventh semester, students will have earned 30 credits.

The eighth semester includes industrial practice and final attestation, totaling 30 credits. The industrial practice lasts at least 12 weeks, and the preparation and defense of the bachelor's thesis are allocated 10 weeks.

The distribution of credits by modules and courses is presented in Table 4.3.

Table 4.3 is a summary table reflecting the volume of loans disbursed by modules of the educational program.

Course of study	Semester	Number of modules to be mastered	Number of subjects studied		Number of credits KZ					hours	ECTS	Quantity	
			CC	UC & EC	Theoretical training	Project activities	Production practice	Final certification	Total	Total in		exam	differential test
1	1	5	2	3	33	0	0	0	33	990	33	5	
	2	6	2	4	27	0	0	0	27	810	27	3	2
2	3	5	0	5	30	0	0	0	30	900	30	5	
	4	5	0	5	30	0	0	0	30	900	30	5	
3	5	6	0	6	30	0	0	0	30	900	30	6	
	6	6	0	6	30	0	0	0	30	900	30	5	1
4	7	6	0	6	25	5	0	0	30	900	30	6	
	8	0	0	0	0	0	15	15	30	900	30	FC	1 PP
Total			**4**	**35**	**210**	**0**	**15**	**15**	**240**	**7200**	**240**	**35+ FC**	**4**

*including elective disciplines containing project activities.

By developing additional modules in the university component of the program during the third and fourth years, it becomes possible to train specialists in a wide range of modern specializations, keeping pace with the times.

The educational program adopts an individualized approach, ensuring the integration of professional and qualification standards into the development of learning outcomes.

Student-centric learning is implemented—an educational principle that shifts the focus of the learning process from teaching (as the primary role of faculty members in the "transmission" of knowledge) to learning (as the active educational activity of the student).

The educational program is designed to implement the principles of democratic governance in education, to expand academic freedom and the autonomy of educational institutions. This will ensure the training of highly motivated professionals for innovative and high-tech sectors of energy and telecommunications.

Appendix №1

Appendix 2 to the order
Minister of Education and Science
Of the Republic of Kazakhstan
dated May 5, 2020, No. 182
Appendix 1 to
the state the mandatory
standard of higher education

The structure of the educational program of higher education

№	**Name of cycles and discipline**	Total labor intensity	
		in academic hours	in academic credits
1	2	3	4
1	**Cycle of general education disciplines (GED)**	**750**	**25**
1)	Compulsory component including:	600	20
	Modern history of Kazakhstan	150	5
	Philosophy	150	5
	Kazakh	300	10
2)	University component	150	5
	Interdisciplinary Project	150	5
2	**Cycle of basic disciplines (BD)**	**3450**	**115**
1)	University component and (or) optional component	3450	115
3	**Cycle of profile disciplines (PD)**	**2 550**	**85**
1)	University component and (or) optional component	2 100	70
2)	Professional practice	450	15
4	**Additional types of training (ATT)**	*****	*****
1)	University component and (or) optional component	750	25
	Foreign language (advanced study of German) *	750	25
5	**Final certification (FC)**	**450**	**15**
1)	Writing and defending a thesis, graduation project, or preparing and passing a comprehensive exam	450	15
6	**Total**	**At least 7 200**	**At least 240**

* Additional classes for advanced study of technical German.

Appendix №2

Information about the disciplines studied and the competencies being formed

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
1	Kazakh language	GED	CC	5	The course content includes the development of all types of speech activity and vocabulary work, work with authentic texts, mastering the language system, skills of written and oral communication in various spheres of life (social, domestic, educational and professional).	1, 4
2	Foreign language (technical scientific English)	BD	UC	5	The course develops proficiency in scientific and technical English within both professional and academic contexts. Students acquire technical terminology, analyze subject-specific texts, and improve their oral and written communication skills. They learn to discuss professional topics, interpret and adapt technical information, and critically evaluate specialized sources.	3, 5
3	Fundamentals of Electrical Engineering 1	BD	UC	8	Electrical quantities and basic circuits. Series, parallel, and mixed connection of loads and sources. Methods for calculating linear circuits. Network transformations and bridge circuits. Operating point analysis with linear and nonlinear sources and loads. Electric fields, resistance, capacitance. Alternating current and voltage. Equivalent circuit parameters. First-order differential equations in electrical circuits.	2, 6
4	History of Kazakhstan	GED	CC	5	Examines historical events, processes and development of Kazakhstan from ancient times to the present. Formation of students' systematic understanding of their country's past, its culture, traditions and historical development. Studying the course through lectures, seminars, group and individual classes, as well as using sources and archival materials	1, 4
5	Advanced preparatory course for STEM subjects (Mathematics, Physics)	BD	UC	5	The course develops skills in equation solving, graph interpretation, data analysis, as well as logical and spatial reasoning. It covers the fundamentals of algebra, geometry, trigonometry, kinematics, dynamics, and electricity. The course fosters an understanding of physical principles and mathematical methods, emphasizing their practical application in engineering, programming, and scientific disciplines.	2, 6

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
6	Foreign language (German)	BD	UC	5	The course is aimed at developing communication skills and practical competence in the use of a foreign language across everyday, socio-political, professional, and academic contexts. Students will be able to express their thoughts fluently in both spoken and written forms in accordance with the language's norms, participate in dialogues and group discussions within the scope of the studied material, and reproduce and analyze the content of technical texts.	3, 5
7	Engineering Mathematics 1	BD	UC	7	The course is aimed at equipping students with a broad spectrum of mathematical knowledge and developing their ability for both inductive and deductive reasoning, along with fostering mathematical intuition relevant to professional activities. The curriculum covers complex numbers, vector calculus, analytic geometry, conic sections, matrix operations, systems of linear equations, coordinate transformations, the principal axis theorem, differential calculus for functions of a single variable, and series expansions including Taylor series.	2, 6, 10
8	Kazakh language 2	GED	CC	5	The course content includes the development of all types of speech activity and vocabulary work, work with authentic texts, mastering the language system, skills of written and oral communication in various spheres of life (social, domestic, educational and professional).	1, 4
9	Philosophy	GED	CC	5	As a result of studying the course, students will master general cultural and professional competences, namely, they will learn to perceive, analyse, understand socially and personally significant philosophical problems, different worldview paradigms, learn the skills of analytical reading of texts using traditional methods and modern information technologies.	1, 5
10	Physics	BD	UC	5	Physical quantities, error calculation, and the SI system. Kinematics and translational dynamics. Force, work, energy, power, and momentum. Mechanical harmonic oscillations and the concept of frequency. Frequency spectrum of time-domain signals and an introduction to Fourier analysis and its applications. Mechanical waves: wavelength, propagation speed, interference, and the Doppler effect. Acoustics: sound, infrasound, and ultrasound, sound fields and their applications. Transition to electromagnetic oscillations and the electromagnetic wave spectrum.	2, 6

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
11	Engineering Informatics 1	BD	UC	5	The course aims to develop a comprehensive body of knowledge in the field of information technologies. The curriculum includes the study of software engineering methodology, planning and execution of assigned tasks, requirements analysis, computer architecture and its features, data encoding and representation, Boolean algebra and its application in computing, algorithms and data structures such as sorting, searching, linked lists, trees, etc., as well as runtime evaluation.	2, 8
12	Foreign language (German Language A1)	ДВО	UC	доп	The course aims to develop basic communication skills and practical use of a foreign language in everyday life. Students will learn to use simple phrases, participate in short dialogues, and express basic ideas both orally and in writing.	3, 5
13	Introduction to Applied Engineering Sciences 1	BD	UC	5	The course of study emphasizes the training of students and the development of their understanding of future professional activities. Students learn specialized vocabulary, theoretical concepts, and the fundamentals of their field of study, as well as the specific aspects of engineering and the role of engineers in today's world. They learn how to formulate engineering tasks, define criteria, demonstrate creativity, design for innovation, and develop both professional and personal skills. The course also assists students in selecting an individualized educational path by providing guidance on value systems, sustainable development principles, safety measures, and anti-corruption practices.	2, 3, 8
14	Engineering Mathematics 2	BD	UC	7	The discipline forms mathematical knowledge and skills in students, allowing them to engage in scientific and professional activities in the future, as well as skills and abilities in solving engineering problems. It includes integral calculus for functions of one variable and Fourier series, differential calculus for functions of several variables, error calculation, problems on extreme values, the least squares method, ordinary differential equations, the Laplace transform, oscillations, systems of differential equations, coupled oscillations, scalar and vector fields, differential operators, integrals over regions, curves and surfaces.	2, 6, 10
15	Engineering Informatics 2	BD	UC	3	The course is designed to provide undergraduate students with foundational competencies in the use of modern information technologies and practical skills for working with application software tools. The curriculum includes an introduction to Python programming, covering key concepts such as variables,	2, 8

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
					conditional statements, loops, functions, and file handling (reading and writing data). Additionally, students explore data visualization techniques, the creation of custom Python modules, and the integration of external libraries. The course also provides an introductory overview of programming in MATLAB and C.	
16	Fundamentals of Electrical Engineering 2	BD	UC	5	Direct current (DC) and alternating current (AC) quantities; sinusoidal voltage. Representation of sinusoidal waveforms and frequency dependence. Series and parallel AC circuits. Power in AC circuits: active, reactive, and apparent power; power factor and methods of power factor improvement. Complex circuit analysis for series, parallel, and mixed configurations. Two-port networks and network calculations.	2, 6
17	Fundamentals of Electronics 1	BD	UC	5	Fundamentals of logic functions. Number systems and encoding. Computation using logic functions. Logic function minimization. Common combinational logic functions. Systematic design and analysis of combinational circuits. Sequential circuits (flip-flops). Arithmetic logic unit (ALU).	3, 8
18	Materials, Components and Technologies	BD	UC	5	The objective of this course is to develop students' knowledge in the field of materials science and the technologies applied in various areas of engineering and manufacturing. The curriculum covers the structure of matter, materials and crystal lattices, band theory, insulators, metals, and semiconductors. Topics include electrical conductivity, resistance/conductance, the design and fabrication of resistors, capacitors, inductors, and magnetic materials. The course also addresses semiconductor materials, doping methods, p-n junctions, diodes, transistors, charge carrier distribution and temperature behavior, silicon processing, lithography, and the production of integrated circuits.	3, 7
19	Foreign language (German A2): Introduction to Applied Engineering Sciences 2 or	ДВО	UC	доп	The course focuses on developing communication skills in daily situations and social contexts. Students will be able to use familiar expressions, engage in simple conversations, reproduce and analyze short texts, and present ideas orally and in writing following language norms.	3, 5

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
	Short Technical Project					
20	Signals and systems	BD	UC	5	The objective of this course is to develop a systematic approach among undergraduate students for analyzing the behavior of radio-electronic systems and determining their response to given input signals. The course covers continuous and discrete signals and systems, signal operations, the effect of deterministic signals on linear time-invariant systems, modulated signals, z-transformation, frequency characteristics, and the properties of discrete-time systems. It also includes methods for computing system responses.	3, 6
21	Physical technologies	BD	UC	5	Geometrical and wave optics: image formation using lenses and mirrors, lenses, mirrors, interference, diffraction, and resolving power. Optical instruments, fiber optics, and microscopy. Electromagnetic oscillations and types of radiation (radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, and gamma rays), as well as polarization. Molecular and nuclear physics, radioactivity, and radiation safety. Lasers: coherence, light amplification, measurement techniques, and optical tomography.	3, 8
22	Fundamentals of Electrical Engineering 3	PD	UC	5	Multifrequency processes: Fourier series decomposition of functions, signal characteristics, and the behavior of linear and nonlinear switching elements. Response of fundamental switching components (R, L, C) under periodic excitation. Differential equations of electrical circuits, initial conditions, transient processes, voltage switching on and off. Electrical safety: types of grounding systems (TN, TT, IT), protective devices (circuit breakers, residual current devices), testing, measurements, and cable sizing.	2, 6
23	Fundamentals of electronics 2	BD	UC	10	RLC circuits: components such as resistors, inductors, and capacitors; transfer functions and circuit design principles. Diodes: rectifier, switching, and Zener diodes; signal processing. Transistors: bipolar junction and field-effect transistors; basic configurations, operating point, amplifiers, switching and small-signal amplifiers, feedback, current sources. Operational amplifiers: characteristics, feedback, frequency response, oscillation generation, circuit applications.	3, 8

№	Name of disciplines	Cycle	Compo nent	Number of credits	Brief description of the discipline	Learning outcomes (№)
24	Microcomputer Technology	BD	UC	5	The course explores the structure of the CPU and the arithmetic logic unit (ALU), as well as the connection of necessary memory components to the system bus, using the Arduino UNO as an example. It covers interrupt handling and polling mechanisms, operation of the watchdog timer, and key microcontroller components such as timers, ADCs (analog-to-digital converters), and PWM (pulse-width modulation). The course includes hands-on practice with Arduino UNO and various modules.	3, 9
25	Foreign language (German Language B1)	ДВО	UC	доп	The course is designed to enhance communication skills in social and socio-political contexts. Students will learn to express opinions freely, discuss familiar topics, participate in dialogues and polylogues, analyze technical texts, and present ideas orally and in writing according to language standards.	3, 5
26	Digital signal processing	BD	UC	5	Discrete signals (sampling and reconstruction). LTI systems (characteristics and classification). Correlation and convolution. Fourier transforms and window functions. Z-transform and pole-zero (P/Z) diagrams. Digital filters: properties and design.	4, 7, 10
27	Electric Machines	PD	UC	5	Electrical machines: energy conversion and magnetic circuits. Direct current (DC) machines: design and components, air gap, torque generation, and commutation. DC motors (shunt and series types): circuit diagrams, characteristics, starting, and braking methods. Transformers: construction, equivalent circuits, efficiency, and autotransformers. Asynchronous and synchronous machines: rotating magnetic field, induction, operational characteristics, starting, and synchronization. Small electric machines.	4, 7, 11
28	Measurement technology	BD	UC	5	Fundamentals and core concepts of measurement engineering. Measurement uncertainty and errors. Principles of measuring electrical quantities. Digital acquisition of measured values. Structure and operating principles of analog and digital instruments used for electrical measurements. Measurement amplifiers. Oscilloscopes and spectral analysis. Basics of measuring key process variables.	2, 8
29	Communication technology	BD	UC	5	Functional blocks of message transmission. Analog and digital signals. Addition and multiplication of harmonic oscillations. Amplitude modulation. Angle modulation. Digital carrier modulation techniques. Noise suppression in digital carrier modulation.	4, 7

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
30	Computer Networks	PD	UC	5	Fundamentals of networking: topologies, Internet protocols, services, messages, and communication protocols. Data link layer: MAC, access methods, and Ethernet. Network layer: IP addressing (IPv4/IPv6) and routing. Transport layer: connectionless and connection-oriented data transmission using TCP/UDP, sockets, client-server architecture, and DNS. Local area networks (LANs): switches and routers. Practical training includes network commands, packet sniffing, and routing.	4, 7
31	Bus Systems	PD	UC	5	The course examines the fundamental concepts and characteristics of bus-based systems, including architectural features, hardware and software tools, and the structure and evaluation of basic bus systems such as I2C, SPI, RS-485, CAN, USB, and 1-Wire. It covers bus communication protocols, including Modbus-RTU, and the development of a custom bus protocol based on Modbus-RTU. The course includes hands-on training with Arduino UNO and various shields, including RS-485.	4, 11
32	Foreign language (German Language B2)	ДВО	UC	доп	The course deepens skills in the practical application of a foreign language in socio-political, industrial, and academic fields. Students will confidently engage in discussions, substantiate their views, analyze complex texts, and express their thoughts orally and in writing in line with language norms.	3, 5
33	Control Engineering	BD	UC	5	The discipline studies the modelling of dynamic systems in time and frequency domains, their properties, calculation of responses, linearisation, model coupling, identification, stability, closed-loop properties, design of standard, adaptive and tuning rules for controllers, as well as design of compensators and controllers in the frequency domain. Numerical methods for analysis and control circuit design are also covered.	3, 12
34	Industrial Control Systems	PD	UC	5	Automation technologies: devices, PLCs, and their architecture (power supply, CPU, communication, input/output modules). Operating principles: microprogramming, operating systems, cycles, and response time. Program development with consideration of process dynamics. IEC 61131-3 standards, variable models, and functional blocks. Programming languages: FBD (Function Block Diagram), IL (Instruction List), LD (Ladder Diagram), SFC (Sequential Function Chart), and ST (Structured Text).	2, 11

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
35	Non-technical Elective Course 1.)	PD	EC	5	Курс на выбор	
36	Communication Systems	PD	UC	5	Information: definitions, technical systems, and signals. Communication model: message transmission, information theory, probability, entropy, redundancy, and channel capacity (Shannon). Coding: block codes, parity check, and CRC. Line coding: RZ and NRZ. Source coding: PCM and Shannon's sampling theorem.	4, 9, 11
37	Electronic Circuits	PD	UC	5	Voltage regulators for power supply systems. Controlled sources and impedance converters. Signal generators. Active filters (linear and switched-capacitor types). Analog computational circuits.	4, 11
38	Electromagnetic Compatibility	PD	UC	5	Electromagnetic compatibility (EMC): principles, sources, and types of electromagnetic interference (EMI). Methods of interference reduction, including shielding and filtering. Regulatory requirements and standards (IEC, CISPR). EMC testing and protective measures in electronics and power systems. Impact of EMC on communication devices, control systems, and medical equipment.	3, 11
39	Foreign language (German Language B2+)	ДВО	UC	доп	The course focuses on improving communication skills in professional and academic fields, including production and research contexts. Students will participate confidently in dialogues and polylogues, analyze technical texts, and present ideas orally and in writing with a high degree of accuracy.	3, 5
40	Digital Circuit Design	PD	UC	5	Design of combinational circuits (logic networks). Design of synchronous sequential circuits (memory-based synchronous systems). Types of finite state machines and state diagrams. Logic gate families. Semiconductor memory. Programmable logic devices (PLDs) and their architectures. Field-programmable gate arrays (FPGAs).	4, 11
41	Power Electronics	PD	UC	5	Structure and operational behavior of power electronic components. Basic converter circuit topologies and their interaction with power sources and loads. Analysis of basic circuits and representation of circuit structures. Description of circuit modifications using Petri nets. Modeling and simulation tools for basic power circuits. Development of practical skills in measuring electrical quantities through hands-on exercises.	4, 12

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
42	Interdisciplinary Project	GED	UC	5	The course is an interdisciplinary program designed to foster teamwork and project management skills, while also providing a comprehensive understanding of engineering technologies. The curriculum encompasses subjects such as economics, law, entrepreneurship, and financial literacy, equipping students with a well-rounded set of skills.	4, 10, 13
43	Elective modules	PD	EC	5	Optional modules	
44	Elective modules	PD	EC	5	Optional modules	
45	Elective modules	PD	EC	5	Optional modules	
46	Internship	PD	Pr	12	Formation of knowledge on operation of systems and equipment, working conditions of service personnel, occupational safety and health rules. Mastering the skills of independent planning of activities, constructive interaction with colleagues. Research algorithms from collecting materials and choosing calculation methods to practical design solutions.	4, 10
47	Colloquium on the Internship	PD	Pr	3	It is a complex of processing research materials and presenting research results. Particular attention is paid to the algorithm of actions for preparing the resulting conclusions. Tasks of describing research methods, graphs and diagrams, formulating research conclusions, summarizing literature, drawing up links to sources and others are being worked out.	4, 3
48	Bachelor's Degree Thesis	FC	FC	12	The final study, which confirms the student's ability to apply the knowledge gained in practice: identify relevant questions, put hypotheses, collect, process and analyze data, make calculations, solve professional problems. Thesis demonstrates the level of training, skills of and critical thinking and readiness for further work, training or scientific activities.	3, 13
49	Bachelor's Colloquium	FC	FC	3	The course introduces modern methods, devices, and materials used in biological and medical research. Students explore current challenges in biomedical engineering, the characteristics of biological systems, biomedical materials, and devices used for medical diagnostics.	3, 4

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
	Elective modules including (1-16):	PD	EC	15	Optional modules, incl.	
1	Augmented and Virtual Reality - Principles and Practice	PD	EC	5	Basics: AR/VR (presence, immersion, interactivity, visualization methods, tracking, displays, software). AR/VR Applications (Advantages/Disadvantages, Problems) Creating base application: for virtual reality (Unity, Windows Mixed Reality, SteamVR, OpenVR, Visual Studio) for augmented reality (Unity, HoloLens 2, Android, Vuforia, Visual Studio) Interaction with virtual elements in AR/VR (collider, physics)№	4, 12
2	Machine Learning and AI	PD	EC	5	Introduction to Machine Learning (MOD) The difference between artificial intelligence and MO Identify the issue and related questions Model architecture and MO methods (graphical methods, artificial intelligence) Preprocessing and data standardization, feature extraction Supervised and unsupervised learning Importance of the loss function Machine learning algorithms training and validation Classification/regression, probability/distribution basis.	4, 9, 11
3	Software Design	PD	EC	5	Introduction to object orientation: advantages/disadvantages (examples); Model-based software design framework from analysis to design; Visual modeling using UML; UML interaction diagrams as a communication tool in software design; From UML Diagram to Program Code; Software systems testing strategies; A hands-on course using a PC/laptop.	2, 10
4	Internet Security	PD	EC	5	The course covers cyber threats and data protection. Examples of attacks (Slammer, Stuxnet, Snowden), technical threats (DDoS, malicious code, vulnerabilities, web attacks, CVSS), social engineering are analyzed. Security levels are considered: network (IP, IPSec, IKE), transport (SSL/TLS, TCP, UDP), wireless networks (WEP, WPA2), SSH protocol, tunneling (PPTP, L2TP, L2TP), authentication methods.	4, 13

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
5	Embedded Systems Programming	PD	EC	5	The structure and mode of operation of embedded computer systems with and without an operating system. Implementing complex tasks in individual or distributed networked computer systems. Define and implement simple requirements for real-time applications. Basics of the Linux operating system. Learning the C or Python programming language.	10, 11
6	Applications of Programmable Logic	PD	EC	5	Programmable LUNs. Low Cost FPGA series, for example, Cyclone (Intel). Basics of the VHDL programming language Programmable chip system (SOPC). Practical course (e.g. streaming MP3 over Ethernet using Intel FPGA. Cyclone IV).	10, 11
7	Digital Image Processing	PD	EC	5	Image properties, image transformations; Linear and nonlinear filtering; Geometric operators; Image processing in the frequency domain; Feature segmentation and highlighting; Classification of image objects; Introduction to image processing using HLL; Implementation of the above algorithms in the independent solution of the problem of industrial image processing.	6, 9, 10
8	Selected Chapters of Medical Technology	PD	EC	5	The course of study emphasizes the training of students and the development of their understanding of future professional activities. Students learn specialized vocabulary, theoretical concepts, and the fundamentals of their field of study, as well as the specific aspects of engineering and the role of engineers in today's world. They learn how to formulate engineering tasks, define criteria, demonstrate creativity, design for innovation, and develop both professional and personal skills. The course also assists students in selecting an individualized educational path by providing guidance on value systems, sustainable development principles, safety measures, and anti-corruption practices.	3, 4, 11
9	Project Work	PD	EC	5	Introduction to practical engineering technologies; Orientation and processing of current topics in group work; Visiting companies to establish contacts for internships and dissertations; Development of the first scientific evidence with presentation.	1, 5, 13

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
10	Quality Management Specialist	PD	EC	5	The course covers principles and methods of quality management, standardization, certification, auditing, and quality control. It explores quality management systems (ISO 9001), risk management, process improvement, and analytical methods. Special attention is given to modern tools and technologies for ensuring quality across various industries.	3, 13
11	Business Administration	PD	EC	5	The course covers the fundamentals of business, including sales and marketing tools within management processes; procedures for physical and financial planning; procurement and production organization; human resource management; investment and financing. Students develop competencies in economics and law, entrepreneurship, and financial literacy.	1, 5, 13
12	Project and Quality Management	PD	EC	5	The aim of the course is to develop the skills of ISO 9001 Quality Management in students. During the course of studying the course, the following are considered: structure, content, practical methods (planning, control, assurance, quality improvement (CTQ, Kano, FMEA)), management plan, process capabilities, Q control chart, PDCA; Classical project management processes: initiation, definition, planning, control, completion; Agile project management: preparation, implementation using SCRUM; Network plan technique: creation, use for planning and control of projects.	3, 13
13	Law	PD	EC	5	The aim of the discipline is to study constitutional law, a fundamental branch of law that regulates the foundations of the state system, the rights and freedoms of citizens, and the system of state authorities. The discipline studies: the basic principles of constitutional law - the rule of law, democracy, separation of powers and legal statehood; The Constitution and its role – the structure, functions and mechanisms for implementing the norms of the Constitution in public administration; the rights and freedoms of man and citizen – their guarantees, restrictions and methods of protection; government bodies – their powers, interaction and principles of activity; electoral law and processes – the procedure for holding elections, the political system and the participation of citizens in governing the state; constitutional reforms and their impact - historical changes, development of legal norms and adaptation of the system to modern challenges. The study of the discipline is aimed at a deep understanding of the principles of	13

№	Name of disciplines	Cycle	Component	Number of credits	Brief description of the discipline	Learning outcomes (№)
					legal regulation and the development of analytical skills for working with constitutional norms.	
14	Media Project	PD	EC	5	The aim of the course is to develop skills of critical analysis and project management in the audiovisual sphere. Models and methods of media project management, creation of technical specifications, and application of software are studied. The practical implementation of tasks covers audiovisual projects, multimedia applications, as well as the development of both hardware and software necessary for the successful implementation of media projects.	1, 4, 12
15	Starting a Business	PD	EC	5	The purpose of the course is to develop students' basic knowledge and practical skills necessary for creating and running a business, as well as understanding key aspects of business management in modern economic conditions. The course studies an introduction to entrepreneurship, where students consider: concept, essence and types of entrepreneurial activity, the role of entrepreneurship in the economy, the history of the development of entrepreneurship. During the course of studying the discipline, students acquire the skills of choosing a business idea and market analysis, business models and their types, developing a business plan.	13
16	Engineering Ethics	PD	EC	5	The course is focused on the study of engineering ethics, the engineer's code of ethics, and the professional code of conduct. It includes analysis of risks and technological opportunities in life sciences, including genetic engineering and nanotechnology. The course also explores the environmental aspects of technological development and the engineer’s responsibility for the safety of innovations. Case studies are examined on topics such as water usage, sanitation, and eco-technologies. Students develop critical thinking skills and the ability to account for environmental safety in engineering practice.	1, 11, 13

Appendix №3

Matrix of correlation between the learning outcomes of the educational programme as a whole and the competences formed

№	Learning outcomes/ Module name	1	2	3	4	5	6	7	8	9	10	11	12	13
1	Kazakh language 1	+			+									
2	Foreign language (technical scientific English)			+		+								
3	Fundamentals of Electrical Engineering 1		+				+							
4	History of Kazakhstan	+			+									
5	Advanced preparatory course for STEM subjects (Mathematics, Physics)		+				+							
6	Foreign language (German)			+		+								
7	Engineering Mathematics 1		+				+				+			
8	Kazakh language 2	+			+									
9	Philosophy	+				+								
10	Physics		+				+							
11	Engineering Informatics 1		+						+					
12	Foreign language (German Language A1)			+		+								
13	Introduction to Applied Engineering Sciences 1		+	+					+					
14	Engineering Mathematics 2		+				+				+			
15	Engineering Informatics 2		+						+					
16	Fundamentals of Electrical Engineering 2		+				+							
17	Fundamentals of Electronics 1			+					+					
18	Materials, Components and Technologies			+				+						
19	Foreign language (German A2): Introduction to Applied Engineering Sciences 2 or Short Technical Project			+		+								
20	Signals and systems			+			+							
21	Physical technologies			+					+					
22	Fundamentals of Electrical Engineering 3		+				+							
23	Fundamentals of electronics 2			+					+					
24	Microcomputer Technology			+						+				
25	Foreign language (German Language B1)			+		+								
26	Digital signal processing				+			+			+			
27	Electric Machines				+			+				+		
28	Measurement technology		+						+					
29	Communication technology				+			+						
30	Computer Networks				+			+						

№	Learning outcomes/ Module name	1	2	3	4	5	6	7	8	9	10	11	12	13
31	Bus Systems				+							+		
32	Foreign language (German Language B2)			+		+								
33	Control Engineering			+									+	
34	Industrial Control Systems		+									+		
35	Non-technical Elective Course 1.)													
36	Communication Systems				+					+		+		
37	Electronic Circuits				+							+		
38	Electromagnetic Compatibility			+								+		
39	Foreign language (German Language B2+)			+		+								
40	Digital Circuit Design				+							+		
41	Power Electronics				+								+	
42	Interdisciplinary Project				+						+			+
43	Elective modules													
44	Elective modules													
45	Elective modules													
46	Internship				+						+			
47	Colloquium on the Internship			+	+									
48	Bachelor's Degree Thesis			+										+
49	Bachelor's Colloquium			+	+									
	Elective modules (1-16) including:													
1	Augmented and Virtual Reality - Principles and Practice				+								+	
2	Machine Learning and AI				+					+		+		
3	Software Design		+								+			
4	Internet Security				+									+
5	Embedded Systems Programming										+	+		
6	Applications of Programmable Logic										+	+		
7	Digital Image Processing						+			+	+			
8	Selected Chapters of Medical Technology			+	+							+		
9	Project Work	+				+								+
10	Quality Management Specialist			+										+
11	Business Administration	+				+								+
12	Project and Quality Management			+										+
13	Law													+
14	Media Project	+			+								+	
15	Starting a Business													+
16	Engineering Ethics	+										+		+