ASIIN Seal

Accreditation Report

Bachelor's Degree Programmes

Electrical Power Engineering

Automation and Control Engineering

Master's Degree Programme

Electrical Power Engineering

Automation and Control Engineering

Provided by

D. Serikbaev East Kazakhstan Technical University

Version: 25 March 2025

Table of Content

A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
BA Электроэнергетика	Ba Electrical Power Engineering	ASIIN		02
BA Автоматизация и управление	Ba Automation and Control Engineering	ASIIN	(ENAEE) 12.06.2019-12.06.2024	01, 02
MA Электроэнергетика	Ma Electrical Power Engineering	ASIIN		02
MA Автоматизация и управление	Ma Automation and Control Engineering	ASIIN	(ENAEE) 12.06.2019-12.06.2024	01, 02
Date of the contract: 14.04.2022 **Submission of the final version of the self-assessment report:** 05.01.2023 **Date of the onsite visit:** 25. – 27.01.2023 **at: D. Serikbaev East Kazakhstan Technical University**				
Peer panel: Prof. Dr. Madhukar Chandra, TU Chemnitz Prof. Dr. Jürg P. Keller, Fachhochschule Nordwestschweiz Prof. Dr. Peter Nauth, Frankfurt University of Applied Sciences Dr. Madina Aliyarova, Almaty University of power engineering and Telecommunication Nurkanat Ailbayev, Stock company “UKTMP”				

[1] ASIIN Seal for degree programmes;
[2] TC: Technical Committee for the following subject areas: TC 01 - Mechanical Engineering/Process Engineering; TC 02 - Electrical Engineering/Information Technology;

Kamidolla Yerassyl Umirzakuly, student at Almaty University of power engineering and Telecommunication	
Representative of the ASIIN headquarter: Paulina Petracenko	
Responsible decision-making committee: Accreditation Commission for Degree Programmes	
Criteria used: European Standards and Guidelines as of May 15, 2015 ASIIN General Criteria, as of December 7, 2021 Subject-Specific Criteria of Technical Committee 02 – Electrical Engineering/Information Technology as of September 23, 2022 Subject-Specific Criteria of Technical Committee 04 – Informatics/Computer Science as of March 29, 2018	

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Electrical Power Engineering	Бакалавр техники и технологий / Bachelor of Engineering and Technologies	Electricity Supply	6	Full time	/	4 years / 8 semesters	240ECTS	Annually, 1st September 2019
Automation and Control Engineering	Бакалавр техники и технологий / Bachelor of Engineering and Technologies		6	Full time	/	4 years / 8 semesters	240ECTS	Annually, 1st September 2019
Electrical Power Engineering	Master of Science	Electricity Supply	7	Full time	/	2 years / 4 semesters	120 ECTS	Annually, 1st September 2019
Automation and Control Engineering	Master of Science		7	Full time	/	2 years / 4 semesters	120 ECTS	Annually, 1st September 2019

For the Bachelor's degree programme Electrical Power Engineering the institution has presented the following profile on their website:

"The purpose of the educational programme: Preparation of highly competitive and sought after in the labor market specialists for the energy sector of the Republic of Kazakhstan, meeting the needs and demands of today's market and international standards.

Graduates of the programme "Power engineering" can have the following positions: Director, master manufacturing site; head master; Maintenance Engineer; engineer repair; engineer; test engineers and regime adjustment of equipment; Electrical Engineer; Energy Engineer; Heating engineer; engineer electrical measurements; engineer of relay protection and automation; Engineer PCS; engineering equipment; Metrology engineer; shift supervisor shop etc.

[3] EQF = The European Qualifications Framework for lifelong learning

Places and items of professional activity of graduates: power plants and complexes based on traditional energy sources; electrical machines, transformers, electromechanical complexes and systems, including their management and regulation; electrical and electronic devices, systems and systems of electromechanical and electronic devices, automatic devices and flows of energy management systems; electric drive mechanisms and equipment and technological systems in various industries; various kinds of electric vehicles and tools to ensure effective functioning of the transport system; automatic power systems, converter devices, electric power, technological and auxiliary units, their automation, control and diagnostics; regulatory and technical documentation and standardization of systems, methods and test means and quality control of the electrical industry products, and electrical power supply systems, electrotechnological plants and systems."

For the Bachelor's degree programme Automation and Control Engineering the institution has presented the following profile on their website:

"Sphere of professional activity: Graduates are prepared for work in the field of automation, informatization and management in technical systems related to the application of information processing tools and methods for management in all areas of production.

Professional subjects: The subject of professional activity is the development, creation and operation of automated production systems; methods of analysis, forecasting and control of technological processes, technical systems and research facilities of high technologies.

Areas of professional activity: Engineering and scientific activities in the field of automation and control of technical systems and technological processes, as well as in the field of applied sciences and science-intensive production.

Content of professional activity: Service and operational activities: operation of automatic, automated and information systems, means of data transmission and information flows, diagnostics, monitoring and control, their technical, information, mathematical and software; prevention, repair, adjustment of technical means of automation and informatization, testing of technological equipment."

For the Master's degree programme Electrical Power Engineering the institution has presented the following profile on their website:

"The purpose of the educational program: Preparation of highly competitive and sought after in the labor market specialists for the energy sector of the Republic of Kazakhstan, meeting the needs and demands of today's market and international standards.

The list of professional positions: Maintenance Engineer; engineer repair; engineer; test engineers and regime adjustment of equipment; Electrical Engineer; Energy Engineer; engineer electrical measurements; engineer of relay protection and automation.

The area of professional activity: The set of technical means, techniques and methods for the production of human activity, transmission, distribution, transformation, application of electric energy, the control flow of energy, development and manufacture of elements, devices and systems implementing these processes."

For the Master's degree programme Automation and Control Engineering the institution has presented the following profile on their website:

"The purpose of the educational program: Training of engineering specialists in the field of automation and control, as well as scientific and pedagogical personnel

Training of specialists is carried out in two directions:

- profile (1.5 years);
- scientific and pedagogical (2 years).

Objectives of study in the master's degree:

- Formation of the skills of graduates to carry out integrated design, development and creation of algorithmic, hardware and software for automation systems, management and control of technological processes and industries.
- Formation of knowledge and skills in order to control automated complexes based on a systematic approach to solving problems.
- Formation of judgment, logical thinking of a graduate, allowing to carry out experimental research activities for analytical and experimental work and research, for diagnostics and assessment of the state of units and technological processes using the necessary methods and means of control and analysis.
- Formation of communication skills allowing to carry out scientific and pedagogical activities for carrying out research and experimental work using the necessary methods and means of management, control and analysis, as well as transfer existing knowledge and their rationale to specialists and non-specialists.
- Preparing a graduate for self-study and mastering new professional knowledge and skills, continuous professional self-improvement.

Professional competencies of the master are formed by the ability to carry out information-analytical and information-bibliographic work with the involvement of modern information

technologies; to generalize the results of experimental research and analytical work; the ability to apply methods of calculating elements and nodes of automation and control systems, to carry out design work and draw up design and technological documentation in accordance with standards, specifications and other regulatory documents; the use of information and computer technologies in the field of professional activity, the use of modern methods for the development of energy-saving and environmentally friendly automation and control systems.

Area of professional activity: Design of automated systems for various purposes, development of design and engineering and design and technological documentation, organization of automated production process control systems, research and innovation, pedagogical activities."

C Peer Report for the ASIIN Seal

1. The Degree Programme: Concept, content & implementation

Evidence:

- Self-Assessment Report (including learning module matrices)
- Discussions during the Audit
- Websites of all programmes
- Diploma Supplements for Ba Automation and Control Engineering
- Module Handbooks for all programmes

Preliminary assessment and analysis of the peers:
For the degree programmes under review, the higher education institution (HEI) presents a description of the learning outcomes in the self-assessment report (SAR). This description is accompanied by detailed learning module matrices for each programme, matching learning objectives, modules and the ASIIN Subject-Specific Criteria (SSC). The learning objectives of each individual module are also listed in the module descriptions. Furthermore, the objectives and learning outcomes of each programme are presented on the websites and the Diploma Supplements of the respective study programmes. They are thus transparent, binding and accessible to all stakeholders.

According to the Diploma Supplements the following learning outcomes should be achieved in the programmes:

<u>Ba Electrical Power Engineering</u>

- Mastering basic knowledge in the field of natural sciences (social, humanitarian, economic) disciplines that contribute to the formation of a highly educated person with a broad outlook and a culture of thinking
- Be able to organize workplaces, their technical facilities, position technical equipment in accordance with its production technology, standards of safety and industrial hygiene, fire safety and labor protection
- Be skilled in testing methodology, installation and maintenance of technological equipment in accordance with the profile of work

- Be skilled in handling modern technology, be able to use information technology in the field of professional activity
- Be ready to collect and analyze source data for the design of equipment items and objects of activity in general, using regulatory documentation and modern m ethods of information searching and processing
- Be involved in development of project design documents, design of completed design work in accordance with standards, specifications and other regulatory documents

Ma Electrical Power Engineering

- Possess the skills of perceiving and analyzing information of philosophical and production content, methods of conducting discussion and polemics
- To be able to correctly express a thought, reasonably defend one's own opinion on issues of industrial and social significance
- Have communication skills that allow you to effectively implement professional activities
- Search and process information using information technology
- Demonstrate knowledge that contributes to the formation of an integral personality in a social production environment and an increase in the responsibility of the individual
- Apply methods to ensure the effectiveness of social systems in the aspect of solving the assigned tasks
- To be able to analyze the feasibility and reliability of technical solutions in the electric power industry
- Be able to use computer and information technology in the aspect of the specialty
- Apply methods of mathematical analysis when solving engineering problems; identify the physical in nature of phenomena and processes
- Possess the ability of theoretical and experimental research in the electric power industry
- Apply electrical engineering design skills
- Be able to develop rational technical solutions in the electric power industry

Ba Automation and Control Engineering

- Specialized knowledge in the field of mathematics, natural sciences, humanities and economics.
- Ability to conduct experiments according to specified methods with the processing and analysis of results, to apply standard test methods in automation.

- Conduct a preliminary feasibility study of design solutions, carry out organizational and planned calculations for the creation or reorganization of production sites, plan the work of personnel and wages, apply progressive methods of operation.
- Ability to apply standard methods of calculating elements and assemblies of automation and control systems, to carry out design work and draw up design and technological documentation in accordance with standards, specifications and other regulatory documents, including using computer-aided design tools.
- Apply modern methods for the development of energy-saving and environmentally friendly automation and control systems that ensure the safety of life of people and their protection from the possible consequences of accidents, disasters and natural disasters.

Ma Automation and Control Engineering

- Demonstrate knowledge and understanding in practice of special mathematical knowledge using acquired competencies in undergraduate studies
- Transferring conclusions, knowledge and considerations to the audience and specialists, using modern means of obtaining, storing, processing information
- Can integrate knowledge for organizing, planning and conducting research.
- Use the opportunities of acquired communicative ability to clearly and clearly substantiate their findings and knowledge to specialists and non-specialists.
- They can continue training on their own to gain new knowledge, knowledge of aspects of integrated engineering activities, awareness of health issues, life safety and occupational safety
- Demonstrate knowledge and understanding of mathematical, natural, humanitarian and economic sciences in the development of control automation systems.
- Can apply the skills in practical use of methods of mathematical analysis, the basics of theoretical and experimental research in the field of automation in new or unfamiliar situations
- Can apply knowledge, understanding and problem-solving ability in new or unfamiliar situations and contexts within broader areas related to the field of study.
- Can integrate knowledge, deal with complex issues, and make judgments based on incomplete or limited information.
- Demonstrate knowledge that allows to develop a feasibility study of design solutions.
- Demonstrate knowledge that allows the use of modern methods of calculating elements and nodes of automation and control systems.

- They can continue training on their own to obtain new knowledge and apply knowledge in metrology to ensure compliance with the necessary requirements of modern technological processes
- Use the opportunities of acquired communicative ability to develop energy-saving and environmentally friendly automation and control systems

The peers discuss the learning outcomes of each degree programme, which can be found in their entirety in the annex to this accreditation report, with regard to the following criteria: the level of academic qualification aimed at, the respective ASIIN subject-specific label (SSC), whether the intended qualification profiles allow the students to take up an occupation corresponding to their education, which stakeholders are involved in the continuous assessment and further development of the objectives. The peers refer to the SSC of the Technical Committees Electrical Engineering and Information Technology as well as Mechanical Engineering as a basis for judging whether the objectives and intended learning outcomes of the degree programmes under review correspond with the criteria.

The peers conclude that the objectives and intended learning outcomes of all degree programmes under accreditation are well adapted to the demands of the Kazakh industry and labor market. As the programme coordinators declare in the audit discussions, it is their primary goal to train students for the regional industry. The peers learn for instance that there is a large number of industrial companies located near EKTU such as Kazzinc (a metallurgical company) and Ustkamenogorsk Hydroplant. However, the programme coordinators are currently also working on widening the possibilities of graduates so that they are be able to work in international companies as well. Analyzing the objectives and learning outcomes, the peers agree that the intended qualification profiles allow the students to take up an occupation corresponding to their education. Furthermore, they appreciate the abundance of career opportunities that are available to the students due to the thriving industry region of East Kazakhstan. This is also reflected by the statistics that indicate that 96% of graduates of EKTU find an employment within a year after their studies.

The close connection between EKTU and the local industry is also visible in the involvement of industry partners in the development of the curricula and the intended learning outcomes. Thus, industry representatives report during the audit that they are regularly consulted to give their feedback on the programmes. In fact, several industry partners are part of the academic council of EKTU, which results in their continuous involvement in all major changes in the study programs. Students equally state that their feedback for instance through evaluations is considered in the development of the curricula and the intended learning outcomes. The peers appreciate that all relevant stakeholders are included in the

process of formulating and further developing the objectives and learning outcomes of the programmes to be accredited.

Furthermore, the peers conclude that the formulated objectives and intended learning outcomes of all degree programmes under accreditation are consistent with the EQF levels aimed at and adhere to the relevant ASIIN SSC. However, the peers note that the formulation of the learning outcomes with regard to the graduates' specific skills and competencies in the different technical areas is not always clear and specific. While the objectives give a concrete overview of the possible occupations of the graduates, the description of the theoretical and practical skills to be achieved lacks preciseness. For example, according to the Diploma Supplement for the Ba programme Automation and Control Engineering, graduates should have the "ability to conduct experiments according to specified methods with the processing and analysis of results, to apply standard test methods in automation"; yet, it is not clarified what standard test methods are. The goal of acquiring "specialized knowledge in the field of mathematics, natural sciences, humanities and economics" is even more general und vague. Similarly, one objective in the Ma programme Automation and Control Engineering vaguely indicates that graduates should "demonstrate knowledge and understanding in practice of special mathematical knowledge using acquired competencies in undergraduate studies" but does not specify what special mathematical knowledge. Therefore, the peers insist that the learning objectives of all study programmes under review must be formulated clearly and precisely and give detailed information about the exact competencies students should acquire during their studies.

The experts identify the same issue on the level of the module descriptions. Here too a series of module descriptions features generic learning objectives. For example, the module "Robust Invariant Systems" in the Ba programme Automation and Control Engineering lists the following learning objectives:

"Knowledge: Parameters of multifactor models
Skill: The selection of the appropriate forecasting model, taking into account the characteristics of ATP
Formation of judgments: Assessment of the proximity and adequacy of the model
Communication skills: group work
Learning skills: independent model selection taking into account the characteristics of ATP elements"

The module description merely lists several general terms and does not specify the exact operational competencies that the students should achieve in relation to the mentioned topics. The experts identify various other module descriptions that contain vague references to the intended learning outcomes such as the modules "Algebraic theory of multidimensional control systems" and "Theoretical Framework of Optimal Management". Due

to the unclear documentation, the experts have difficulties in assessing the actual goals and contents of the modules and in determining whether they correspond to each other. In conclusion, the peers agree that the learning objectives need to be formulated more clearly and precisely at both programme and module level. In addition, EKTU needs to ensure that the content and level of the modules are consistent with the level of the intended learning outcomes.

In a similar context, the peers recognize that the theoretical level of the Ba programmes in Automation and Control Engineering and Electrical Power Engineering must be increased. They identify several modules, which strongly focus on the practical application of the subject and thereby resemble the level of an advanced training of a technician. Other modules, on the other hand, feature a higher theoretical level. Overall, however, the peers determine a definite need to elevate the theoretical part in terms of both width and depth in the Ba programmes. This issue will be presented in more detail in chapter 1.3 of this report.

Moreover, the experts suggest adding more transferable skills to the intended learning outcomes such as the ability to operate on technical working tasks in a team and to coordinate it if necessary, and to demonstrate an awareness of project management and business practices, such as risk and change management, and understand their limitations.

Criterion 1.2 Name of the degree programme

Evidence:

- Diploma Supplements for all degree programmes
- Module Handbook for all degree programmes
- Self-Assessment Report
- Discussions during the audit

Preliminary assessment and analysis of the peers:
The peers agree that the names of the degree programmes adequately reflect their respective aims, learning outcomes and curricula.

Criterion 1.3 Curriculum

Evidence:

- Study plans for all degree programmes
- Module handbooks for all degree programmes
- Self-Assessment Report
- Discussions during the audit

Preliminary assessment and analysis of the peers:
All the Bachelor programmes have a duration of four years, whereas the Master programmes have a duration of two years. In their self-assessment report as well as the module handbook, the university explains the individual competences and skills that are associated with each of these module groups and which individual modules are contained in which group. In the Bachelor programmes, students are taught general knowledge in areas such as “Modern History of Kazakhstan” and “Philosophy” in addition to the technical subjects. According to the self-assessment report, all Bachelor programmes at EKTU are divided into four academic cycles. The first cycle consists of general education modules, the second cycle of basic modules in the technical subjects, the third cycle of specialized modules in the technical subjects and the forth cycle of the completion of the final project. The Master programmes are structured similarly: The first cycle is composed of basic modules in the technical subjects, the second cycle of specialized modules in the technical subjects, the third cycle of additional training and the forth cycle of the completion of the Master’s thesis. In terms of the additional training, the students are carrying out advanced research projects and/or pedagogical training in order to prepare for their future career as researchers and lecturers.

As already mentioned in chapter 1.1 of this report, the intended learning outcomes for all programmes under review and the content of the modules are not fully congruent. Hence, it does not become completely clear from the module descriptions and the structure of the curriculum how the module contents contribute to achieving the intended learning outcomes. For example, according to the programme description of Ba Automation and Control Engineering, the programme covers a high number of subjects and topics. However, most of these topics are not listed in the module descriptions of the modules. Similarly, the module handbook of the Ba programme Electrical Power Engineering includes the modules “Nanotechnologies and Power Engineering” and “New Electrotechnical Material”. Yet, the module descriptions of these modules do not reflect the content of the titles. In addition, the module descriptions of the modules’ learning outcomes and content are formulated quite vaguely, which is why the experts have difficulties gaining a clear image of the scope and the depth of the individual modules. For example, while some module descriptions go into great detail about the content of the modules, others only superficially describe the their topics. The peers therefore come to the conclusion that the module handbooks do not transparently mirror the actual contents covered in the programmes, which complicates the assessment of the curricula. As discussed further in chapter 5.1 of this report, the peers request that the module descriptions must be revised so that they include precise and accurate descriptions of the module content.

Furthermore, the peers identify a deficit in terms of structure and content of the curricula. They remark that the content of various modules does not match the level described by the intended learning outcomes. This is particularly visible in the Ba programmes. After the revision of the module descriptions and exemplary exams and final projects, the peers conclude that the level of some modules does not correspond to the level indicated by the intended learning outcomes. As already mentioned in chapter 1.1, many modules focus on the basics in the respective technical fields of the two programmes. In addition, several modules have a strong focus on the practical application of the subject. After the inspection of the final bachelor projects, the peers furthermore remark that the final project resembles more a report, where the learning results of the entire Ba programme are reproduced rather than an individual research project. Thus, the peers could not clearly identify elements of the students' autonomous research and analysis in the project reports. This issue will be discussed in more detail in chapter 3 of this report.

The peers also see the time designated for lectures as another reason for the insufficient level of theory in the study programmes. As will be outlined in more detail in chapter 2.2, a typical 5 ECTS module contains 15 hours of lecture. According to the experts, this period is scarcely sufficient to cover the theory in the necessary breadth and depth. Furthermore, examples of the lab classes, which are often held complementary to the lectures, left the peers with the impression that the experiments are on a very basic level.

The peers are convinced that EKTU will manage to take this into action in the near future due to the programmes' potential that is already visible in various modules. Thus, the experts recognize various modules that cover advanced content and theory and, in which students independently work on developing software and applications. Exemplary modules are "Developing Problem-Oriented Web Applications" or "Software for Control Devices" in the Ba programme Automation and Control Engineering, in which students for instance carry out experiments with virtual reality tools. The peers also appreciate the usage of Festo labs in the Ba programme Automation and Control Engineering, which corresponds to up-to-date developments in the discipline.

In terms of the variety and topicality of topics covered by the study programmes, the experts conclude that the majority of the courses cover standard topics of the respective technical field while only few courses address subjects that are part of current scientific discourses. As already mentioned, the degree programs are largely aligned and adapted to the requirements of industry. As a result, the curricula of the degree programs focus predominantly on standard topics of the respective disciplines. This is particularly visible in the Ma programme Automation and Control Engineering. The experts note that currently relevant topics such as Mobile Robotics, I4.0 (integration of plant automation into corporate IT), Wireless Communication including IoT, Model based Controller Design (i.e. LQR/LQG,

Robust Controller Design, Modell Predictive Control), System Identification, and Filtering are not addressed in the study programme. Furthermore, they remark that many of the existing elective modules teach very similar content. The peers therefore recommend introducing more elective modules in the study programme that cover attractive topics and reflect the state of the art in automation and control technology. This issue if further discussed in chapter 2.1 of this report.

The peers also inspect and discuss the subject of microcontrollers in the Ba programme Automation and Control Engineering. In the discussion with the teachers, they are informed that an external teacher/professor from Hungary teaches the module that specifically targets the instruction of "Microcontrollers". For this reason, the class is held online. The teachers report that microcontrolling is shown in simulation only since they do not have a microcontrolling lab. The peers agree that due to the lack of a microcontrolling lab and the opportunity to program microcontrollers, the students are missing a relevant competence. Another consequence is that the lecturers are not able to teach anything beyond circuit theory and thus are not able to cover an essential part of automation and control engineering. Therefore, the peers insist that EKTU establishes microcontroller lab in order to teach students the topic of microcontrollers and its programming sufficiently in width and depth.

The peers conclude that the level of complexity and theory varies in the modules of the two BA programmes. They request that the level of theory is raised in the overall curricula in order to ensure that the modules allow the students to achieve the intended learning outcomes. In addition, the topic of microcontrollers and its programming must be integrated within the framework of an advanced microcontroller lab.

Criterion 1.4 Admission requirements

Evidence:

- "Admission Rules for Students of Degree Programs of Graduate and Postgraduate Education of NJSC "EKTU named after D. Serikbayev'"
- Self-Assessment Report
- Discussions during the audit

Preliminary assessment and analysis of the peers:
Based on the documents defining the admission requirements, the peers learn that most of the admission policy is centrally regulated and follows next to the general regulations issued by the Ministry of Education and Science of the Republic of Kazakhstan. At the local level, the admission rules are published in the "Admission Rules for Students of Degree

Programs of Graduate and Postgraduate Education of NJSC “EKTU named after D. Serikbayev’”. Generally, people with a secondary, technical, vocational, post-secondary, or higher education are admitted to a Bachelor programme at EKTU. Furthermore, students interested in one of the Bachelor’s degree programmes under review need to have completed the single national testing (UNT) in three mandatory sub-jects, which are Mathematical literacy, Reading literacy, and History of Kazakhstan, and in the two specialized subjects Mathematics and Physics. According to the self-assessment report, applicants must score at least 50 points, including at least 5 points in each discipline; the maximum score is 140. Applicants for the largest number of points on a competitive basis are awarded state grants. Applicants who do not pass the competition, but have reached the threshold level of points, are entitled to study on a paid basis. Admission of foreign citizens is carried out based on the results of an interview conducted by the selection committee. Educational documents issued by foreign educational organizations are recognized by EKTU in accordance with the procedure established by law in accordance with the Rules for the recognition and notification of education documents.

Statistics of both Ba programmes under review show that the number of applicants and admitted students has been growing in the last years. In 2017 in the Ba programme Electrical Power Engineering, there were 277 applicants and 68 enrolled students. In 2021, there were 423 applicants and 176 admitted students. Similarly, in 2017 in the Ba Automation and Control Engineering 83 people applied for the programme and 26 were admitted. In 2021, there were 189 applicants and 37 admitted students. The peers welcome the admission requirements and the continuous growth of enrolled students, which mirrors the demand of graduates in the fields of study programmes.

In order to be admitted to one of the Master programs under review, students need to have completed a higher education program. In addition, students interested in a Master programme must participate in a competitive test (CT) in which the student’s knowledge in a foreign language, their expertise in a group of programs and their readiness for training are assessed. The CT is carried out by the National Testing Center of the Ministry of Education and Science of the Republic of Kazakhstan. According to the admission requirements defined by EKTU, “enrollment of citizens in the magistracy on a paid basis is carried out based on the results of CT in accordance with the Scale of 150-point grading system for CT in the magistracy with the Kazakh or Russian language of instruction: at least 50 points, while in a foreign language - at least 25 points, according to the profile of the group educational programs: with the choice of one correct answer - at least 7 points, with the choice of one or more correct answers - at least 7 points, on the Studying readiness test - at least 7 points”. After the analysis of the number of applicants and enrolled students in the Ma

programmes to be accredited, the peers note a partial increase in students in these programmes. Thus, in 2017 in the Ma programme Electrical Power Engineering, there were 6 applicants and 3 admitted students. In 2021, the number rose to 20 applicants and 10 admitted students. In the Ma programme Automation and Control Engineering, however, the number of applicants and enrolled students have remained more or less the same. In 2017, there were 17 applicants and 15 admitted students. Against the background that Master degree programmes are mainly pursued by students intending to be academic scientists or teachers or intending to deepen their knowledge after already having started a professional career, the peers are overall satisfied with the number of enrolled students in the two Master programmes.

In conclusion, the auditors find the terms of admission to be binding and transparent as they are available on the website of EKTU in both Russian and English. They confirm that the admission requirements support the students in achieving the intended learning outcomes.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 1:

The experts examine EKTU's statement but do not consider the information provided to be sufficient to overcome most of the deficiencies they have identified in the programmes. Therefore, they insist that EKTU defines concrete and precise learning outcomes both on programme and module level. In addition, EKTU must ensure that the module outcomes correspond with the programme outcomes and reflect the module contents. This is particularly important so that the experts have a clear overview of the content taught in the programmes. Furthermore, they agree that the theoretical level in the two Bachelor's degree programmes must be increased.

EKTU comments on the experts' criticism regarding the lack of microcontroller programming in the Bachelor programme Automation and Control. EKTU explains that they provide practical microcontroller exercises in various (multi-purpose) labs. Furthermore, the students receive the opportunity to attend an online microcontroller course, hold by a lecturer from Obuda University, Hungary. By applying the theoretical knowledge to microcontroller hardware, students deepen their knowledge on microcontrollers. Since EKTU offers students the opportunity to learn the theoretical basics of microcontroller programming and apply them to microcontroller hardware, the experts consider the deficit to have been resolved. Nonetheless, they recommend establishing a designated laboratory for the purpose of programming microcontrollers.

Moreover, the experts recommend in all programmes to increase the time designated for lectures in order to cover the subject material in more breadth and depth.

The Criterion is not fulfilled.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- Self-Assessment Report (including learning module matrices and study plans/curricula)
- Module Handbooks for all programmes
- "The Regulations on the Procedure for recognition of the results of non-formal Education in D. Serikbayev East Kazakhstan technical University"
- Exemplary transcripts for academic mobility
- Discussions during the Audit

Preliminary assessment and analysis of the peers:
The study programmes under review are divided into modules, which comprise a sum of teaching and learning. Furthermore, the Ba programmes are structured in "Major" (main educational programme) and "Minor" (additional educational programme). Modules of the major include compulsory and elective modules in the core subject area of the programme. A minor constitutes an optional technical specialization that allows students to design an individualized course of study. Minors consist of three modules, which are studied in the second and third year of Ba programmes. Each module is credited with 5 ECTS points, resulting in a total of 15 ECTS for all minors. All minor modules are taught on a specific day to avoid overlap with other major modules. During the audit, the peers are informed that there are currently ten minors offered at the Institute of Power Engineering and Machine Building and the Institute of Automation and information Technology. Students report that the range of minor subjects is published transparently on the university's website and that students have the opportunity to suggest another subject to the pool if they feel that an important subject is missing. Furthermore, lecturers present the content of all current minors at the end of every academic year so that students can gain a deeper insight into the minors offered. The peers appreciate the division of the programmes into major and minor so that students can develop an expertise in a technical field of their choice.

The Master programmes also offer students the opportunity to develop a specialization by taking elective courses worth up to 35 ECTS credits. However, as discussed in chapter 1.3,

the experts note that particularly in the Ma programme Automation and Control Engineering the electives largely cover standard topics. The peers therefore recommend introducing elective modules in the study programme that cover more attractive topics and reflect the state of the art in automation and control technology. They suggest establishing modules, which cover for example Mobile Robotics, I4.0 (integration of plant automation into corporate IT), Wireless Communication including IoT, Model based Controller Design (i.e. LQR/LQG, Robust Controller Design, Modell Predictive Control), System Identification, and Filtering, Telecommunication Technology, Digital circuit design, and advanced computer architecture.

As noted in Section 1.3 of this report, the peers note that the degree of complexity and depth with which module content is covered varies from module to module. While some modules explore the respective subject in great detail and teach advanced theories, other modules such as "Robust Invariant Systems" and "Algebraic theory of multidimensional control systems" cover the subjects only superficially. Moreover, the peers cannot see exactly how the modules of an individual programme are connected to each other in all programmes to be accredited. They are missing a strategy behind the composition and constellation of the modules that clearly illustrates how the modules build on each other. The structure of the modules should show the technical connections between the topics of the modules and the pedagogical strategy that will allow students to develop their skills and knowledge in the discipline so that the intended learning outcomes are achieved. In addition, the peers agree that the module arrangement should reflect the roadmap the students may follow, and this aspect, for instance, may be illustrated with a diagram that shows the links between the modules.

Mobility

According to the self-assessment report and further documents, EKTU has collaborations with a large number of universities abroad. Stakeholders can view the entire lists of partner universities on the website of EKTU. These include, for example, Hoseo University in South Korea, University of Cadiz in Spain, Lublin University in Poland, and the Massachusetts Institute of Technology in the USA. In addition, EKTU collaborates with a number of companies abroad such as Alfred Wertli AG in Switzerland and Interactive Corporation in Japan. The recognition of achievements acquired at these partner institutions is ensured through an academic agreement. All students participating in academic mobility receive a transcript confirming the acquisition and recognition of credits. Generally, the rules for the recognition of achievements and competences acquired outside the higher education institution can be found in the binding document "The Regulations on the Procedure for recognition of the results of non-formal Education in D. Serikbayev East Kazakhstan technical University" on the website of EKTU.

Next to student mobility, EKTU also offers teachers and researchers opportunities to participate in an international exchange programme. According to the self-assessment report, each year the faculty hosts a foreign lecturer/researcher and/or sends one of its lecturers abroad. In 2019 for instance, Professor Daria Lvovna Alontseva taught several lectures at the University of Obuda, Budapest, and Sekeshfekhervar in Hungary. Associate professor Olga Yakolevna Shvets participated in a research project at the Berlin Technical University. The peers appreciate that EKTU encourages both students and staff to participate in international exchange programmes and conclude that the university provides an appropriate framework for conducting academic mobility. They particularly welcome the process of recognition of achievements acquired externally.

Criterion 2.2 Work load and credits

Evidence:

- Module handbooks for all degree programmes
- Study plans for all degree programmes
- Self-Assessment Report
- „Interim, Final Control and assessment of student knowledge in NJSC 'EKTU named after D. Serikbayev' Documented procedure"
- Exemplary teaching surveys
- Discussions during the audit

Preliminary assessment and analysis of the peers:
EKTU uses the ECTS Users' Guide for the calculation of the credits. One ECTS point corresponds to 30 hours of study time, which includes teaching and self-study time. The SAR and the study plans illustrate that the workload is evenly distributed in all programs. Thus, the total amount of the planned student workload does not exceed 60 ECTS credits per academic year in all programs. The workload of most modules is structured so that approximately 30% of the study time is contact hours spent in the classroom, while approximately 70% of the time is devoted to students independently studying. The 30% contact hours are in turn divided into lecture and practical hours and - depending on the module - also laboratory hours. In most cases, about 30% of the contact hours are lecture hours and 70% are practical hours and, if applicable, laboratory hours. In the example of a 5 ECTS module (which makes up most modules in Ba degree programs), 45 hours are contact hours, of which 15 hours are for lectures and 30 hours are for practical hours. The remaining 105 hours are for students' independent study. During the audit, the teachers throw light on

the term “practical hours”. They explain that these are usually conducted in the form of seminars, in which students have to solve tasks both individually and in groups.

In the students discussion round, the students report that they are familiar with the work-load regulations and that all teachers follow these norms. Therefore, the work load is evenly balanced and manageable. Furthermore, regular teaching evaluations assess and monitor the students’ actual workload. The peers are satisfied to hear that the workload norms are transparently communicated and that all teachers follow these regulations so that no peaks in the work load emerge.

However, as mentioned in chapter 1.3, the experts view the time designated for lectures as insufficient. Specifically using the example of a typical 5-ECTS module, which makes up most modules in Bachelor programmes, the experts consider 15 hours of lecture time to be quite low and recommend increasing lecture time to allow the teachers to cover the material in greater breadth and depth and thus increase the level of theory in the programs.

As the statistical data provided by EKTU shows, the average time students require to complete their studies corresponds roughly to the expected time of eight semesters in the Bachelor programmes and four semesters in the Master programmes. The data verifies that all four degree programmes under review can be completed in the expected period.

Criterion 2.3 Teaching methodology

Evidence:

- Module handbooks for all degree programmes
- Self-Assessment Report
- Discussions during the audit

Preliminary assessment and analysis of the peers:
From the presented material as well as the discussions on site, it becomes apparent that members of EKTU are invested in offering students a high quality of teaching and overall studying experience. According to the self-assessment report, it is the goal of the university to form professionally competent, competitive and culturally developed graduates, who is a modern specialist in the respective technical field. To achieve this goal, the composition of teaching methods integrates knowledge from a variety of discipline: humanitarian and cultural, socio-economic, psychological, pedagogical and technical fields. The peers appreciate this strategy. However, they cannot formally assess the different forms of teaching methods applied in the programmes under review since they are not listed in the module handbooks (see chapter 5.1). In the audit discussions, the peers are informed that teachers

employ a variety of teaching forms and methods. Next to lectures and seminars, students participate in laboratory sessions carrying out practical tasks, roundtable discussions and internships. Furthermore, it is a common practice among teachers to implement problem-based learning and the teaching format of the flipped classroom. The students report that they are satisfied with the variety of teaching forms and particularly welcome interactive formats such as roundtable discussions. The peers appreciate the diversity of teaching methods and the continuous efforts of the teaching staff to develop new methods. As already mentioned, the work load/study time is roughly divided into 30% teaching time and 70% independent study time. As mentioned before, the experts consider the time designated for lectures as insufficient and recommend increasing lecture time so that the material is covered in greater breadth and depth, which in turn should lead to an increase of the level of theory in the programmes. In addition, several examples of laboratory work left the experts with the impression that the tasks that are carried out during lab classes remain on a basic level. Along with the required raise in the study and application of advanced theories, the peers see the need to raise the complexity of practical classes. Furthermore, the peers suggest defining and documenting the teaching forms of the practical classes and exercises in more detail to allow for a better understanding.

As mentioned in chapter 1.3 of this report, the Bachelor programmes include only few research elements such as the final thesis. In the Master programmes, however, various compulsory modules require the students to carry out research independently. Examples include the modules “Research Project Including Internship and Master Thesis”, “Research Practice”, and “Organization and Planning of Research”. The peers consider the amount and quality of research carried out in the Master programmes to be moderate but worthy of improvement. To conclude, the masters theses do not reveal skills in applying theoretical knowledge for advancing system development. In addition, theses researching the robustness, precision, and validity of the results of other R&D groups are missing.

Criterion 2.4 Support and assistance

Evidence:

- Self-Assessment Report
- Discussions during the audit

Preliminary assessment and analysis of the peers:

In order to support students in completing their studies on time with good achievements, the university and the faculty provide academic and personal support and assistance through various means. The offers can be divided into two types: academic support and non-academic support. Academic advice includes the academic advisors, the international

office, the programme coordinators, the Dean and the supervisors for the theses. Non-academic support comprises the medical centre, sports facilities, the language centre, the career centre, the central library, computer laboratories and student dormitories.

The main contact person for every student is their academic advisor, who is assigned to them in their first semester. An academic advisor shall help them develop an adequate schedule for their studies, choose electives according to their skills and interests and support them in case of academic and non-academic problems. Each student meets his or her academic advisor on a regular basis, who is also responsible for monitoring the study progress. The academic advisor also has to approve the student's study plan for the semester. As the peers learn and highly appreciate, the study progress is not only monitored by the academic advisor on an individual basis, but the faculty is automatically alerted when students fall below a certain number of credit points per semester and are thus threatened with dropping out. In these cases, additional advice can be provided. Therefore, at the beginning of each semester, GPA provides direction for the students regarding their study plans, targets to be achieved and strategies for selecting courses. During the semester, GPA monitors the academic progress of the students. At the end of the semester, GPA evaluates the student's achievement under their supervision by checking the GPA that the students achieve.

Furthermore, there is supporting staff in the international office, the career center and the general academic administration. The career center regularly organizes job fairs, seminars with potential employers, trainings for writing applications etc. in order to support the students in their career planning. Moreover, there are many scholarships offered to students, (e.g. from private companies, the government or other foundations). This includes scholarship for students from low-income families and for those with high academic achievements. New students can attend classes to develop their effective learning and soft skills.

In addition, every student who enrols for the thesis course will be assigned one or two thesis supervisors. The role of the thesis supervisors is to help students to complete their thesis research; they also monitor the progress of the thesis in order to ensure the completion of the thesis in the intended amount of time. The students confirm towards the peers that they are supervised in the research group during their work on the thesis. There are regular meetings where the students present their results and receive feedback from the other members.

All students at EKTU have access to the online-learning site (LMD platform or Moodle). By using those two platforms, lecturers can upload their syllabus and learning materials or modules as well as assignment for students. Through those platforms, students can also interact with other students and lecturers.

The peers conclude that there are enough resources available to provide individual assistance, advice, and support for all students. The support systems help the students to achieve the intended learning outcomes and to complete their studies successfully and without delay.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 2:

The experts examine EKTU's statement but do not consider the information provided to be sufficient to overcome the deficiencies they have identified in the programmes. Therefore, they require that EKTU develops a strategy to design all modules homogenously and in consistency with each other. Furthermore, they recommend in the Master programme Automation and Control to offer the students a wider range of optional subjects, in which the students can develop a specialization.

The Criterion is partly fulfilled.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Self-Assessment Report
- Module descriptions for each degree programme
- Websites
- Academic regulations
- Sample written exams and final theses

Preliminary assessment and analysis of the peers:

Each course has to determine objectives, which support the achievement of the Programme Learning Outcomes of the respective programme. Accordingly, each course must assess whether all defined learning outcomes stated in the module descriptions have been achieved. For this purpose, EKTU utilizes various types of examination.

In each course, assignments as well as a mid-term and a final examination are employed. There are different assessment methods in the programmes, such as written tests, practical

performances, assignments, small projects, oral tests and presentations. In most courses, mid-term and final exam consist of written tests and additional assignments are used. However, the other assessment methods are also used to a certain degree. Via the Academic Calendar, the students are informed about mid-term and final exams. The form and length of each exam is mentioned in the module descriptions that are available to the students via EKTU's homepage and in the internal university system known as LMS platform or Moodle.

The final grade of each module is calculated based on the score of these individual kinds of assessment, whereby the lecturer determines the ratio between them in accordance with the Academic Guidelines. The exact formula is given in the module handbook. At the first meeting of a course, the students are informed about what exactly is required to pass the module and about how the final grade is determined through the teaching and learning plan. EKTU uses a grading system with the grades A, A-, B+, B, B-, C+, C, C-, D+, D, FX and F, where a D (equivalent to a Grade Point of 1) is necessary to pass a module.

Based on the academic regulation to be eligible to take final exam, students must attend at least 50 % of the total course sessions. Students who have obstacles due to illness or other reasons and are not able to fulfil 50% of the total course sessions need to inform the academic supervisor and related lecturers. The arrangement to re-sit an exam can be adjusted in advance as compensation for the student's disability by providing the evidence. Furthermore, students who are not able to attend the final exam due to illness or other reasons can provide proof and take the follow-up exam scheduled by the study programme.

The peers discuss with the students the organization and feasibility of the exams. They learn that the exams are evenly distributed so that there are always a few days between the individual exams. The students furthermore confirm that the teacher chooses and communicates the form of the exam at the beginning of the course. Occasionally, teachers also ask students about their desired exam format and follow the students' request. Overall, the students report to be satisfied with the variety of exam forms. With regard to the feasibility of the exams, students indicate that while some exams are more difficult than others, on average all exams are feasible. Finally, students also confirm that they are well informed about the examination schedule and the rules for grading.

Every student is required to do a thesis in the last year of studies. Usually, two research supervisors supervise a student's final thesis. One will act as the principal supervisor and the other act as co-supervisor. In case the student writes her or his thesis in collaboration with the industry, she or he is also assigned a supervisor from the industry. After completing the work on the thesis, the student has to present and defend the results in front of

teachers and fellow students. In terms of the process of finding a suitable topic of the final project or thesis, there are two possibilities: either students can propose their own ideas or they can ask their academic advisor or other teachers for suggestions. In the Bachelor programmes, the final thesis is credited with 12 ECTS and includes writing and defending the final thesis. In the Master programmes, the students' research work is distributed over several modules and semesters. Thus, in the framework of the module "Research Project Including Internship and Master Thesis" that students have to complete every semester and the module "Research Practice", students acquire 33 ECTS and develop a certain research profile. The previous research modules serve as the basis for the "Final Attestation" (12 ECTS), in which the students write and defend their thesis. As part of the Master studies, students have to carry out a scientific internship in scientific organizations and/or organizations of relevant industries.

During the on-site visit, the peers were provided with a selection of exams and final projects to check. The peers confirm that the exemplary exams and theses in the Master programmes correspond to EQF level 7 and illustrate students' abilities to carry out research and solve complex problems. However, they see room for improvement here, as the master theses do not reveal skills in applying theoretical knowledge for advancing system development. Overall, they consider the amount and quality of research carried out in the Master programmes to be moderate but worthy of improvement. Therefore, the experts recommend enhancing the level of the Master thesis so that students demonstrate their ability to apply theoretical knowledge to the advancement of systems. More precisely, the peers agree that the master thesis should feature a clear and logical structure including a thorough SOTA (State of the art analysis) from which research or technical problems / questions not yet addressed are derived. The definition of the research/technical question and methods should be based on the previous step. In addition, the master thesis should exemplify that claims or conclusions are justified by the students' calculations or measurements or by referring to results of other or R&D groups.

With regard to the Bachelor programmes, on the other hand, the exemplary exams and theses reveal deficits in the Ba programmes. As already mentioned in chapter 1.1 and 1.3 of this report, the peers identify an incongruence between the programme learning outcomes and the actual level of several modules. This discrepancy is evident in various exams, in which students do not demonstrate their knowledge of advanced theory and, in particular, in the final thesis. According to the peers, the exemplary theses do not resemble a standard academic thesis, in which a student demonstrates that he or she is capable of independently researching, analyzing, and solving a problem. Instead, the theses rather resemble a summary of the students' knowledge acquired over the course of their studies or

a report of an internship. Therefore, the peers are missing elements of advanced and innovative research and analysis in the thesis. They conclude that the content and structure of the Bachelor thesis must be changed so that it demonstrates that students are able to work independently on a task at EQF level 6. They recommend formulating and establishing a procedure, which all students have to follow to accomplish their final thesis. This should ensure that the final thesis matches the corresponding level. The peer panel sees a link here between the insufficient amount of students' research in the Bachelor thesis and the low level of theory in some of the Bachelor modules. As described in chapter 1.3, they believe that an increase in the overall level of theory, research and complexity of subjects in the Bachelor programmes is necessary to align the curriculum with the intended learning outcomes of the Ba programmes.

The peers conclude that the criteria regarding the examinations system, concept, and organization are fulfilled. Furthermore, they confirm that the examination and final thesis in the Master programmes are suitable to verify whether the intended learning outcomes are achieved or not. However, the Bachelor thesis does not correspond to EQF level 6 in the sense that students do not demonstrate their capability of independently carrying out a project on a complex research topic.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 3:

The experts examine EKTU's statement but do not consider the information provided to be sufficient to overcome the deficiencies they have identified in the programmes. As the sample Bachelor theses provided by EKTU resemble more the repetition of content learned throughout their studies, the experts insist that the Bachelor theses must demonstrate that the students are able to work independently on a task at the level of the degree programme. In addition, they recommend that the scientific level of the Master thesis be raised so that students demonstrate their ability to apply theoretical knowledge to the advancement of systems.

The Criterion is not fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:

- Self-Assessment Report
- Staff Handbook
- Samples of lecturer evaluation by students
- Study plans of the degree programmes
- Module descriptions
- Websites
- Discussions during the audit

Preliminary assessment and analysis of the peers:
At EKTU, the staff members have different academic positions. There are professors, as-associate professors, senior teachers and teachers. The academic position of each staff member is based on research activities, publications, academic education, supervision of students, and other supporting activities. For example, there are teachers who hold a Master's degree and teachers who hold a PhD degree. A full professor needs to hold a PhD degree. The main difference of tasks and responsibilities based on academic staff position lies on the proportion of teaching and research activities. The higher the academic staff position is, the greater is the proportion of research activities, but the lower is the proportion of teaching activities. The latter may become professors once they have earned a certain amount of credits with regard to their academic work.

There are 30 teaching staff for Ba programme Electrical Power Engineering (9 associate professors, 16 senior lecturers, and 5 lecturers), 9 for the Ma programme Electrical Power Engineering (1 professor, 3 associate professors, and 5 senior lecturers), 25 for the Ba programme Automation and Control Engineering (5 associate professors, 19 senior lecturers, and 1 lecturer), and 9 for the Ma programme Automation and Control Engineering (2 professors, 2 associate professors, and 5 senior lecturers). The number of teaching staff with a PhD is as follows: 16 for the Ba Electrical Power Engineering, 9 for the Ma Electrical Power Engineering, 22 for the Ba Automation and Control Engineering, and 9 for the Ma Automation and Control Engineering. During the audit, the peers are informed that there are different terms for PhD degrees in Kazakhstan depending on when the scientists finished their PhD. Scientists, who accomplished their doctoral degree before 2010, were given the title "Candidate". After that, the Kazakh ministry changed the title to doctorate/PhD.

These numbers mean that the ratio between academic staff and students is approximately 1:12 in all four degree programmes. In addition, the faculty regularly invites visiting lecturers from Kazakhstan and abroad to facilitate academic exchange. The academic staff is

supported by a considerable number of administrative and technical employees at department, faculty, and university level.

The academic staff is actively involved in research projects funded by grants from the Kazakh government, the university itself or other research funds, which results in a reasonable number of publications per year. EKTU positions itself as a university with a practice-oriented focus and therefore a strong cooperation with key industrial partners, which the peers appreciate. They learn that, within this framework, students can also be involved in research projects, for instance through their theses.

The peers ask about the share of teaching and the share of research of the teaching staff. They learn that the workload and its distribution depends on the position of the teacher. According to the programme coordinators, often about 35% of the overall working hours is invested in teaching, while 45% is research and 20% administrative/planning tasks. This means that, depending on the semester, of the total 1.500 hours per year, about 600 hours are used for teaching and 900 hours for research and administrative/planning tasks. The peers support this approach, because EKTU claims to offer predominantly practice-oriented education, which is also confirmed by the very strong connection to industry (in terms of internships, theses, guest lecturers etc.).

In summary, the peers highlight the well qualified and engaged staff members and confirm that the composition and scientific orientation of the teaching staff are suitable for successfully implementing and sustaining the degree programmes. Both students and staff members confirm that in case of questions or problems, there is always an academic advisor available to solve the issues together with the student.

Criterion 4.2 Staff development

Evidence:

- Self-Assessment Report
- Staff Handbook
- Discussions during the audit

Preliminary assessment and analysis of the peers:
According to the self-assessment report and the discussions during the on-site audit, EKTU encourages the continuing professional development of its staff. For this purpose, various opportunities are provided. There is a mandatory didactic training for new academic staff that encompasses curriculum design, teaching material, and innovative teaching and learn-

ing methods. Moreover, workshops are held to refresh and to deepen various didactic competences in each semester. The lecturers can also regularly participate in external didactical trainings offered and funded by the government. Senior lecturers must mentor and train the newly recruited staff. The junior staff has to assist the senior as a sit-in lecturer for a minimum of one year.

The teaching staff is encouraged to study abroad or to participate in international research projects and conferences in order to enhance their knowledge, increase their English proficiency and to build international networks. For this purpose, the university informs about possible scholarships to support academic mobility. In general, the staff exchange is managed and under the coordination of the Faculty of Professional Development (FPD) of EKTU. For junior lecturers with a master's degree, EKTU offers systematic training to prepare them for acquiring a PhD abroad, for instance through English courses, information on foreign education systems, administrative support, and supporting (international) research collaborations. According to the professional development overview provided by EKTU, in the last five years, a few lecturers from the four study programmes under review have been involved in international activities. After reviewing the data on in-going and out-going lecturers, however, the peers conclude that there has been only little academic exchange activity in the department in the last seven years. In addition, EKTU cooperates mainly with universities in Russia and East Europe. Therefore, the experts recommend strengthening the international cooperation and widening the scope of the cooperating universities.

Criterion 4.3 Funds and equipment

Evidence:

- List of equipment
- On-site visit of the institution
- Self-Assessment Report
- Discussions during the audit

Preliminary assessment and analysis of the peers:

The university and the faculty are mainly funded by the Kazakh government and the community, through tuition fees and through grants for research projects in collaboration with industry. The figures presented by the university show that the faculty's income is stable and the funding of the degree programmes is secured. The academic staff emphasize that from their point of view, all four programmes under review receive sufficient funding for teaching and learning activities as well as research, which results in well-equipped facilities

and good access to literature, databases and modern software. The students confirm this positive impression and state their satisfaction with the available resources.

In the self-assessment report, EKTU gives an overview of the available learning spaces and the library. Moreover, they list information on the software licences, laboratories and equipment used in the four study programmes under review. During the on-site visit, the university showed the peers the relevant research and teaching facilities and, in particular, the different laboratories available for the four study programmes. These include the Centers for Competence and Technology Transfer in the fields of both automation and mechatronics as well as energy. They visit, for example, the laboratory “Industrial controllers” used in the Automation and Control programmes to develop practical skills in programming industrial controllers. In the context of the Electrical Power Engineering programmes, the peers visit, among other things, laboratory for high voltage tests and asynchronous motors.

The peers appreciate the general learning spaces and resources provided by the library. Furthermore, they deem the research and teaching facilities sufficient for the execution of the four study programmes. However, as mentioned in chapter 1.3 of this report, the peers are missing evidences to what extent the subject of microcontrollers is taught in the Bachelor programme Automation and Control. Yet, the topic of microcontrollers and its programming is essential for a study programme focussing on Automation and Control. The peers, therefore, require that a laboratory for the purpose of programming microcontrollers is established.

In addition, the experts generally see room for improvement with regard to the laboratories and the equipment used in the study programmes under review. The available laboratories and equipment are sufficient to enable students to learn and practice the study subjects on a fundamental level. Yet, the peers recommend adding further laboratories and equipment that go beyond the essential needs of the study programmes. As was mentioned in chapter 1.3., the experts recommend introducing elective modules on the topics of robotics, I4.0, whireless communication including IoT, model based controller design, System Identification, and Filtering. To supplement theoretical instruction in these subjects with practical application, they recommend the establishment of laboratories with suitable equipment. They suggest, for example, creating a lab for the experimentation with computer vision.

In order to assess future changes of the laboratories and the equipment adequately, especially the establishment of a high advanced laboratory for microcontrollers, the peers insist that a follow-up visit be conducted.

In summary, the peer group judges the available funds, the technical equipment, and the infrastructure (laboratories, studios, library, seminar rooms etc.) to comply largely with the

requirements for adequately sustaining the degree programmes. However, they require to add a high advanced laboratory for microcontrollers and generally expand the laboratories in all four study programmes.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 4:

Due to the non-transparent documentation and the labs, which show possibilities for improvement and expansion, the peers conclude that a follow-up visit needs to be carried out to assess the changes in the labs and the general state of the programmes.

As mentioned in chapter 1.3, they recommend establishing a designated laboratory for the purpose of programming microcontrollers.

They also recommend strengthening the international cooperation in terms of lectures and research.

The Criterion is partly fulfilled.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Module descriptions
- Websites

Preliminary assessment and analysis of the peers:
The module handbooks for all four programmes are published on the university's website and are thus accessible to the students as well as to all stakeholders.

The experts observe that they contain the necessary information about the module identification code, the persons responsible for each module, the credit points awarded, the intended learning outcomes, the module content, the forms of assessment, and recommended literature. However, various details in the module manuals are missing. Hence, the module descriptions do not specify the teaching methods and the work load (while the work load is indicated in the study plans, it also must be indicated in the module descriptions), the planned use/applicability of the modules (in which study programmes the mod-

ules are taught), the admission and examination requirements, and the date of last amendment made. Furthermore, the module descriptions inform about the forms of assessment but do not provide details on how the module mark is calculated.

Generally, the module descriptions do not seem to be up-to-date to the experts since the audit discussions reveal occasional discrepancies between the module descriptions and the actual conditions. The programme coordinators confirm during the audit that the module descriptions provided are from 2019 and do not include the most recent updates. For example, the module handbooks do not inform about the fact that the Physics module has been transformed into two modules ("Physics 1" and "Physics 2"). The peers therefore insist that EKTU provides updated module handbooks for all four programmes.

In addition, the peers note that the descriptions about the module content are inconsistent in terms of the depth and clarity of presentation. Some module descriptions provide concise and detailed information about the subjects covered in the module, while others contain only superficial information about the content. Due to the inhomogeneous and partly vague presentation of the modules, the module descriptions do not provide a transparent and clear overview of the subjects taught in the modules. In this context, the peers notice for instance that several module descriptions are very similar to each other and give the modules "Control Theory", "Linear Systems of Automatic Control" and "Automation of Standard Technology Processes" as examples. In summary, all three modules' intended learning outcomes indicate that students will learn the fundamentals of automation and control technology, but without specifying the exact competencies.

Moreover, the peers remark that occasionally the title of the module does not clearly reflect the content of the respective module. For instance, the content descriptions of the modules "Nanotechnologies and Power Engineering" and "New Electrotechnical Material" in the Bachelor programme Electrical Power Engineering do not reflect the titles. Consequently, the peers agree that EKTU must provide module descriptions, which are homogenous in their presentation and give concise information about the content of the modules. In this context, differences between modules should be emphasized. Furthermore, it must be ensured that the module titles are in line with the module descriptions.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Sample Diploma Supplement and Transcript of Records for each degree programme

Preliminary assessment and analysis of the peers:
According to the self-assessment report, students of all four degree programmes under review are awarded a Diploma and a Diploma Supplement after graduation. The Diploma consists of a Diploma Certificate and a Transcript of Records. The Diploma as well as the Diploma Supplement provide information about the programme, the curriculum, the individual grading, the average grading and the higher education system in Kazakhstan. However, the peers learn during the audit that not every student is automatically given a Diploma Supplement after graduation. Instead, the Diploma Supplement is only generated and issued if a student specifically requests it. The peers conclude that EKTU must hand out a Diploma Supplement to all students after graduation.

Criterion 5.3 Relevant rules

Evidence:

- Self-Assessment Reports
- All relevant regulations on the studies, examination, admission and quality assurance are published on the university's website

Preliminary assessment and analysis of the peers:
The experts confirm that the rights and duties of both EKTU and the students are clearly defined and binding. All rules and regulations are published on the university's website in Kazakh/Russian as well as in English and hence available to all stakeholders. In addition, the students receive all relevant course material in the language of the degree pro-gramme at the beginning of each semester.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 5:

The experts conclude that the module handbooks must be fundamentally revised and updated. In particular, they need to include precise and accurate descriptions of the module content, the intended learning outcomes, the teaching methods, the work load, the planned use/applicability, the admission and examination requirements, the date of last amendment made and the calculation of the module mark. In addition, EKTU must ensure that the module title and the module descriptions correspond with each other.

As EKTU does not automatically issue a Diploma Supplement to every student upon graduation, experts agree that EKTU needs to set up a mechanism to ensure that every graduate receives a Diploma Supplement.

The Criterion is partly fulfilled.

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:

- Self-Assessment Report
- Questionnaire templates
- Academic regulations
- Discussions during the audit

Preliminary assessment and analysis of the peers:
The experts discuss the quality management system at EKTU with the programme coordinators and the students. They learn that there is a continuous process in order to improve the quality of the degree programmes and it is carried out through internal and external quality assurance.

All programmes at EKTU are regular part of internal quality assessment procedures of the Management and Quality System which is certified in accordance with International Quality Standards ISO 9001. This encompasses all activities focused on implementing measures for improving the teaching and learning quality at the university and therefore includes besides internal audits also evaluations of the single courses by students.

Since EKTU is striving to become an internationally acknowledged university, the reliance on students' feedback and the necessity to ensure and improve the employability of the graduates are of major importance to the coordinators. Internal evaluation of the quality of the degree programmes is mainly provided through student, alumni and employer surveys.

On the institutional level, the performance of the departments is continuously checked through a specific information system. There is a major curriculum revision process for each programme every three years and a minor one every year (cf. chapter 1). The graduates are followed by EKTU through a regular tracer study conducted by the career centre. Internal and external stakeholders give input through these processes in various ways.

Lastly, at the end of each semester, the students give their feedback on the courses by filling out the questionnaire online. The questionnaires are developed by the course sur-

vey committee and include questions with respect to the courses in general and about the teachers' performance. The discussion with the students revealed that those in charge are always eager and open for feedback aside from the official evaluations and that students have the impression that their comments are taken into consideration with regard to the further improvement of the programmes. This becomes apparent in the already mentioned constant curricular revision process that is performed under participation of students and industry partners. The industry representatives confirm in the discussion that the university is eager to receive feedback about new developments and trends and the employability of their graduates. The peers particularly appreciate that EKTU implemented an academic committee consisting of students, alumni, teachings staff, different associations and other stakeholders who are involved in modifying and improving the curricula of the degree programmes.

Concerning the internal feedback loops, the results of the course evaluations are centrally assessed and analysed before they are communicated to the Head of Department who would then be responsible to initiate any measures if problems or needs for improvement have been detected. A summary of the results is made accessible to the students. In case the satisfaction of the students with staff members is deficient, the Heads of Department will contact the respective teacher, discuss the issue and propose solutions. If no improvement can be achieved over a longer period, the staff member will be dismissed. Thus, the peers agree that the quality management circles at EKTU are well established and work under participation of all stakeholders.

In summary, the peers are satisfied with the quality management system at EKTU, especially with the continuous feedback loops and the involvement of important stakeholder groups such as students, alumni and representatives from the industry.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 6:

The experts consider the criterion fulfilled.

D Additional Documents

No additional documents needed

E Comment of the Higher Education Institution (29.05.2023)

The institution provided a detailed/extensive/ statement as well as the following additional documents:

- Diploma BA Electrical Power Engineering;
- Ba Automation and Control Engineering

and

The following quotes the comment of the institution:

1 Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 1

1.1 The Academic Councils of the School of Nuclear and Traditional Energy Technologies, No. 9 dated 05/24/2023 and the School of Information Technology and Intelligent Systems No. 9 dated 05/25/2023 considered the issue of making changes to the wording of the results of training in degree programs Ba Electrical Power Engineering, Ma Electrical Power Engineering, Ba Automation and Control Engineering, and Ma Automation and Control Engineering. Following the discussion, a decision was made:

– to introduce specifics into the learning outcomes in accordance with this ASIIN SSC recommendation in the new academic year;

– to add more transferable skills to the expected learning outcomes, such as the ability to work on technical work tasks in a team and coordinate it if necessary, as well as demonstrate awareness of project management and business practices, such as risk and change management, and understand their limitations;

– to review the learning objectives for all degree programs for 2023 according to the recommendations of the accreditation report;

– in accordance with the Rules of the organization of the educational process on credit technology of education in organizations of higher and (or) postgraduate education (Order of the Minister of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152), the volume of classroom work is at least 30% of the volume of each discipline. When planning the volume of academic work, it is assumed that one academic

credit is equal to 30 academic hours for all its types. The discipline is evaluated with a volume of at least 5 academic credits. It is allowed to evaluate the discipline in 3-4 academic credits. Thus, the discipline of 5 academic credits is estimated at 150 academic hours, while the volume of classroom work is 45 academic hours, of which 15 are lectures and 30 are practical/ laboratory classes. The independent work of students (105 hours) is divided into two parts: autonomous work, which is carried out under the guidance of a teacher in accordance with the “Schedule of SAWTG”, that allows lecturers to cover theoretical material more widely and deeply, and for the second part, which is carried out completely autonomously.

1.3 The scientific Councils of the School of Nuclear and Traditional Energy Technologies, No. 9 dated 05/24/2023 and the School of Information Technology and Intelligent Systems No. 9 dated 05/25/2023, reviewed the modules of the Ma Electrical Power Engineering programs in the disciplines "Nanotechnology and Energy" and "New Electrical Materials" and in the disciplines “Control Theory”, “Linear Systems of Automatic Control” and “Automation of Standard Technology Processes”.

As a result of the discussion, the following decisions were made:

– to introduce a clear idea of these disciplines into the content and learning outcomes of the modules;

– to revise the descriptions of the modules to include accurate descriptions of the modules content the in these disciplines.

Disagreement with the comments of experts and our explanations on the issue of competence in the field of microcontroller programming and the need to create an appropriate laboratory. (criterion 1.3 “Curriculum” and criterion 4.3 ”Facilities and Equipment”).

The discipline "Microcontrollers in Measurement and Control Systems" (6 credits, 30 lectures, 30 laboratory works) is studied within Ma Automation and Control Engineering, and not at BA Automation and Control Engineering, as it is written in the report. Classes are conducted by a professor from Obuda University (Hungary) online only for undergraduates. The discipline provides for the performance of laboratory tasks in the MPLAB program, regardless of the mode of the classes (online / offline). MPLAB is an integrated development environment, which is a set of software products designed for the process of creating, editing and debugging programs for microcontrollers of the PIC family. The program is installed on computers in the laboratory of the Center of Competence and Technology Transfer in the Field of Automation and Mechatronics, and it is also possible to install the distribution kit on students' personal computers.

The basis for mastering the discipline are undergraduate subjects:

– component of choice" (5 credits, 15 lectures, 30 laboratory works) - "Programming IBMPC compatible controllers" / "Programming controllers in C ++",

– elective component (5 credits, 15 lectures, 30 laboratory works) - "Microprocessor technology in Control Systems" / "Microprocessor Technology in Measurement Systems".

To obtain competence in programming microcontrollers, there is a laboratory of "Electronic and Microprocessor Technology" at the Center of Competence and Technology Transfer in the field of Automation and Mechatronics. The laboratory includes three specialized classrooms. One of the classrooms has a direction "Electronics and Programming".

(https://www.ektu.kz/departments/sc_ite/about_school/centertt_auto_mechatronic/laboratories/electronicmicroprocessortechnology.aspx?lang=en)

The hardware and software of the laboratory in the field of microcontroller programming is as follows:

1) " Programming of PIC microcontrollers " stand

Developer boards for PIC16, PIC18 series microcontrollers are used.

2) Sets of training equipment for programming ATMEGA microcontrollers. (20 sets)

ATmega328 microcontrollers based on the ArduinoUNO PCB, ATmega2560 microcontrollers based on the ArduinoMega 2560 PCB are used.

Additionally, ESP8266 NodeMcu modules with Wi-Fi interface support and wireless board for Internet of Things development compatible with Arduino were purchased

3) STM32 DISCOVERY 3 debug boards

4) Arduino shields, which can be used for lab work and with development boards for STM32, PIC and other microcontroller families.

5) PC with ArduinoIDE, MPLAB, Microchip Studio, STM32CubeIDE software installed.

Microchip Studio is an integrated development environment for microcontrollers of the AVR and SAM families, which includes a C compiler, debugging tools and programmer support.

STM32CubeIDE is an integrated development environment for microcontrollers of the STM32 family, which includes a C compiler, debugging tools and programmer support

ArduinoIDE is an integrated development environment designed to create and upload programs to Arduino-compatible boards, as well as boards from other manufacturers.

With the existing equipment, the Center has the ability to conduct classes in disciplines related to the development of embedded devices based on microcontrollers, devices that support the concept of "Internet of Things", including conducting experiments without creating a special laboratory.

Competence in the field of microcontroller programming is confirmed by the topics of graduation projects and master's theses, the participation of students in programming competitions within the university and republican ones (for example, World Skills Kazakhstan, the Republican Olympiad inrobotics “IITUROBOCON”).

2 Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 2:

2.1 At the next Academic Councils of Schools (Minutes No. 5 June 2023), it is planned to consider the structure of the modules reflecting the technical connections between the topics of the modules and the pedagogical strategy that will allow students to develop their skills and knowledge in the discipline so that the intended learning outcomes of Ba Electrical Power educational programs are achieved Engineering) and Ma Electrical Power Engineering), Ba Automation and Control Engineering and Ma Automation and Control Engineering. As a result, a scientific seminar will be held.

2.2 In accordance with the Rules for organizing the educational process on credit technology of education in organizations of higher and (or) postgraduate education (Order of the Minister of Education and Science of the Republic of Kazakhstan dated April 20, 2011 No. 152), the volume of classroom work is at least 30% of the volume of each discipline.

When planning the volume of academic work, it is assumed that one academic credit is equal to 30 academic hours for all its types. The discipline is evaluated with a volume of at least 5 academic credits. It is allowed to evaluate the discipline in 3-4 academic credits. Thus, the discipline of 5 academic credits is estimated at 150 academic hours, while the volume of classroom work is 45 academic hours, of which 15 are lectures and 30 are practical/ laboratory classes. The independent work of students (105 hours) is divided into two parts: autonomous work, which is carried out under the guidance of a teacher in accordance with the "Schedule of SAWTG", that allows lecturers to cover theoretical material more widely and deeply, and for the second part, which is carried out completely autonomously.

2.3 Dissertation research of undergraduates in the degree program Ma Electrical Power Engineering is a manuscript that consists of four parts:

– the first part is the analysis of the results of similar research works, identification of existing unresolved issues, setting the goals and objectives of the master's thesis;

– the second part is the theoretical part, which consists in determining the research method and identifying the scientific novelty of the research;

– the third part is the calculation part, where the undergraduate conducts laboratory research or conducts practical calculations;

– the fourth part is the practical application or implementation of the results for production and determination of energy efficiency.

At the meeting of the Academic Council of the School of Nuclear and Traditional Energy Technologies No. 9 dated 05/24/2023, the results of the Master's research defenses were considered. Based on the results of the discussion, it is recommended to use the obtained theoretical knowledge more widely in master's theses.

According to the Ba Electrical Power Engineering, a diploma project / work is carried out, the purpose of completing the final work is:

–systematization, consolidation and expansion of theoretical knowledge and practical skills in the degree program and their application in solving specific scientific, technical, economic and industrial tasks, as well as cultural tasks;

–development of autonomous work skills and mastering the methodology of scientific research and experimentation in solving problems and questions;

–finding out the student's readiness for autonomous work in the conditions of modern production, science, technology, culture, as well as the level of his professional competence.

The diploma project / work consists of 10 sections, in each section the calculation and analysis of the designed (modernized) object is carried out.

The first technological part describes the object, its location, equipment used, energy consumption category**.** In the **second part**, a comparison of 2 variants of circuits is made and a feasibility study is drawn up for choosing a circuit, in the **third** part, loads are calculated using the calculation coefficient method for the plant and for workshops, according to the results of the calculation, transformers and capacities are selected. In the **fourth part**, the reactive power is calculated, the results are compared and the number of workshop transformers is specified. In the **fifth part**, a cartogram is compiled. A plan of the plant is drawn up, the location of the GPP is determined, the share of power and lighting loads is

determined. In the **sixth** section, short-circuit currents are calculated and equipment is selected. An equivalent circuit is selected; short-circuit currents are calculated according to it, equipment is selected, which is calculated by thermal and dynamic resistance. In the **economic** part, the substantiation of the necessary costs (primarily capital) required for the actual implementation of the developed technical solutions is carried out, and then the process of recovering the invested funds is analyzed, and as a result, an assessment of the economic efficiency of investments in the project is given. The **next** section deals with issues of industrial safety, environmental safety, fire and explosion safety. In the **ninth** section of relay protection and automation, the calculation and analysis of the protection of settings is carried out, according to which the scheme Relay protection and automation is drawn up. The **last** section is a special part of the graduation project, which is a deeper development of one of the previously listed issues or a theoretical development of a specific issue specified in the assignment. At the end, a **conclusion** is written, which reflects the results of the goals of the diploma design.
The student's **final** work demonstrates his independent work on the analysis and research of a given practice-oriented topic, which is related to topical issues of the production process, when performing work, graphic editors, application packages for solving technical calculations are used, and the work is completely individual.

3 Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 3

3.1.1 Commission for Assurance and Quality of the Nuclear and Traditional Energy Technologies School No. 7, dated 05/22/2023 examined completed master's theses, concluded that master's theses in the educational program Ma Electrical Power Engineering are justified by calculations and research of undergraduates and there are links to the results of other research works.

Also at the meeting of the Academic Council of the School of Nuclear and Traditional Energy Technologies (No. 6 June 2023) on the Ma Electrical Power Engineering degree program, the recommendations given by ASIIN colleagues will be considered that the conclusions in a master's thesis should be justified by calculations or a master student’s studies or references to the results of others or research groups.

3.1.2 A thesis/project is carried out by the students of Ba Automation and Control Engineering in accordance with the approved methodological guidelines.

A thesis / project on Ba Automation and Control Engineering can be carried out in the following areas:

1. **The first direction.** Development or modernization of automation control systems of technological processes of modern industrial production. It is planned to compare an upgraded automation system with the existing one, but taking into account the use of modern automation equipment and/or controllers in order to increase the efficiency of the system.

2. **The second direction.** Development and research of mathematical models of technological processes, equipment and devices for various purposes.

3. **The third direction**. Development of monitoring and control systems based on microcontrollers. It is planned to develop software and hardware for the operation of systems for various purposes and/or with integration into the existing control automation system.

The final qualifying paper is an explanatory note and design documentation.

The structure of the explanatory note of the theses consists of 5 sections: theoretical, calculation, design, economic, safety and environmental friendliness.

Section 1. The study of a technological unit as a control object is considered. This section provides a description of a technological facility and the processes taking place in it, the existing state of automation, the justification for the need for modernization or new developments in automation, the points of selection of ACS pulses and rational regulatory actions are established, the requirements for the quality indicators of control and regulation systems are formulated.

Section 2. Development of a functional scheme of automatic control and regulation.

The substantiation of the proposed functional scheme of automation and its hardware design is given:

- selection and calculation of measuring instruments in process automation systems, justification of control, regulation, alarm and blocking parameters;

– the measuring range and the required accuracy of measurement of technological parameters;

– the choice of the set of automatio equipment to implement automation system ;

– calculation of some special measuring tools according to the current regulatory and technical documentation.

Calculation of the local ATS. This section presents the research of a technological unit as an object of regulation of one of its state parameters, the adopted calculation methodology and calculations of this local automatic control system, its hardware implementation, optimal tuning parameters and quality indicators by the method of extended frequency response or logarithmic frequency response.

Section 3 - Installation, adjustment and operation of the developed system. This section provides a description of the structural, electrical and installation diagrams, instructions for installation, setting up[i] and operation of the developed ATS.

Development of SCADA system of automatic regulation of automation system processes, which will allow to maintain the desired mode of operation in the system under study without direct human participation, whose duty remains only the controller setting for a certain mode and its launch.

Section 4. Project feasibility study. This section contains technical and economic calculations of the effectiveness of the adopted technical solutions.

Section 5. Life Safety. Occupational health and safety and environmental protection measures are provided.

The basic list of drawings is as follows:

- A block diagram;
- A functional circuit for automation;
- graphs, charts, tables, characteristics of experimental data and results of local CAP calculations;
- A local CAP circuit diagram;
- A drawing of the panel facade of the instrumentation panel and its assembly diagram;
- A diagram of external connections of the board panel, etc.

4 Final assessment of the peers after the comment of the Higher Institution regarding criterion 4:

4.2 EKTU cooperates with the University of Delaware. In cooperation with the University of Delaware,we prepared a joint application for a competition and implemented a project in the field of renewable energy in the American Councils for International Education based on the agreement on cooperation between our universities.

There are plans to develop a master's degree program in renewable energy, as well as to exchange experiences and teachers between universities and to develop research on this subject at the university.

In the future, there are plans to strengthen international cooperation and expand the circle of cooperating universities.

In 2022 the University of Delaware, USA has invited the following professors for degree programs 6B07104 Electrical Power Engineering and 7M07104 Electrical Power Engineering: Associate Professor Tamara Segeda and lecturer Aizhan Sarsenova. The letter of invitation is attached (Appendix A).

There are plans to develop a master's degree program in renewable energy, as well as to exchange experiences and teachers between universities and to develop research on this subject at the university.

In the future, there are plans to strengthen international cooperation and expand the circle of cooperating universities.

4.3 School of Nuclear and Traditional Energy Technologies plans to establish a laboratory for training and research into the potential of wind energy. In addition, master classes, excursions, and public lectures at enterprises in the field of study are also organized to enhance professional knowledge and skills.

Explanation of additional laboratories (criterion 4.3 "Facilities and equipment")

The hardware and software of the laboratory in the field of microcontroller programming is as follows:

1) " Programming of PIC microcontrollers " stand

Developer boards for PIC16, PIC18 series microcontrollers are used.

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With the existing equipment, the Center has the ability to conduct classes in disciplines related to the development of embedded devices based on microcontrollers, devices that support the concept of "Internet of Things", including conducting experiments without creating a special laboratory.

Competence in the field of microcontroller programming is confirmed by the topics of graduation projects and master's theses, the participation of students in programming competitions within the university and republican ones (for example,
World Skills Kazakhstan, the Republican Olympiad inrobotics “IITUROBOCON”).

On the basis of the laboratory "Electronic and microprocessor technology" the direction "Microprocessor systems and robotics" was created. (https://www.ektu.kz/departments/sc_ite/about_school/centertt_auto_mechatronic/laboratories/electronicmicroprocessortechnology.aspx?lang=en) The technical and software of the laboratory in this area is as follows:

1) A set of equipment "Technological line Festo" of FESTO company.

2) PC with installed software MatLAB, SiemensTIAPortal. SIEMENS TIA Portal is a software product for designing SIMATIC automation components

With the existing equipment, the Center is able to conduct classes on topics related to industrial robotics, I4.0, controller design and machine vision, including conducting experiments without creating a special laboratory. There is no need to create a separate laboratory for experiments with computer vision.

5 Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 5:

5.1 Earlier in paragraph 1.3, the issue was considered: on the content of the disciplines "Nanotechnologies and Energy" and "New Electrical Materials" of the educational program Ma Electrical Power Engineering, and on the disciplines "Control Theory", "Linear Systems of Automatic Control" and "Automation of Standard Technology Processes” for Ba Automation and Control Engineering, the following recommendations were adopted:

– to introduce a clear idea of these disciplines into the content and learning outcomes of the modules;

– revise module descriptions to include accurate descriptions of module content.

According to the Ba Electrical Power Engineering undergraduate program, since 2020, the "Physics" module - 4 credits has been transformed into the "Physics 1" module - 6 credits and "Physics 2" - 6 credits, module reference books are presented in Фттт В.

5.2 According to paragraph 36, "Persons who have completed training in the educational program of higher education, EPOHE (Educational programs of higher education) , with the exception of the Academy of Justice, military, special educational institutions, educational organizations implementing educational programs of higher and (or) postgraduate education in the field of healthcare, who have a license to engage in educational activities and have been accredited by the accreditation bodies listed in register of recognized accreditation bodies, issues a document on education of its own sample with an appendix and (or) a pan-European supplement to the diploma (Diploma Supplement) for free", Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 No. 2: "On approval of state mandatory standards of higher and postgraduate education" on the basis of this order, an internal regulatory The document Regulation on Diploma Supplement in the NAO "D. Serikbayev EKTU" item23 is issued at the request of the student.

https://www.ektu.kz/files/corporategovernance/doc/Regulition_on_DS.pdf. On the recommendation of ASIIN experts, Diploma Supplement will be issued to all graduates from 2023.

6 Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 6:

In the future, EKTU plans to improve the quality management system by involving all interested parties, such as students, undergraduates, graduates and industry representatives.

Appendix A

UNIVERSITY OF DELAWARE

DEPARTMENT OF PHYSICS AND ASTRONOMY
DEPARTMENT OF MATERIALS SCIENCE AND ENGINEERING

University of Delaware
Newark, Delaware 19716
Ph: 302/831-1618
Fax: 302/831-4545

June 20, 2022

To whom it may concern.

This letter serves as an invitation for Aizhan Sarsenova (Kazakhstan Passport No. N11550884) to come to the University of Delaware as a part of our joint U.S.-Kazakhstan University Partnerships Program under UniCEN. The funds available through the project will cover all your transport, boarding, and lodging expenses during your stay at the University of Delaware, Newark, DE 19716. The ideal time of travel to the University of Delaware will be between Sept 1 and Sept 30, 2022. During your visit, we will discuss the details of the courses associated with the MS program in Renewable Energy that we are jointly developing for the Eastern Kazakhstan Technical University. We will also arrange your visits to various University of Delaware laboratories of the PI and Co-PIs.

Please let us know if you need anything else to facilitate your visit.

We hope to see you here soon.

Sincerely,

Syed Ismat Shah

S. Ismat Shah
Professor
Materials Science and Engineering
Physics and Astronomy
Director, Energy and Environmental Policy Program
University of Delaware
208 Dupont Hall
Newark, DE 19716
Ismat@udel.edu, 302-831-1618, 301-831-4545 (FAX)

Appendix B

<table>
<tr><td colspan="2">2.1 Module of Natural Science – 18 ESTS</td></tr>
<tr><td colspan="2">3. Physics 2</td></tr>
<tr><td>Semestr:</td><td>2</td></tr>
<tr><td>Teachers:</td><td>Erbolatova Gulnara Ualkhanova</td></tr>
<tr><td>Component:</td><td>University component</td></tr>
<tr><td>Cycle:</td><td>Base disciplines</td></tr>
<tr><td>ECTS:</td><td>6</td></tr>
<tr><td>Course Workload:</td><td>
<table>
<tr><th>Types of classes</th><th>Hours</th></tr>
<tr><td>Lecture</td><td>15</td></tr>
<tr><td>Laboratory works</td><td>30</td></tr>
<tr><td>Practical works</td><td>15</td></tr>
<tr><td>SAWTG (Student Autonomous Work under Teacher Guidance)</td><td>30</td></tr>
<tr><td>SAW (Student autonomous work)</td><td>90</td></tr>
<tr><td>Form of final control</td><td>Exam</td></tr>
<tr><td>Final assessment method</td><td>Written exam</td></tr>
</table>
</td></tr>
<tr><td>Control forms:</td><td>Rating 1, Rating 2, Exam</td></tr>
<tr><td>Short content:</td><td>The course is devoted to the theory of oscillations and waves. In the second section, elements of geometric optics and wave optics are presented. Along with the general properties, the features of light waves are noted. In the next section, the quantum nature of radiation is studied. Elements of quantum statistics and condensed matter physics are given. The final section outlines the elements of the physics of the atomic nucleus and elementary particles.</td></tr>
<tr><td>Goal:</td><td>Creation of the foundations for students of a sufficiently broad theoretical training in the field of physics, allowing future engineers to navigate the flow of scientific and technical information and providing them with the opportunity to use new physical principles in those areas of technology in which they specialize</td></tr>
<tr><td>Objective:</td><td>Formation of students' knowledge and skills of using fundamental laws, theories of classical and modern physics, as well as methods of physical research as the basis of a professional activity system. Disclosure of the essence of the basic concepts, laws, theories of classical and modern physics in their internal relationship and integrity, since for the future bachelor it is important not so much to describe physical laws, but rather to master the skills of their practical use to solve technical problems.</td></tr>
<tr><td>Learning outcome:</td><td>- Basic physical phenomena and laws of classical and modern physics, methods of physical research; limits of applicability of various physical concepts,</td></tr>
</table>

<table>
<tr><td></td><td>laws, theories. - Familiarization of students with measuring equipment, development of the ability to conduct experimental studies, process the results of the experiment and analyze them. - Ability to navigate the flow of scientific and technical information and the ability to use new physical principles in professional activities. - be able to organize their work, evaluate the results of their activities with a high degree of independence, master the skills of independent work; be able to apply basic knowledge in professional activities; possess theory and skills of practical work; analyze the results, draw the necessary conclusions and formulate proposals; present the results obtained in the research in the form of reports. - Possess the skills to acquire new knowledge in the professional field and continue education, strive for professional and personal growth.</td></tr>
<tr><td>Teaching methods:</td><td>interactive learning technologies;
computer learning technologies;
solving educational problems;
independent research work of students during the educational process.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th>Period</th><th>Type of task</th><th>Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="4">1 rating</td><td>Practical tasks</td><td>35</td><td rowspan="4">0-100</td></tr>
<tr><td>Laboratory works</td><td>30</td></tr>
<tr><td>Rating Test 1</td><td>20</td></tr>
<tr><td>Коллоквиум 1</td><td>15</td></tr>
<tr><td rowspan="4">2 rating</td><td>Practical tasks</td><td>35</td><td rowspan="4">0-100</td></tr>
<tr><td>Laboratory works</td><td>30</td></tr>
<tr><td>Rating Test 1</td><td>20</td></tr>
<tr><td>Colloquium 2 2</td><td>15</td></tr>
<tr><td>Total control</td><td colspan="2">Exam</td><td>0-100</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>1. Harmonic oscillations, their parameters. Pendulums. Harmonic oscillatory circuit. Electromechanical analogy. Energy of harmonic oscillations.
2. Addition of vibrations. damped vibrations. Parameters of damped oscillations. Decay modes.
3. Forced vibrations. Alternating current. Ohm's law for alternating current. Resonance. Power in the AC circuit.
4. Wave motion. Characteristics of the wave process. Plane wave equation. Wave energy, Umov vector. Wave interference. standing waves. Some properties of electromagnetic waves.
5. The nature of light. Laws of refraction and reflection of light. Light interference. Interference in thin films. Illumination of optics. Lines of equal slope and equal thickness.
6. Diffraction of light. Fresnel zone method. Diffraction by a slit and a grating.</td></tr>
</table>

	7. Dispersion and absorption of light. 8. Polarization of light. 9. Quantum optics. Thermal radiation. The laws of thermal radiation. Quantum hypothesis and Planck's formula. 10. Photoelectric effect. Photons, their characteristics. Compton effect. 11. Regularities of line emission spectra. Bohr's postulates. Bohr's theory. 12. Corpuscular-wave dualism. wave function. Schrödinger equation. The hydrogen atom in Schrödinger's theory. 13. The concept of quantum statistics. Bose-Einstein and Fermi-Dirac statistics. 14. Condensed state. Dielectrics, semiconductors and metals in zone theory. Electrical conductivity of metals. Superconductivity. 15. Atomic nucleus, its structure and properties. Kernel characteristics. mass defect. Communication energy. Radioactivity. α-, β-, γ radiation. Interaction of radioactive radiation with matter. Elementary particles.
Literature:	1 Detlaf A.A., Yavorsky B.M. Physics course, - M .: Higher School, 2009. 2. Trofimova T.I. Physics course. - M .: Higher school, 2003. 3. Saveliev I.V. Course of physics, vol. 1-3. - M .: Nauka, 2009. 4. Trofimova T.I. Physics course textbook for universities. M.: academy, 2004 5. Frish, S.E. Course of general physics / S.E. Frish, A.V. Timoreva. - M.: GITTL, 2007. 6. Goldin, L.L. Introduction to quantum physics / L.L. Goldin, G.I. Novikov. - M.: Nauka, 2008. 7. Irodov, I.E. Collection of problems in atomic physics and nuclear physics / I.E. Irodov. - M.: Energoatomizdat, 2004 8. Kislov, A.N. Atomic and nuclear physics / A.N. Kislov. - Yekaterinburg: from. Ural University, 2017. 9. Volkenstein V.S. Collection of tasks for the general course of physics. – M.: Nauka, 2005. 10. Zhaksylykova A.A. Physics. Teaching aid for practical exercises and independent work for students of technical universities. - Ust-Kamenogorsk: EKSTU, 2007. 11. Zhaksylykova A.A., Payuk V.A. Physics II. Lecture notes for distance learning. - Ust-Kamenogorsk: EKSTU, 2008
4. Physics 1	
Semestr:	1
Teachers:	Erbolatova Gulnara Ualkhanova
Component:	University component
Cycle:	Base disciplines
ECTS:	6
Course Workload:	**Types of classes** — **Hours** Lecture — 15 Laboratory works — 30

	Practical works	15
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	SAW (Student autonomous work)	90
	Form of final control	Exam
	Final assessment method	A written exam
Control forms:	Rating 1, Rating 2, Exam	
Short content:	The course consists of several sections. The first section is devoted to the presentation of kinematics, the dynamics of a material point and a rigid body. The second section deals with the fundamentals of molecular physics and thermodynamics. The third section deals with electrostatics, direct current and electromagnetism. The characteristics of the fields are considered; laws and phenomena confirming the unity of nature and the relationship of electric and magnetic fields.	
Goal:	studying and teaching physical phenomena and basic ideas; mastering fundamental concepts, laws, theories of modern classical physics and methods of physical research. Formation of a system of thinking in accordance with the scientific approach and modern physics	
Objective:	- formation of knowledge about physical phenomena, concepts, laws, theories, methods, practical facts; - formation of views that give a scientific picture of the world in accordance with the degree of development of modern science; - acquaintance with the main directions of scientific and technological progress with the application of the laws of physics in industrial engineering and technology; - mastering methods and techniques for solving specific problems or problems in various fields of physics	
Learning outcome:	- vastering by students the basic physical phenomena and laws of classical and modern physics, methods of physical research; - familiarization of students with measuring equipment, conducting experimental studies, processing the results of the experiment and their analysis; - formation of students' scientific thinking and dialectical worldview, a correct understanding of the limits of applicability of various physical concepts, laws, theories and the ability to assess the degree of reliability of the results obtained using experimental or mathematical research methods; - be able to apply basic knowledge in professional activities; own theories and skills of practical work; analyze the results, draw the necessary conclusions and formulate proposals; present the results obtained in the research in the form of a report.	
Teaching methods:	When conducting training sessions, the following educational technologies are provided: - interactive lecture (using the following active forms of learning: guided discussion or conversation; moderation; demonstration of slides or educational films; brainstorming; motivational speech); - building scenarios for various situations based on the specified conditions; - information	

<table>
<tr><td></td><td>and communication technology (for example, classes in a computer class using professional software packages); - search and research (independent research activity of students in the learning process); - the solution of educational tasks.</td></tr>
<tr><td>Assessment of the student's knowledge:</td><td>
<table>
<tr><th>Period</th><th>Type of task</th><th>Number of points (max)</th><th>Total</th></tr>
<tr><td rowspan="4">1 rating</td><td>Practical tasks</td><td>35</td><td rowspan="4">0-100</td></tr>
<tr><td>Laboratory works</td><td>30</td></tr>
<tr><td>Rating Test 1</td><td>20</td></tr>
<tr><td>Коллоквиум 1</td><td>15</td></tr>
<tr><td rowspan="4">2 rating</td><td>Practical tasks</td><td>35</td><td rowspan="4">0-100</td></tr>
<tr><td>Laboratory works</td><td>30</td></tr>
<tr><td>Rating Test 1</td><td>20</td></tr>
<tr><td>Colloquium 2 2</td><td>15</td></tr>
<tr><td>Total control</td><td colspan="2">Exam</td><td>0-100</td></tr>
</table>
</td></tr>
<tr><td>Topics of lectures:</td><td>1.Mechanical motion is the simplest form of motion of matter. Space and time. Reference system. The concept of a material point. Progressive movement.
2. Kinematics of rotational motion. Angular velocity and angular acceleration. The main problem of dynamics. Newton's first law. Weight. Force. Pulse.
3. The concept of an absolute rigid body. Moment of inertia of a rigid body about a fixed axis. Principal axes of a rigid body and moments of inertia of the head. Steiner's theorem.
4. Conservation laws are a consequence of the symmetry of space and time. External and internal forces. The law of conservation of momentum is the basic law of nature.
5. General characteristics of harmonic oscillations. Differential equation of harmonic oscillations.
6. Ideal gas. Gas pressure. Temperature. Methods for measuring pressure and temperature, dimensions, and units of measurement. The equation of state for an ideal gas. Ideal gas laws. Average energy of molecules.
7. The average number of collisions and the average length of the free path of molecules. Diffusion in Gaza. Thermal conductivity. Internal friction (viscosity).
8. Internal energy of a thermodynamic system. The number of degrees of freedom. The amount of work and heat. The first law of thermodynamics and its physical principle.
9. Reversible and irreversible processes. Circular branches. Working with a round process. Carnot cycle. The physical meaning of entropy
10. Mutual influence of electric charges. The law of conservation of electric</td></tr>
</table>

	charges. Electric field. Electric field strength. The principle of superposition. electric dipole. Vector flow, Gauss theorem. 11. Dielectrics in an electrostatic field. polarization charges. Polarization-lanu. type of dielectric. Dirac. Electrical shift. 12. General characteristics and conditions for the existence of electric current. Throughput overvoltage. Differential type of Ohm's and Joule-Lenz laws. Kirchhoff's rules. Potential difference. 13. Vector of magnetic induction. The principle of superposition. Biot-Savart-Laplace law. Calculation of magnetic fields of the simplest systems. Electromotive force of the current source. Movement of a charged particle in a magnetic field. 14. Basic law of electromagnetic induction. Lenz's law. Processes of self-induction and mutual induction. Inductance of a long solenoid. Mutual induction coefficient. 15. Maxwell's system of equations. Relativity of electric and magnetic fields. Vector and scalar potentials. wave equation. Oscillatory circuit. Free and involuntary electromagnetic oscillations
Literature:	1. Aleshkevich, V.A. Course of general physics. Molecular physics / V.A. Aleshkevich. - M.: Fizmatlit, 2016. 2. Bondarev, B.V. Course of general physics. In 3 books. Book. 2: Electromagnetism, optics, quantum physics: Textbook / B.V. Bondarev, N.P. Kalashnikov, G.G. Spirin. - Lyubertsy: Yurayt, 2015. 3. Bondarev, B.V. Course of general physics. Book 2: Electromagnetism, optics, quantum physics: Textbook for bachelors / B.V. Bondarev, N.P. Kalashnikov, G.G. Spirin. - Lyubertsy: Yurayt, 2016. 4. Bondarev, B.V. Course of general physics. Book 3: Thermodynamics, statistical physics, structure of matter: Textbook for bachelors / B.V. Bondarev, N.P. Kalashnikov, G.G. Spirin. - Lyubertsy: Yurayt, 2016. 5. Bondarev, B.V. Course of general physics. book 1: mechanics: Textbook for bachelors / B.V. Bondarev, N.P. Kalashnikov, G.G. Spirin. - Lyubertsy: Yurayt, 2016. 6. Bondarev, B.V. Course of general physics. In 3 books. Book 1: Mechanics: Textbook / B.V. Bondarev, N.P. Kalashnikov, G.G. Spirin. - Lyubertsy: Yurayt, 2015. 7. Buchachenko, A.L. From quantum strings to the secrets of thinking.: Excursus on the most fascinating issues of physics, chemistry, biology, mathematics / A.L. Buchachenko. - M.: Lenand, 2017. 8. Goloskokov, D.P. Course of mathematical physics using the Maple package: Textbook / D.P. Goloskokov. - St. Petersburg: Lan, 2015. 9. Goloskokov, D.P. A course of mathematical physics using the Maple package: Textbook / D.P. Goloskokov. - St. Petersburg: Lan, 2015. 10. Detlaf, A.A. Physics Course: Textbook / A.A. Detlaf. - M.: Academia, 2015

In the future, EKTU plans to improve the quality management system by involving all interested parties, such as students, undergraduates, graduates and industry representatives.

F Summary: Peer recommendations (31.05.2023)

Taking into account the additional information and the comments given by EKTU the peers summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	**ASIIN Seal**	**Maximum duration of accreditation**	**Subject-specific label**	**Maximum duration of accreditation**
Ba Electrical Power Engineering	With requirements for one year	30.09.2028	–	–
Ma Electrical Power Engineering	With requirements for one year	30.09.2028	–	–
Ba Automation and Control Engineering	With requirements for one year	30.09.2028	–	–
Ma Automation and Control Engineering	With requirements for one year	30.09.2028	–	–

Requirements

For all degree programmes

A 1. (ASIIN 1.1, 1.3) Define concrete and precise intended learning outcomes and ensure that the module content aligns with the intended learning outcomes.

A 2. (ASIIN 4.3) A follow-up visit must be carried out in order to assess alterations in the laboratories.

A 3. (ASIIN 5.1) Submit up-to-date module handbooks, which include precise and accurate descriptions of the module content, the intended learning outcomes, the teaching methods, the work load, the planned use/applicability, the admission and examination requirements, the date of last amendment made and the calculation of the module mark. Ensure that the module title and the module descriptions correspond with each other.

A 4. (ASIIN 5.2) Provide a Diploma Supplement to every student directly after graduation.

For both Ba programmes:

A 5. (ASIIN 1.1, 1.3) Increase the theoretical level of the programmes.

A 6. (ASIIN 2.1) Develop a strategy to design all modules homogenously and in consistency with each other.

A 7. (ASIIN 3) Ba theses must demonstrate that the students are able to work independently on a task at the level of the degree programme.

Recommendations

For all degree programmes

E 1. (ASIIN 1.3) It is recommended to increase the time designated for lectures in order to cover the subject material in more breadth and depth.

E 2. (ASIIN 4.2) It is recommended to strengthen the international cooperation in terms of lectures and research.

E 3. (ASIIN 4.3) It is recommended to expand the laboratories.

For the Ba programme Automation and Control

E 4. (ASIIN 1.3, 4.3) It is recommended to establish a laboratory for the purpose of programming microcontrollers.

For the Ma programme Automation and Control

E 5. (ASIIN 2.1) It is recommended to offer the students a wider range of optional subjects, in which the students can develop a specialization.

For both Master programmes

E 6. (ASIIN 3) It is recommended that the scientific level of the Master thesis be raised so that students demonstrate their ability to apply theoretical knowledge to the advancement of systems.

G Comment of the Technical Committees

Technical Committee 01 – Mechanical Engineering/Process Engineering (05.06.2023)

Assessment and analysis for the award of the ASIIN seal:

The Technical committee discusses the procedure. The criticism of the auditors that the treatment of central subject areas of the two Bachelor's programmes does not appear from the module descriptions appears to the committee to be not only a problem of lack of transparency. On the one hand, the problem does not only refer to individual contents, but obviously to central areas of the programmes especially with regard to theoretical background. On the other hand, these deficits apparently also affect the quality of the theses. Since, according to the auditors, the theses are more like reports than scientific papers, the students are obviously not prepared to work on appropriate tasks.

Furthermore, the modules apparently only represent meaningful teaching units to a limited extent, so that the Bachelor's programmes would also have to be fundamentally revised structurally.

The Technical committee therefore proposes to suspend the accreditation of the two Bachelor's degree programmes so that the before accreditation the university can ensure:

that the study aims and the content of the programmes correspond to the intended qualification level so that theses demonstrate that students are able to work independently on a task at the level of the degree programme (EQF 6).

Additionally the university has to design all modules homogenously and in consistency with each other.

The Technical Committee 01 – Mechanical Engineering/Process Engineering recommends

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Automation and Control Engineering	Suspension	30.09.2028	–	–
Ma Automation and Control Engineering	With requirements for one year	30.09.2028	–	–

Technical Committee 02 – Electrical Engineering/Information Technology (07.06.2023)

Assessment and analysis for the award of the ASIIN seal:

The Technical committee discusses the procedure. The members note the high number of severe requirements, indicating that the overall level of the programmes is comparatively low. However, as one of the main problems identified during the audit is the lack of transparency in the documentation of the module content, the Technical Committee argues that these deficiencies could easily be remedied by the submission of clear and precise documents. They therefore follow the peers' assessment without any changes.

The Technical Committee 02 – Electrical Engineering/Information Technology recommends the award of the seals as follows:

Degree Programme	**ASIIN Seal**	**Maximum duration of accreditation**	**Subject-specific label**	**Maximum duration of accreditation**
Ba Electrical Power Engineering	With requirements for one year	30.09.2028	–	–
Ma Electrical Power Engineering	With requirements for one year	30.09.2028	–	–
Ba Automation and Control Engineering	With requirements for one year	30.09.2028	–	–
Ma Automation and Control Engineering	With requirements for one year	30.09.2028	–	–

H Decision of the Accreditation Commission (23.06.2023)

Assessment and analysis for the award of the subject-specific ASIIN seal:

The Accreditation Commission discusses the case and in particular TC 01's proposal to suspend the two Bachelor's programmes. Similar to TC 1 and TC 02, they argue whether the main deficits identified by the experts are due to the lack of transparency, which could be easily remedied, or whether there are fundamental deficits in the Bachelor's programmes that would require suspension. Since the experts believe that the main problem lies in the lack of transparent documentation, in particular the module descriptions, and that they first need accurate documentation in order to correctly evaluate the degree programmes, the Commission decides to follow the experts' assessment and postpone the final decision to the next commission meeting in September 2023: EKTU will be asked to provide accurate documents so that the experts and the Commission meeting can reassess the programmes. The Master programmes will be accredited with requirements. In addition, they decide to delete the recommendation regarding the expansion of the laboratories in the Bachelor programmes since this is already insinuated by the requirement to revisit the laboratories on-site to assess upgrades.

The Accreditation Commission decides to award the following seals:

Degree Programme	**ASIIN Seal**	**Maximum duration of accreditation**	**Subject-specific label**	**Maximum duration of accreditation**
Ba Electrical Power Engineering	Pending	30.09.2028	–	–
Ma Electrical Power Engineering	With requirements for one year	30.09.2028	–	–
Ba Automation and Control Engineering	Pending	30.09.2028	–	–
Ma Automation and Control Engineering	With requirements for one year	30.09.2028	–	–

Possible Requirements for the two Ba programmes:

A 1. (ASIIN 1.1, 1.3) Ensure that concrete and precise defined study aims and the content of the programmes correspond to the intended qualification level so that theses demonstrate that students are able to work independently on a task at the level of the degree programme (EQF 6). (alternatively as precondition)

A 2. (ASIIN 2.1) Design all modules homogenously and in consistency with each other. (alternatively as precondition)

A 3. (ASIIN 4.3) A follow-up visit must be carried out in order to assess necessary upgrades in the laboratories.

A 4. (ASIIN 5.1) Submit up-to-date module handbooks, which include precise and accurate descriptions of the module content, the intended learning outcomes, the teaching methods, the work load, the planned use/applicability, the admission and examination requirements, the date of last amendment made and the calculation of the module mark. Ensure that the module title and the module descriptions correspond with each other.

Possible Recommendation for the two Ba programmes:

E 1. (ASIIN 1.3) It is recommended to increase the time designated for lectures in order to cover the subject material in more breadth and depth.

E 2. (ASIIN 4.2) It is recommended to strengthen the international cooperation in terms of lectures and research.

Possible Recommendation for the Ba programme Automation and Control

E 3. (ASIIN 1.3, 4.3) It is recommended to establish a laboratory for the purpose of programming microcontrollers.

<u>For the Ma Programmes</u>

Requirements for both Ma programmes

A 1. (ASIIN 1.1, 1.3) Define concrete and precise intended learning outcomes and ensure that the module content aligns with the intended learning outcomes.

A 2. (ASIIN 4.3) A follow-up visit must be carried out in order to assess necessary upgrades in the laboratories.

A 3. (ASIIN 5.1) Submit up-to-date module handbooks, which include precise and accurate descriptions of the module content, the intended learning outcomes, the teaching methods, the work load, the planned use/applicability, the admission and examination requirements, the date of last amendment made and the calculation of the module mark. Ensure that the module title and the module descriptions correspond with each other.

A 4. (ASIIN 5.2) Provide a Diploma Supplement to every student directly after graduation.

Recommendations for both Ma programmes

E 1. (ASIIN 1.3) It is recommended to increase the time designated for lectures in order to cover the subject material in more breadth and depth.

E 2. (ASIIN 4.2) It is recommended to strengthen the international cooperation in terms of lectures and research.

For the Ma programme Automation and Control

E 3. (ASIIN 2.1) It is recommended to offer the students a wider range of optional subjects, in which the students can develop a specialization.

For both Ma programmes

E 4. (ASIIN 3) It is recommended that the scientific level of the Master thesis be raised so that students demonstrate their ability to apply theoretical knowledge to the advancement of systems.

I Summary: Peer recommendations for Bachelor programmes (01.09.2023)

Following a resubmission of the module descriptions and theses for the Bachelors programmes by the EKTU, the evaluators have re-evaluated the two Bachelors programmes. They see a slight improvement in the presentation of some modules such as “Enterprise Engineering Modules” and “Design of Microprocessor Automated Control Systems”. Here, the learning outcomes and content are described clearly and concisely. However, many other modules show deficits not only in presentation and documentation, but also in depth and choice of content. In modules such as “Microprocessor Technology in Control Systems”. “Controler Programming in C++“, and “Technical Means of Information-Measuring Systems”, the learning outcomes are formulated generically and at a very basic level of competence. The experts also note inconsistencies between the learning outcomes and the lecture topics here. They point in particular to the description of the module “Electronics & Microprocessor Technology”, which seems incoherent and illogical.

In addition, the Bachelors programmes still do not appear to be well structured, as the auditors found many redundancies that are not explained in the module descriptions. For example, there is a disproportionate number of modules on sensors and scada systems. Overall, the experts have the impression that the Bachelors degree programmes are an uncoordinated selection of different topics from the fields of electrical engineering and automation and control technology.

In conclusion, the experts summarise their analysis and final evaluation for the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Electrical Power Engineering	Suspension	30.09.2028	–	–
Ba Automation and Control Engineering	Suspension	30.09.2028	–	–

Preconditions

For the Bachelor Programmes

V 1. (ASIIN 1.1, 1.3) Ensure that concrete and precise defined study aims and the content of the programmes correspond to the intended qualification level so that theses

demonstrate that students are able to work independently on a task at the level of the degree programme (EQF 6).

V 2. (ASIIN 2.1) Design all modules homogenously and in consistency with each other.

V 3. (ASIIN 5.1) Submit up-to-date module handbooks, which include precise and accurate descriptions of the module content, the intended learning outcomes, the teaching methods, the work load, the planned use/applicability, the admission and examination requirements, the date of last amendment made and the calculation of the module mark. Ensure that the module title and the module descriptions correspond with each other.

Requirements:

For both Ba programmes

A 1. (ASIIN 4.3) A follow-up visit must be carried out in order to assess necessary upgrades in the laboratories.

Recommendations:

For both Ba programmes

E 1. (ASIIN 1.3) It is recommended to increase the time designated for lectures in order to cover the subject material in more breadth and depth.

E 2. (ASIIN 4.2) It is recommended to strengthen the international cooperation in terms of lectures and research.

Recommendation for the Ba programme Automation and Control

E 3. (ASIIN 1.3, 4.3) It is recommended to establish a laboratory for the purpose of programming microcontrollers.

J Comment of the Technical Committees

Technical Committee 01 – Mechanical Engineering/Process Engineering (08.09.2023)

Assessment and analysis for the award of the ASIIN seal:

The TC discusses the accreditation procedure and follows the decision of the experts without any changes.

The Technical Committee 01 – Mechanical Engineering/Process Engineering recommends the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Electrical Power Engineering	Suspension	30.09.2028	–	–
Ba Automation and Control Engineering	Suspension	30.09.2028	–	–

Technical Committee 02 – Electrical Engineering/Information Technology (04.09.2023)

Assessment and analysis for the award of the ASIIN seal:

The TC discusses the accreditation case in detail. They retrace the process of the case until now: In June 2023, the case (including Bachelor's and Master's degree programmes) was discussed by the committees for the first time. At that time, TC 02 decided to follow the decision of the experts and to accredit the study programmes with requirements for one year, while TC 01 proposed to suspend the Bachelor's study programmes due to the severity of the deficits found. The Accreditation Commission concluded in June that it could not make a final decision because EKTU had not yet submitted fully transparent module descriptions for the Bachelor's degree programmes, which is why the experts had difficulties defining the exact level of the modules. Over the summer, EKTU submitted new module

descriptions and thesis samples. However, the experts saw only minor improvements in the module descriptions. Many modules still present very general or even incoherent and illogical outcomes and content. Overall, the modules still seem to be put together in an uncoordinated way. Since the university did not succeed in addressing the serious concerns of the evaluators regarding the low level of the Bachelor's programmes, the TC decides to follow the decision of the evaluators and suspend the two Bachelor's programmes.

The Technical Committee 02 – Electrical Engineering/Information Technology recommends the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Electrical Power Engineering	Suspension	30.09.2028	–	–
Ba Automation and Control Engineering	Suspension	30.09.2028	–	–

K Decision of the Accreditation Commission (22.09.2023)

Assessment and analysis for the award of the subject-specific ASIIN seal:

The commission discusses and follows the vote of the experts and the technical committees. They share their opinion that the two Bachelor programmes feature too severe deficits, which is why the recommend to suspend the accreditation of the two programmes. They solely correct a grammatical error in precondition V1.

The Accreditation Commission decides to award the following seals:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Electrical Power Engineering	Suspension	30.09.2028	–	–
Ba Automation and Control Engineering	Suspension	30.09.2028	–	–

Preconditions

For the Bachelor Programmes

V 1. (ASIIN 1.1, 1.3) Ensure that concrete and precisely defined study aims and the content of the programmes correspond to the intended qualification level so that theses demonstrate that students are able to work independently on a task at the level of the degree programme (EQF 6).

V 2. (ASIIN 2.1) Design all modules homogenously and in consistency with each other.

V 3. (ASIIN 5.1) Submit up-to-date module handbooks, which include precise and accurate descriptions of the module content, the intended learning outcomes, the teaching methods, the work load, the planned use/applicability, the admission and examination requirements, the date of last amendment made and the calculation of the module mark. Ensure that the module title and the module descriptions correspond with each other.

Requirements:

For both Ba programmes

A 1. (ASIIN 4.3) A follow-up visit must be carried out in order to assess necessary upgrades in the laboratories.

Recommendations:

For both Ba programmes

E 1. (ASIIN 1.3) It is recommended to increase the time designated for lectures in order to cover the subject material in more breadth and depth.

E 2. (ASIIN 4.2) It is recommended to strengthen the international cooperation in terms of lectures and research.

Recommendation for the Ba programme Automation and Control

E 3. (ASIIN 1.3, 4.3) It is recommended to establish a laboratory for the purpose of programming microcontrollers.

L Fulfilment of Requirements (28.06.2024)

Analysis of the experts and the Technical Committees (07.06.2024)

Requirements

For all degree programmes

A 1. (ASIIN 1.1, 1.3) Define concrete and precise intended learning outcomes and ensure that the module content aligns with the intended learning outcomes.

Initial Treatment	
Peers	not fulfilled Justification: The experts review the PLOs and module descriptions and find that they are still vague and unclear. In particular, the module descriptions lack concrete topics and learning outcomes. In addition, the learning outcomes are not competence-oriented or are on a very basic level such as 'Demonstrate knowledge', 'apply methods', or 'demonstrate skills'. Examples of insufficient module descriptions are of the modules "Control systems for industrial robots" and "Machine Learning and Data Analysis".
TC 01	not fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
TC 02	not fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
AC	not fulfilled Vote: unanimous Justification: The commission follows the vote of the experts.

A 2. (ASIIN 4.3) A follow-up visit must be carried out in order to assess necessary upgrades in the laboratories.

Initial Treatment	
Peers	Fulfilled Justification:

	EKTU submits a video of the laboratories of the Master's programmes, as the experts are of the opinion that a video is sufficient to assess the changes in the laboratories. The experts found that the current state of the lab equipment shown in the video is satisfactory; in particular, the mobile robotics and microcontroller labs are now well equipped.
TC 01	fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
TC 02	Fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
AC	fulfilled Vote: unanimous Justification: The commission follows the vote of the experts.

A 3. (ASIIN 5.1) Submit up-to-date module handbooks, which include precise and accurate descriptions of the module content, the intended learning outcomes, the teaching methods, the workload, the planned use/applicability, the admission and examination requirements, the date of last amendment made and the calculation of the module mark. Ensure that the module title and the module descriptions correspond with each other.

Initial Treatment	
Peers	not fulfilled Justification: The experts review the module descriptions and find that there is no substantial improvement in the module handbooks. They note that information is still missing, contradictory or unclear to an external assessor.
TC 01	not fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
TC 02	not fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
AC	not fulfilled Vote: unanimous Justification: The commission follows the vote of the experts.

A 4. (ASIIN 5.2) Provide a Diploma Supplement to every student directly after graduation.

Initial Treatment	
Peers	fulfilled Justification: The HEI states that starting from 2023, a Diploma Supplement is issued to every Master's graduate. EKTU also submits exemplary Diploma Supplements, which are in line with ASIIN criteria.
TC 01	fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
TC 02	Fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
AC	fulfilled Vote: unanimous Justification: The commission follows the vote of the experts.

Decision of the Accreditation Commission (28.06.2024)

Degree programme	**ASIIN-label**	**Subject-specific label**	**Accreditation until max.**
Ma Electrical Power Engineering	Requirement 1, and 3 not fulfilled	/	6 months prolongation
Ma Automation and Control Engineering	Requirement 1, and 3 not fulfilled	/	6 months prolongation

M Fulfilment of Requirements (06.12.2024)

Analysis of the experts and the Technical Committees (25.11.2024)

Requirements

For all degree programmes

A 1. (ASIIN 1.1, 1.3) Define concrete and precise intended learning outcomes and ensure that the module content aligns with the intended learning outcomes.

Secondary Treatment	
Peers	Fulfilled Justification: The experts review the revised PLOs and module descriptions and note that significant improvements have been made. For example, the learning outcomes are now more precise and conclusive and the module descriptions show that the content and the PLOs are consistent.
TC 01	Fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
TC 02	Fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
AC	fulfilled Vote: unanimous Justification: The commission follows the vote of the experts and committees.

A 2. (ASIIN 5.1) Submit up-to-date module handbooks, which include precise and accurate descriptions of the module content, the intended learning outcomes, the teaching methods, the workload, the planned use/applicability, the admission and examination requirements, the date of last amendment made and the calculation of the module mark. Ensure that the module title and the module descriptions correspond with each other.

Secondary Treatment	
Peers	Fulfilled Justification: As already mentioned, the experts find that the module descriptions are now much more coherent: They contain

	all the necessary information, which is presented in a concrete and precise manner.
TC 01	Fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
TC 02	Fulfilled Vote: unanimous Justification: The TC follows the vote of the experts.
AC	fulfilled Vote: unanimous Justification: The commission follows the vote of the experts and committees.

Decision of the Accreditation Commission (06.12.2024)

Degree programme	**ASIIN-label**	**Subject-specific label**	**Accreditation until max.**
Ma Electrical Power Engineering	All Requirements fulfilled	/	30.09.2028
Ma Automation and Control Engineering	All Requirements fulfilled	/	30.09.2028

N Resumption of the procedure for the Bachelor Programmes

Comment/opinion of the university (13.01.2025)

The HEI submitted a statement letter on 13.01.2025 outlining which documents have been provided in order to fulfil the precidintions and the requirement. A detailed statement describing the changes/improvements made was not provided.

The following list shows the evidence that has been submitted according to the respective precondition/requirement:

Preconditions for the Bachelor Programmes

V 1. (ASIIN 1.1, 1.3) Ensure that concrete and precisely defined study aims and the content of the programmes correspond to the intended qualification level so that theses demonstrate that students are able to work independently on a task at the leve of the degree programme (EQF 6).

- Updated data on the results of training in the educational program «6B07101 Automation and Control Engineering» are given in Appendix A.

- Updated data on the results of training in the educational program «6B07104-Electrical Power Engineering» are given in Appendix B.

V 2. (ASIIN 2.1) Design all modules homogenously and in consistency with each other.

- Updated module curriculum for the educational program «6B07101 Automation and Control Engineering» are provided in Appendix C.

- Updated module curriculum for the educational program «6B07104-Electrical Power Engineering» are provided in Appendix D.

V 3. (ASIIN 5.1) Submit up-to-date module handbooks, which include precise and accurate descriptions of the module content, the intended learning outcomes, the teaching methods, the work load, the planned use/applicability, the admission and examina-

tion requirements, the date of last amendment made and the calculation of the module mark. Ensure that the module title and the module descriptions correspond with each other.

- Updated module descriptions for the educational program «6B07101 Automation and Control Engineering» are provided in Appendix E.

- Updated module descriptions for the educational program «6B07104-Electrical Power Engineering» are provided in Appendix F.

Requirements: For both Ba programmes

A 1. (ASIIN 4.3) A follow-up visit must be carried out in order to assess necessary upgrades in the laboratories

The attached videos provide information about the Industrial AI Laboratory (https://drive.google.com/file/d/1PEUVFBSr0-Tbzn74uX-qILwYBs9SvNCM6/view?usp=drive_link), the branch of VKTU named after D. Serikbayev at LLP "Ust-Kamenogorsk CHPP" (https://drive.google.com/file/d/1K5iwlNUNSZArM5q3Ece-flLLwe0AksnD9/view?usp=drive_link), and the meteorological tower, including descriptions of the equipment and its application in the educational process (https://drive.google.com/file/d/1Vm7ZPXMRZN-PwI06fnGmy9L2ne6QIuq9/view?usp=drive_link).

The HEI did not provide comments or evidences regarding the recommendations.

Assessment of the experts (05.03.2025)

Preconditions for the Bachelor Programmes

V 1. (ASIIN 1.1, 1.3) Ensure that concrete and precisely defined study aims and the content of the programmes correspond to the intended qualification level so that theses demonstrate that students are able to work independently on a task at the level of the degree programme (EQF 6).

EKTU provides revised module descriptions and intended learning outcomes for the two Ba programmes. The experts review the programme learning outcomes and see clear improvements in their formulation, so that they are now more concise, competence-oriented

and highlight the qualification profile of the graduates. They note that the intended learning outcomes are now in line with EQF level 6. In addition, they find that the description of the content of the modules is now clearer and it is visible how the learning outcomes of the programme are reflected and anchored in the content of the modules, which also reflect EQF level 6.

However, the experts note that EKTU did not provide any samples of the bachelor's theses, so it is not possible for them to assess the quality of the bachelor's theses. In view of the improvement of the programme learning outcomes and module descriptions as well as the overall efforts made by EKTU, the experts suggest that the precondition be changed to a requirement that focuses on the assessment of the bachelor theses demonstrating that the students are able to work independently on a task at the level of the programme, which is in line with EQF 6. Based on the improvements seen so far, the experts are convinced that EKTU will be able to deliver bachelor theses corresponding to EQF level 6 within the provisional accreditation period (i.e. 9 months).

The experts suggest converting the precondition into the following requirement:

(ASIIN 3) Ensure that the theses demonstrate that students are able to work independently on a task at the level of the degree programme (EQF 6).

V 2. (ASIIN 2.1) Design all modules homogenously and in consistency with each other.

The experts review the module descriptions and conclude that the modules are now more homogeneous in the sense that the level of complexity and depth with which the module content is covered (at least according to the description), i.e. the conceptualisation of the module itself, is not as severe across the modules per programme as it was at the time of the site visit. They still observe certain differences in the description of the content and the intended learning outcomes of the individual modules, as well as their level, but ultimately find these variations acceptable within a study programme. They therefore consider the precondition to be fulfilled.

V 3. (ASIIN 5.1) Submit up-to-date module handbooks, which include precise and accurate descriptions of the module content, the intended learning outcomes, the teaching methods, the work load, the planned use/applicability, the admission and examination requirements, the date of last amendment made and the calculation of the module mark. Ensure that the module title and the module descriptions correspond with each other.

The experts review the module descriptions and note that they now include information on all aspects mentioned in the prerequisite. They also see improvements in the formulation of information, particularly in relation to the content of modules and components such as laboratory exercises. They also observe some progress in the formulation of module objectives and learning outcomes, but overall they still see clear room for improvement. For example, the experts feel that the learning outcomes now give a better idea of the competences acquired, but are still not sufficiently precise and, in particular, not sufficiently competence-based. They recognise a division into different competence categories, but find that this is presented rather vaguely. They therefore suggest that the prerequisite should be changed to a requirement, which entails EKTU revising all module descriptions so that they clearly state the objectives and learning outcomes, specifying the concrete scientific knowledge, skills and competences that students will acquire by completing the module.

To clarify their ideas, the experts also give some examples and suggestions of what concrete and competence-oriented objectives should look like:

For example, in relation to laboratory teaching, they suggest the following wording:

- "For the competence: Students can specify, implement and test an industrial automation task using a PLC.
- Beginner task: Students can program a control system for a push-button operated DC motor on a PLC from scratch and fully test it.
- Advanced level: Students can collaboratively implement and test a distributed control system for a simple conveyor system in a group project".

For the control course competency, they give the following suggestions: "Students can design a linear feedback controller using state feedback methods".

For the feedback control lab, they suggest: "Students can apply modelling methods and linear state feedback to a single flywheel drive system and program a controller that executes a setpoint step in the shortest possible time without overshooting".

These suggestions are intended to provide guidance and clarification for EKTU.

The experts suggest converting the precondition into the following requirement:

(ASIIN 1.1, 5.1): Ensure that the module descriptions contain a clear, precise and competency-based presentation of the module's objectives and learning outcomes.

Requirements

For both Ba programmes

A 1. (ASIIN 4.3) A follow-up visit must be carried out in order to assess necessary upgrades in the laboratories

EKTU provides videos of the current laboratories and equipment used in the bachelor programmes. The experts consider the equipment itself to be adequate, but wish that EKTU had also shown what tasks (especially in the field of automation / MCT / embedded systems) the students have to solve with the equipment, i.e. an overall demonstration of the didactic concept, the realisation of the learning objectives and the way in which the students carry out their laboratory practice with the equipment should be visible. This improvement should also be made visible in the corresponding module descriptions. In addition, they also request a demonstration of the sensors/metrology, robotics, mechatronic systems & electric drives laboratories. In conclusion, they suggest that the requirement be reformulated to include these aspects.

The experts suggest reformulating the requirement into:

(ASIIN 2.3, 4.3) Demonstrate how the upgraded laboratory equipment is used in the laboratory work by showing how the equipment (both hardware and software) is used by students to solve practical problems, thereby highlighting the didactic concept.

The experts summarise their analysis and final assessment of the resumption process for the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Electrical Power Engineering	With requirements for one year	30.09.2030	–	–
Ba Automation and Control Engineering	With requirements for one year	30.09.2030	–	–

Requirements

For both Ba programmes

A 1. (ASIIN 1.1, 5.1) Ensure that the module descriptions contain a clear, precise and competency-based presentation of the module's objectives and learning outcomes.

A 2. (ASIIN 2.3, 4.3) Demonstrate how the upgraded laboratory equipment is used in the laboratory work by showing how the equipment (both hardware and software) is used by students to solve practical problems, thereby highlighting the didactic concept.

A 3. (ASIIN 3) Ensure that the theses demonstrate that students are able to work independently on a task at the level of the degree programme (EQF 6).

Recommendations

For both Ba programmes

E 1. (ASIIN 1.3) It is recommended to increase the time designated for lectures in order to cover the subject material in more breadth and depth.

E 2. (ASIIN 4.2) It is recommended to strengthen the international cooperation in terms of lectures and research.

Recommendation for the Ba programme Automation and Control

E 3. (ASIIN 1.3, 4.3) It is recommended to establish a laboratory for the purpose of programming microcontrollers.

Assessment of the Technical Committees (10.03.2025)

Technical Committee 02 – Electrical Engineering/Information Technology (07.03.2025)

Assessment and analysis for the award of the ASIIN seal:

The TC discusses the procedure and agrees with the experts that the two Bachelor programmes have been revised and improved to the extent that a provisional accreditation can be granted and that the aspects of the preconditions that have not been fully met should be converted into requirements as suggested by the experts.

The Technical Committee 02 – Electrical Engineering/Information Technology recommends the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Electrical Power Engineering	With requirements for one year	30.09.2030	–	–
Ba Automation and Control Engineering	With requirements for one year	30.09.2030	–	–

Technical Committee 01 – Mechanical Engineering/Process Engineering (10.03.2025)

Assessment and analysis for the award of the ASIIN seal:

The TC discusses the procedure and agrees with the experts that the Bachelor programme Automation and Control Engineering has been revised and improved to the extent that a provisional accreditation can be granted and that the aspects of the preconditions that have not been fully met should be converted into requirements as suggested by the experts.

The Technical Committee 01 – Mechanical Engineering/Process Engineering recommends the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Automation and Control Engineering	With requirements for one year	30.09.2030	–	–

Decision of the Accreditation Commission (25.03.2025)

Assessment and analysis for the award of the ASIIN seal:

The commission discusses the resumption of the two Bachelor study programmes and agrees with the experts and the TCs that the overall state and quality of the two study programmes is now sufficient to grant accreditation with requirements. They also discuss recommendation E3 and find that, in view of the importance of microcontrollers, it should be required that students also learn the practical aspects of the topic, as there are currently

only online courses on this topic. They therefore propose to maintain the recommendation for the laboratory as this regards more the facilities but also decide to add a requirement that students also learn the practical application of microcontrollers.

The Accreditation Commission decides to award the following seals:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Electrical Power Engineering	With requirements for one year	30.09.2030	–	–
Ba Automation and Control Engineering	With requirements for one year	30.09.2030	–	–

Requirements

For both Ba programmes

A 1. (ASIIN 1.1, 5.1) Ensure that the module descriptions contain a clear, precise and competency-based presentation of the module's objectives and learning outcomes.

A 2. (ASIIN 2.3, 4.3) Demonstrate how the upgraded laboratory equipment is used in the laboratory work by showing how the equipment (both hardware and software) is used by students to solve practical problems, thereby highlighting the didactic concept.

A 3. (ASIIN 3) Ensure that the theses demonstrate that students are able to work independently on a task at the level of the degree programme (EQF 6).

A 4. (ASIIN 1.3) Make sure that students learn about the practical aspects of programming microcontrollers.

Recommendations

For both Ba programmes

E 1. (ASIIN 1.3) It is recommended to increase the time designated for lectures in order to cover the subject material in more breadth and depth.

E 2. (ASIIN 4.2) It is recommended to strengthen the international cooperation in terms of lectures and research.

Recommendation for the Ba programme Automation and Control

E 3. (ASIIN 1.3, 4.3) It is recommended to establish a laboratory for the purpose of programming microcontrollers.

Appendix: Programme Learning Outcomes and Curricula

According to Diploma Supplement, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Electrical Power Engineering:

- "Mastering basic knowledge in the field of natural sciences (social, humanitarian, economic) disciplines that contribute to the formation of a highly educated person with a broad outlook and a culture of thinking
- Be able to organize workplaces, their technical facilities, position technical equipment in accordance with its production technology, standards of safety and industrial hygiene, fire safety and labor protection
- Be skilled in testing methodology, installation and maintenance of technological equipment in accordance with the profile of work
- Be skilled in handling modern technology, be able to use information technology in the field of professional activity
- Be ready to collect and analyze source data for the design of equipment items and objects of activity in general, using regulatory documentation and modern m ethods of information searching and processing
- Be involved in development of project design documents, design of completed design work in accordance with standards, specifications and other regulatory documents"

According to Diploma Supplement, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Electrical Power Engineering:

- "Possess the skills of perceiving and analyzing information of philosophical and production content, methods of conducting discussion and polemics
- To be able to correctly express a thought, reasonably defend one's own opinion on issues of industrial and social significance
- Have communication skills that allow you to effectively implement professional activities
- Search and process information using information technology

- Demonstrate knowledge that contributes to the formation of an integral personality in a social production environment and an increase in the responsibility of the individual
- Apply methods to ensure the effectiveness of social systems in the aspect of solving the assigned tasks
- To be able to analyze the feasibility and reliability of technical solutions in the electric power industry
- Be able to use computer and information technology in the aspect of the specialty
- Apply methods of mathematical analysis when solving engineering problems; identify the physical in nature of phenomena and processes
- Possess the ability of theoretical and experimental research in the electric power industry
- Apply electrical engineering design skills
- Be able to develop rational technical solutions in the electric power industry"

According to Diploma Supplement, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Automation and Control Engineering:

- "Specialized knowledge in the field of mathematics, natural sciences, humanities and economics.
- Ability to conduct experiments according to specified methods with the processing and analysis of results, to apply standard test methods in automation.
- Conduct a preliminary feasibility study of design solutions, carry out organizational and planned calculations for the creation or reorganization of production sites, plan the work of personnel and wages, apply progressive methods of operation.
- Ability to apply standard methods of calculating elements and assemblies of automation and control systems, to carry out design work and draw up design and technological documentation in accordance with standards, specifications and other regulatory documents, including using computer-aided design tools.
- Apply modern methods for the development of energy-saving and environmentally friendly automation and control systems that ensure the safety of life of people and their protection from the possible consequences of accidents, disasters and natural disasters."

According to Diploma Supplement, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Automation and Control Engineering:

- "Demonstrate knowledge and understanding in practice of special mathematical knowledge using acquired competencies in undergraduate studies
- Transferring conclusions, knowledge and considerations to the audience and specialists, using modern means of obtaining, storing, processing information
- Can integrate knowledge for organizing, planning and conducting research.
- Use the opportunities of acquired communicative ability to clearly and clearly substantiate their findings and knowledge to specialists and non-specialists.
- They can continue training on their own to gain new knowledge, knowledge of aspects of integrated engineering activities, awareness of health issues, life safety and occupational safety
- Demonstrate knowledge and understanding of mathematical, natural, humanitarian and economic sciences in the development of control automation systems.
- Can apply the skills in practical use of methods of mathematical analysis, the basics of theoretical and experimental research in the field of automation in new or unfamiliar situations
- Can apply knowledge, understanding and problem-solving ability in new or unfamiliar situations and contexts within broader areas related to the field of study.
- Can integrate knowledge, deal with complex issues, and make judgments based on incomplete or limited information.
- Demonstrate knowledge that allows to develop a feasibility study of design solutions.
- Demonstrate knowledge that allows the use of modern methods of calculating elements and nodes of automation and control systems.
- They can continue training on their own to obtain new knowledge and apply knowledge in metrology to ensure compliance with the necessary requirements of modern technological processes
- Use the opportunities of acquired communicative ability to develop energy-saving and environmentally friendly automation and control systems"

The following **curriculum** is presented for the Ba programme Electrical Power Engineering:

Module code (discipline)	Component	Name of the Discipline	Number of ESTS	Semestr	Form of Control	Students' working time budget (in hours)						
						Total hours	Classroom work				AWTH	SAW
							Total	Among these				
								Lectures	Practical	Lab		
1. General Education Discipline Modules - 56 ESTS												
HM 1.1	**1.1 Humanities Module - 10 ESTS**											
1101	MC	Modern History of Kazakhstan	5	2	StExam	150	45	15	30		30	75
2102	MC	Philosophy	5	3	Exam	150	45	15	30		30	75
CITM 1.2	**1.2 Communication and Information Technology Module - 25 ESTS**											
1103	MC	Kazakh(Russian) Language	5	1	Abs	150	45		45		30	75
			5	2	Exam	150	45		45		30	75
1104	MC	Foreign Language	5	1	Abs	150	45		45		30	75
			5	2	Exam	150	45		45		30	75
1105	MC	Information and Communication Technologies (ineng-lish)	5	1	Exam	150	45	15		30	30	75
SPSM 1.3	**1.3 Social and Political Science Module - 8 ESTS**											
1107	MC	Culture Studies	2	2	Exam	60	30	15	15		15	15
1108	MC	Sociology	2	2	Exam	60	30	15	15		15	15
2109	MC	Political Science	2	4	Exam	60	30	15	15		15	15
2110	MC	Psychology	2	4	Exam	60	30	15	15		15	15
HDM 1.4	**1.4 Human Development Module - 13 ESTS**											
1106	MC	Physical Education	8	1,2,3,4	GradedCredit	240	180		180		30	30
2111	CS	Fundamentals of Ecology and Health and Safety	5	3	Exam	150	45	15	30		30	75
2111		Integrity and Anti-Corruption	5	3	Exam	150	45	15	30		30	75
2111		Economics Basics	5	3	Exam	150	45	15	30		30	75
Total ESTS in general education disciplines			**56**			**1680**	**660**	**120**	**510**	**30**	**330**	**690**
2. Basic Discipline Modules - 112 ESTS												

MNS 2.1	**2.1 Module of Natural Sciences - 18 ESTS**											
1201	UC	Mathematics 1	4	1	Exam	120	45	15	30		30	45
1202	UC	Mathematics 2	4	2	Exam	120	45	15	30		30	45
1203	UC	Physics	4	1	Exam	120	45	15		30	30	45
2222	UC	Complex Analysis	3	3	Exam	90	30	15	15		15	45
2206	CS	AutoCAD	3	3	Exam	90	30		30		15	45
2206		Compass Drawings	3	3	Exam	90	30		30		15	45
EM 2.2	**2.2 Energy Module - 17 ESTS**											
2214	UC	Mathematical Problems and Cmputer Modeling in the Electric Power Industry	5	4	Exam	150	45	15	30		30	75
3217	UC	Renewable Energy	5	5	Exam,CPap	150	45	15	30		30	75
1223	UC	Industrial Training	2	2	GradedCredit	60						60
1204	CS	General Energetics	5	1	Exam	150	45	15	30		30	75
1204		Introduction into the Specialist Field	5	1	Exam	150	45	15	30		30	75
EMM 2.3	**2.3 Electrical Materials Module - 19 ESTS**											
2207	CS	Electrotechnical Material Science	4	3	Exam	120	45	15	30		30	45
2207		Materials in the Electrical Power Engineering	4	3	Exam	120	45	15	30		30	45
2213	CS	Industrial Electronics	5	4	Exam	150	45	15	15	15	30	75
2213		Fundamentals of Electronics	5	4	Exam	150	45	15	15	15	30	75
3216	CS	Overvoltage and Insolation	5	5	Exam	150	45	15	30		30	75
3216		High Voltage Technology	5	5	Exam	150	45	15	30		30	75
3219	CS	Design of Pumps, Ventilators and Smoke Exhausters	5	6	Exam	150	45	15	30		30	75
3219		Thermal Power-Station Turbines	5	6	Exam	150	45	15	30		30	75
MTFEET2.4	**2.4 Module of Theoretical Foundations of Electrical Engineering and Transients - 14 ESTS**											
2212	UC	Theoretical Foundations of Electrical Engineering I	4	3	Exam	120	45	15	15	15	30	45
2215	UC	Theoretical Foundations of Electrical Engineering II	5	4	Exam	150	45	15	15	15	30	75
3218	CS	Transient Processes	5	6	Exam,CPap	150	45	15	30		30	75
3218		Electromagnetic Transients	5	6	Exam	150	45	15	30		30	75
MSEAE 2.5	**2.5 Module of Switching Equipment and Auxiliary Equipment - 16 ESTS**											
1205	UC	Information and Measuring Technology	3	2	Exam	90	30	15	15		15	45
2224	UC	Industrial Training 1	4	4	GradedCredit	120						120
2208	CS	Electrical Apparatus	4	3	Exam	120	45	15	30		30	45
2208		Switching Equipment	4	3	Exam	120	45	15	30		30	45
4221	CS	Electrical Industry	5	7	Exam	150	45	15	30		30	75

4221		Electrotechnical Machines and Equipment	5	7	Exam	150	45	15	30		30	75
EEM 2.6	**2.6 Engineering Entrepreneurship Module - 13 ESTS**											
3209	UC	Entrepreneurship and Business Legal Environment	5	7	Exam	150	45	15	30		30	75
3210	UC	Enterprise Economics	5	6	Exam	150	45	15	30		30	75
4211	UC	Occupational Health and Safety	3	8	Exam	90	30	15	15		15	45
MM 2.7	**2.7 Module of Minor - 15 ESTS**											
	CS	Minor Discipline 1	5	4	Exam	150	45	15	30		30	75
	CS	Minor Discipline 2	5	5	Exam	150	45	15	30		30	75
	CS	Minor Discipline 3	5	6	Exam	150	45	15	30		30	75
Total ESTS in basic disciplines			**112**			**3360**	**1020**	**345**	**600**	**75**	**660**	**1680**
3. Major Disciplines Module - 60 ESTS												
MEMED 3.1	**3.1 Module of Electric Machines and Electric Drive - 15 ESTS**											
3301	UC	Electric Machinery	5	5	Exam	150	45	15	15	15	30	75
3310	UC	Industrial Training 2	5	6	GradedCredit	150						150
3303	CS	Electric Drive and Automation	5	6	Exam	150	45	15	15	15	30	75
3303		Electrical Equipment and Electric Drive	5	6	Exam	150	45	15	15	15	30	75
ARPM 3.2	**3.2 Automation and Relay Protection Module - 13 ESTS**											
4306	UC	Fundamentals of Relay Protection Technology	5	7	Exam	150	45	15	15	15	30	75
4304	CS	Automated Control in the Electric Power Industry	3	7	Exam	90	30	15	15		15	45
4304		Automated Control in the Energy Sector	3	7	Exam	90	30	15	15		15	45
4309	CS	Relay Protection and Automation	5	8	Exam,CPap	150	45	15	15	15	30	75
4309		Relay Protection of Stations and Substations	5	8	Exam,CPap	150	45	15	15	15	30	75
ENM 3.3	**3.3 Electrical Network Module - 14 ESTS**											
4307	UC	Electric Power Stations and Substations	5	7	Exam,CPap	150	45	15	30		30	75
3320	UC	Electric Power Lines and Systems	5	5	Exam	150	45	15	30		30	75
4305	CS	Installation and Operation of Electrical Systems	4	7	Exam	120	45	15	30		30	45
4305		Installation and Operation of Power Supply Systems	4	7	Exam	120	45	15	30		30	45
PSDM 3.4	**3.4 Power Supply System Design Module - 18 ESTS**											
4311	UC	Pre FYP Industrial Ttraining	5	8	GradedCredit	150						150
3302	CS	Lighting System Design	5	5	Exam	150	45	15	30		30	75
3302		Lighting Engineering and Light Sources	5	5	Exam	150	45	15	30		30	75
3219	CS	Electrical Safety in Installations	3	7	Exam	90	30	15	15		15	45
3219		Electrical Safety	3	7	Exam	90	30	15	15		15	45
4308	CS	Electric Power Supply Systems Engineering	5	8	Exam, CPr	150	45	15	30		30	75
4308		Power Supply	5	8	Exam, CPr	150	45	15	30		30	75

Total ESTS for major disciplines			**60**			**1800**	**465**	**165**	**240**	**60**	**300**	**1035**
Total ESTS in general education disciplines		**MC**	**51**			**1530**	**615**	**105**	**480**	**30**	**300**	**615**
		CS	**5**			**150**	**45**	**15**	**30**	**0**	**30**	**75**
Total ESTS in basic disciplines		**UC**	**56**			**1680**	**495**	**180**	**255**	**60**	**315**	**870**
		CS	**56**			**1680**	**525**	**165**	**345**	**15**	**345**	**810**
Total ESTS for major disciplines		**UC**	**30**			**900**	**180**	**60**	**90**	**30**	**120**	**600**
		CS	**30**			**900**	**285**	**105**	**150**	**30**	**180**	**435**
Total ESTS for theoretical learning			**228**			**6840**	**2145**	**630**	**1350**	**165**	**1290**	**3405**
MIA 4		**4 Module of final certification - 12 ESTS**										
IA	MC	Writing and defending a thesis (project) or preparing and passing a comprehensive exam	12			360						360
Total ESTS for the final certification:			**12**			**360**						**360**
Total ESTS/academic hours:			**40**			**7200**	**2145**	**630**	**1350**	**165**	**1290**	**3765**

The following **curriculum** is presented for the Ma programme Electrical Power Engineering:

Module code	Component	Name of the discipline	Number of ECTS	Semestr	Form of control	Students' working time budget (in hours)						
						Total hours	Classroom work				MSIWTC	IWMS
							Total	Among these				
								Lectures	Practical	Lab		
2. Modules of basic disciplines - 35 ESTS												
MGC 2.1	**2.1 Module of general communication - 12 ESTS**											
5201	UC	History and Philosophy of Science	3	1	Exam	90	30	15	15		15	45
5202	UC	Foreign language (professional)	3	1	Exam	90	30		30		15	45
5203	UC	Higher Education Pedagogics	3	2	Exam	90	30	15	15		15	45
5204	UC	Psycology of management	3	1	Exam	90	30	15	15		15	45
PIBM 2.2	**2.2 Power Industry Basics Module - 15 ESTS**											
5205	CS	Reliability and quality of electricity	5	1	Exam	150	45	30	15		30	75
5205		Reliability of electric power systems and power quality	5	1	Exam	150	45	30	15		30	75
5206	CS	Object-oriented Programming Languages	5	1	Exam	150	45	30		15	30	75
5206		Programming Media and Languages	5	1	Exam	150	45	30	15		30	75
5207	CS	Electrical Processing Equipment	5	2	Exam	150	45	15	30		30	75
5207		Electrical plants in industry	5	2	Exam	150	45	15	30		30	75
AM 2.3	**2.3 Analytical module - 8 ESTS**											
5208	UC	System Analysis	5	2	Exam	150	45	30	15		30	75
6209	UC	Pedagogical Practical Training	3	3	GradedCredit	90						90
Total ESTS in basic disciplines			**35**			**1050**	**300**	**150**	**135**	**15**	**180**	**570**
3. Modules of major disciplines - 49 ESTS												
ERM 3.1	**3.1 Experimental Research Module - 15 ESTS**											
6308	UC	Research Practice	9	4	GradedCredit	270						270
5301	CS	Theory of Scientific Experiment Modeling	6	1	Exam	180	60	30	15	15	30	90

5301		Design of experiments	6	1	Exam	180	60	30	15	15	30	90
EPSDM 3.2	**3.2 Electric Power Systems Design Module - 18 ESTS**											
6302	UC	Nanotechnologies in Power Engineering	6	3	Exam	180	60	30	30		30	90
6303	UC	New electrotechnical material	6	3	Exam	180	60	30	30		30	90
5304	CS	Electric-Power System Engineering	6	2	Exam	180	60	15	45		30	90
5304		Design and optimization of power systems	6	2	Exam	180	60	15	45		30	90
MOCTEPI 3.3	**3.3 Module of optimization and control technologies in the electric power industry - 16 ESTS**											
6305	UC	Scientific and Technical Problems in Electrical Engineering	5	3	Exam	150	45	30	15		30	75
6306	UC	Information Technologies in Power Engineering	5	3	Exam	150	45	30		15	30	75
5307	CS	Resource Saving Technologies in Electrical Power Engineering	6	2	Exam	180	60	30	30		30	90
5307		Energy-saving technologies in electric-power industry	6	2	Exam	180	60	30	30		30	90
Total ESTS for major disciplines			**49**			**1470**	**390**	**195**	**165**	**30**	**210**	**870**
Total ESTS in basic disciplines	**UC**		**20**			**600**	**165**	**75**	**90**	**0**	**90**	**345**
	CS		**15**			**450**	**135**	**75**	**45**	**15**	**90**	**225**
Total ESTS for major disciplines	**UC**		**31**			**930**	**210**	**120**	**75**	**15**	**120**	**600**
	CS		**18**			**540**	**180**	**75**	**90**	**15**	**90**	**270**
Total ESTS for theoretical learning			**84**			**2520**	**690**	**345**	**300**	**45**	**390**	**1440**
MMSRW 4	**4 Module of a master's student research work - 24 ESTS**											
	MC	Undergraduate research work including internship and master thesis	24	1,2,3,4	GradedCredit	720	0				0	720
Total ESTS for SRWMS:			**24**			**720**	**0**				**0**	**720**
MFC 5	**5 Module of final certification - 12 academic credits**											
IA	OK	Preparation and defense of a master's thesis	12				360					360
Total ESTS for the final certification:			**12**			**360**						**360**
Total ESTS /academic hours:			**120**			**3600**	**690**	**345**	**300**	**45**	**390**	**2520**

The following **curriculum** is presented for the Ba programme Automation and Control Engineering:

Module code (discipline)	Component	Name of the Discipline	Number of ESTS	Semestr	Form of Control	Students' working time budget (in hours)						
						Total hours	Classroom work				AWTH	SAW
							Total	Among these				
								Lectures	Practical	Lab		
1. General Education Discipline Modules - 56 ESTS												
HM 1.1	**1.1 Humanities Module - 10 ESTS**											
1101	MC	Modern History of Kazakhstan	5	2	StExam	150	45	15	30		30	75
2102	MC	Philosophy	5	4	Exam	150	45	15	30		30	75
CITM 1.2	**1.2 Communication and Information Technology Module - 25 ESTS**											
1103	MC	Kazakh(Russian) Language	5	1	Abs	150	45		45		30	75
			5	2	Exam	150	45		45		30	75
1104	MC	Foreign Language	5	1	Abs	150	45		45		30	75
			5	2	Exam	150	45		45		30	75
1105	MC	Information and Communication Technologies (in english)	5	1	Exam	150	45	15		30	30	75
SPSM 1.3	**1.3 Social and Political Science Module - 8 ESTS**											
1107	MC	Culture Studies	2	1	Exam	60	30	15	15		15	15
1108	MC	Sociology	2	1	Exam	60	30	15	15		15	15
2109	MC	Political Science	2	4	Exam	60	30	15	15		15	15
2110	MC	Psychology	2	4	Exam	60	30	15	15		15	15
HDM 1.4	**1.4 Human Development Module - 13 ESTS**											
1106	MC	Physical Education	8	1,2,3,4	GradedCredit	240	180		180		30	30
2111	CS	Fundamentals of Ecology and Health and Safety	5	3	Exam	150	45	15	30		30	75
2111		Integrity and Anti-Corruption	5	3	Exam	150	45	15	30		30	75
2111		Economics Basics	5	3	Exam	150	45	15	30		30	75
Total ESTS in general education disciplines			**56**			**1680**	**660**	**120**	**510**	**30**	**330**	**690**
2. Basic Discipline Modules - 112 ESTS												
NSM 2.1	**2.1 Natural Science Modules - 22 ESTS**											
1201	UC	Mathematics 1	4	1	Exam	120	45	15	30		30	45
1202	UC	Mathematics 2	4	2	Exam	120	45	15	30		30	45
1204	UC	Physics	4	2	Exam	120	45	15	30		30	45

1206	UC	Introduction into the Specialist Field	5	1	Exam	150	45	15	30		30	75
1220	UC	Industrial Training	2	2	GradedCredit	60						60
1210	CS	Fundamentals of Modern Control System Development	3	2	Exam	90	30	15	15		15	45
1210		Fundamentals of Electronics	3	2	Exam	90	30	15	15		15	45
TPAM 2.2	**2.2 Technological Process Automation Module - 18 ESTS**											
3204	CS	Automatic Control Theory	5	6	Exam	150	45	15	30		30	75
3204		Automation of Technical Processes	5	6	Exam	150	45	15	30		30	75
2208	CS	Computer-aided Design	3	3	Exam	90	30		30		15	45
2208		Computer-aided Design Basics	3	3	Exam	90	30	15	15		15	45
2205	CS	Technical Regulations	5	3	Exam	150	45	15	30		30	75
2205		Automation of Standard Technology Processes	5	3	Exam	150	45	15	30		30	75
3207	CS	Automation Equipment	5	6	Exam	150	45	15	30		30	75
3207		Sensors for Control Systems	5	6	Exam	150	45	15	30		30	75
MSM 2.3	**2.3 Modern Systems Module - 24 ESTS**											
2214	UC	Linear Systems of Automatic Control	5	4	Exam	150	45	15	30		30	75
3214	UC	Nonlinear Systems of Automatic Control	5	5	Exam	150	45	15	30		30	75
2215	UC	Electronic Circuits Building Theory	5	3	Exam	150	45	15	30		30	75
2221	UC	Industrial Training 1	4	4	GradedCredit	120						120
3213	CS	Digital Devices	5	5	Exam	150	45	15	30		30	75
3213		Electronic Signal Converters	5	5	Exam	150	45	15	30		30	75
CEM 2.4	**2.4 Circuit Engineering Module - 20 ESTS**											
2218	UC	Special Chapters of Mathematics	5	3	Exam	150	45	15	30		30	75
2211	CS	Programming Controllers PC IBM	5	3	Exam	150	45	15	30		30	75
2211		Controler Programming in C + +	5	3	Exam	150	45	15	30		30	75
2212	CS	Modern Measuring Transducers	5	4	Exam	150	45	15	30		30	75
2212		Technical Means of Information-Measuring Systems	5	4	Exam	150	45	15	30		30	75
3209	CS	Microprocessor Technology in Control Systems	5	5	Exam	150	45	15	30		30	75
3209		Microprocessor Technology in Measurement Systems	5	5	Exam	150	45	15	30		30	75
EEM 2.5	**2.5 Enterprise Engineering Module - 13 ESTS**											
4216	UC	Occupational Health and Safety	3	8	Exam	90	30	15	15		15	45
3217	UC	Entrepreneurship and Business legal Environment	5	6	Exam	150	45	15	30		30	75
4219	UC	Enterprise Economics	5	7	Exam	150	45	15	30		30	75
MM 2.6	**2.6 Module of Minor - 15 ESTS**											
	CS	Minor Discipline 1	5	4	Exam	150	45	15	30		30	75
	CS	Minor Discipline 2	5	5	Exam	150	45	15	30		30	75
	CS	Minor Discipline 3	5	6	Exam	150	45	15	30		30	75
Total ESTS in basic disciplines			**112**			**3360**	**990**	**330**	**660**	**0**	**645**	**1725**
3. Major Disciplines Module - 60 ESTS												

ACM 3.1	**3.1 Automation and Control Module - 20 ESTS**											
3311	UC	Industrial Training 2	5	6	GradedCredit	150						150
3304	CS	Circuit Engineering	5	5	Exam	150	45	15	30		30	75
3304		Electronics & Microprocessor Technology	5	5	Exam	150	45	15	30		30	75
4301	CS	Basics of Metrology	5	7	Exam	150	45	15	30		30	75
4301		Engineering System Reliability	5	7	Exam	150	45	15	30		30	75
4303	CS	Design of Microprocessor Automated Control Systems	5	7	Exam, CPr	150	45	15	30		30	75
4303		Modern Theories, Methods and Tools for Creating Automation Systems	5	7	Exam	150	45	15	30		30	75
ADM 3.2	**3.2 Automation Design Module - 20 ESTS**											
4307	UC	Automation of industrial processes	5	7	Exam	150	45	15	30		30	75
4308	UC	Mounting and Maintenance of Automation Systems	5	7	Exam	150	45	15	30		30	75
3310	UC	Design of Automated Systems and Complexes	5	5	Exam, CPr	150	45	15	30		30	75
4312	UC	Pre FYP Industrial Training	5	8	GradedCredit	150						150
MIP 3.3	**3.3 Module of Information Processing - 20 ESTS**											
3309	UC	Software for Control Devices	5	6	Exam	150	45	15	30		30	75
4305	CS	Technical Means for Information Processing	5	7	Exam	150	45	15	30		30	75
4305		Systematization of Experimental Means for Laboratory Measurements in Control Systems	5	7	Exam	150	45	15	30		30	75
4306	CS	Automation Elements and Devices	5	8	Exam	150	45	15	30		30	75
4306		Digital Control Systems	5	8	Exam	150	45	15	30		30	75
4302	CS	Automation Systems Software	5	8	Exam	150	45	15	30		30	75
4302		Developing Problem-Oriented Web Applications	5	8	Exam	150	45	15	30		30	75
Total ESTS for major disciplines			**60**			**1800**	**450**	**150**	**300**	**0**	**300**	**1050**
Total ESTS in general education disciplines		**MC**	**51**			**1530**	**615**	**105**	**480**	**30**	**300**	**615**
		CS	**5**			**150**	**45**	**15**	**30**	**0**	**30**	**75**
Total ESTS in basic disciplines		**UC**	**56**			**1680**	**480**	**165**	**315**	**0**	**315**	**885**
		CS	**56**			**1680**	**510**	**165**	**345**	**0**	**330**	**840**
Total ESTS for major disciplines		**UC**	**30**			**900**	**180**	**60**	**120**	**0**	**120**	**600**
		CS	**30**			**900**	**270**	**90**	**180**	**0**	**180**	**450**
Total ESTS for theoretical learning			**228**			**6840**	**2100**	**600**	**1470**	**30**	**1275**	**3465**
MIA 4	**4 Module of Final Certification - 12 ESTS**											
IA	MC	Writing and defending a thesis (project) or preparing and passing a comprehensive exam	12			360						360
Total ESTS for the final certification:			**12**			**360**						**360**
Total ESTS/academic hours:			**240**			**7200**	**2100**	**600**	**1470**	**30**	**1275**	**3825**

The following **curriculum** is presented for the Ma programme Automation and Control Engineering:

Module code	Component	Name of the discipline	Number of ECTS	Semestr	Form of control	Students' working time budget (in hours)						
						Total hours	Classroom work				MSIWTC	IWMS
							Total	Among these				
								Lectures	Practical	Lab		
2. Modules of basic disciplines - 35 ESTS												
MGC 2.1	**2.1 Module of general communication - 12 ESTS**											
5201	UC	History and Philosophy of Science	3	1	Exam	90	30	15	15		15	45
5202	UC	Foreign language (professional)	3	1	Exam	90	30		30		15	45
5203	UC	Higher Education Pedagogics	3	2	Exam	90	30	15	15		15	45
5204	UC	Psycology of management	3	1	Exam	90	30	15	15		15	45
LSM 2.2	**2.2 Local systems module - 13 ESTS**											
5205	UC	Local systems automation and control	5	1	Exam	150	45	15		30	30	75
6209	UC	Pedagogical Practical Training	3	3	GradedCredit	90						90
U5207	CS	Data ware of control systems	5	2	Exam	150	45	15		30	30	75
5207		Information networks and communications	5	2	Exam	150	45	15		30	30	75
MMM2.3	**2.3 Mathematical modeling module - 10 ESTS**											
5208	CS	Mathematical Modeling of Controlling Objects and Systems	5	1	Exam	150	45	15		30	30	75
5208		Theoretical Framework of Optimal Management	5	1	Exam	150	45	15		30	30	75
5206	CS	System Analysis	5	2	Exam	150	45	15		30	30	75
5206		Multifactorial models for predicting elements of automation of technological processes	5	2	Exam	150	45	15		30	30	75
Total ESTS in basic disciplines			**35**			**1050**	**300**	**105**	**75**	**120**	**180**	**570**
3. Modules of major disciplines - 49 ESTS												
AM 3.1	**3.1Automation module - 21 ESTS**											
5301	UC	Automation of Engineering Systems	6	1	Exam	180	60	30		30	30	90
5302	UC	Organization and planning of research	6	2	Exam	180	60	30		30	30	90
6308	UC	Research Practice	9	4	GradedCredit	270						270

MM 3.2	**3.2Microcontroller module - 17 ESTS**											
6303	UC	Methods of artificial intelligence	5	3	Exam	150	45	15		30	30	75
5304	CS	Algebraic theory of multidimensional control systems	6	2	Exam	180	60	30		30	30	90
5304		Software for industrial controllers	6	2	Exam	180	60	30		30	30	90
6305	CS	Microcontroller in Systems of Measurement and Control	6	3	Exam	180	60	30		30	30	90
6305		Robust Invariant Systems	5	3	Exam	150	45	15		30	30	75
SM 3.3	**3.3Software module - 11 ESTS**											
6306	UC	Adaptive methods of prediction of technological process parameters	5	3	Exam	150	45	15		30	30	75
6307	CS	Intelligent Control Systems	6	3	Exam	180	60	30		30	30	90
6307		Intelligent control systems and neural networks	6	3	Exam	180	60	30		30	30	90
Total ESTS for major disciplines			**49**			**1470**	**390**	**180**	**0**	**210**	**210**	**870**
Total ESTS in basic disciplines		**UC**	**20**			**600**	**165**	**60**	**75**	**30**	**90**	**345**
		CS	**15**			**450**	**135**	**45**	**0**	**90**	**90**	**225**
Total ESTS for major disciplines		**UC**	**31**			**930**	**210**	**90**	**0**	**120**	**120**	**600**
		CS	**18**			**540**	**180**	**90**	**0**	**90**	**90**	**270**
Total ESTS for theoretical learning			**84**			**2520**	**690**	**285**	**75**	**330**	**390**	**1440**
MMSRW 4	**4 Module of a master's student research work - 24 ESTS**											
	MC	Undergraduate research work including internship and master thesis	24	1,2,3,4	GradedCredit	720	0				0	720
Total ESTS for SRWMS:			**24**			**720**	**0**				**0**	**720**
MFC 5	**5 Module of final certification - 12 ESTS**											
IA	OK	Preparation and defense of a master's thesis	12				360					360
Total ESTS for the final certification:			**12**			**360**						**360**