ASIIN Seal & EUR-ACE® Label

Accreditation Report

Bachelor's Degree Programmes
Automation and Control
Radio Engineering, Electronics and Telecommunications
Electrical Engineering

Master's Degree Programmes
Automation and Control
Radio Engineering, Electronics and Telecommunications
Electrical Engineering

Provided by
Almaty University of Power Engineering and Telecommunications named after Gumarbek Daukeyev, Kazakhstan

Version: 22 March 2024

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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]
Автоматизация и управление	Bachelor Automation and Control	ASIIN, EUR-ACE®	IAAR[3], 05.04.2019-04.04.2024	2
Радиотехника, электроника и телекоммуникации	Bachelor Radio Engineering, Electronics and Telecommunications	ASIIN, EUR-ACE®	IAAR, 05.04.2019-04.04.2024	2
Электроэнергетика	Bachelor Electrical Engineering	ASIIN, EUR-ACE®	IAAR, 05.04.2019-04.04.2024	2
Автоматизация и управление»	Master Automation and Control	ASIIN, EUR-ACE®	IAAR, 05.04.2019-04.04.2024	2
Радиотехника, электроника и телекоммуникации	Master Radio Engineering, Electronics and Telecommunications	ASIIN, EUR-ACE®	IAAR, 05.04.2019-04.04.2024	2
Электроэнергетика»	Master Electrical Engineering	ASIIN, EUR-ACE®	IAAR, 05.04.2019-04.04.2024	2
Date of the contract: 23.09.2021 **Submission of the final version of the self-assessment report:** 22.10.2022 **Date of the audit (online):** 17.10. – 19.10.2023				
Expert panel:				

[1] ASIIN Seal for degree programmes;
[2] TC: Technical Committee for the following subject areas: TC 02 – Electrical Engineering/Information Technology
[3] IAAR: Independent Agency for Accreditation and Rating

Prof. Dr.-Ing. Elmar Griese, University Siegen Dr. Florian Particke, Siemens Mobility GmbH Prof. Dr. Bolatzhan Kumalakov, Astana IT University Prof. Dr. Annie Ng, Nazarbayev University Yerassyl Yerlanuly, Al-Farabi Kazakh National University, PhD student	
Representative of the ASIIN headquarter: Rainer Arnold	
Responsible decision-making committee: Accreditation Commission	
Criteria used: European Standards and Guidelines as of 15.05.2015 ASIIN General Criteria as of 28.03.2014 Subject-Specific Criteria of Technical Committee 02 – Electrical Engineering/Information Technology as of 23.09.2022	

B Characteristics of the Degree Programmes

a) Name	Final degree (original)	b) Areas of Specialization	c) Corresponding level of the EQF[4]	d) Mode of Study	e) Double / Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Bachelor Automation and Control	Бакалавр техники и технологий / Bachelor of Engineering and Technology.	•Automation and informatization in control systems •Automation and control in the fuel and energy complex •Oil industry automation systems •Automation and business process management •Automation and robotic systems	6	Full-time	Moscow Power Engineering Institute	8 semesters	240 ECTS	annually / 01.09.2004
Bachelor Radio Engineering, Electronics and Telecommunications	Бакалавр в области информационно-коммуникационных технологий / Bachelor of Science in Information and Communication Technologies	•Infocommunication technologies •Innovative technologies	6	Full-time	Moscow Power Engineering Institute	8 semesters	240 ECTS	annually / 01.09.2008

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

B Characteristics of the Degree Programmes

a) Name	Final degree (original)	b) Areas of Specialization	c) Corresponding level of the EQF[4]	d) Mode of Study	e) Double / Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Bachelor Electrical Engineering	Бакалавр техники и технологий / Bachelor of Engineering and Technology.	•System power plants •Electrical networks and systems •Relay protection of electrical power systems •Power supply and energy saving of infrastructure facilities •Renewable sources of energy •Electromechanical converters with digital control	6	Full-time	Moscow Power Engineering Institute	8 semesters	240 ECTS	annually / 01.09.2008
Master Automation and Control	Магистр технических наук / Master of Engineering	-	7	Full-time	-	4 semesters	120 ECTS	annually / 01.09.2008
Master Radio Engineering, Electronics and Telecommunications	Магистр технических наук / Master of Technical Sciences	-	7	Full-time	-	4 semesters	120 ECTS	annually / 01.09.2004
Master Electrical Engineering	Магистр технических наук / Master of Engineering	-	7	Full-time	-	4 semesters	120 ECTS	annually / 01.09.2008

For the Bachelor's degree programme Automation and Control, Almaty University of Power Engineering and Telecommunications (AUPET) has presented the following profile in the Self-Assessment Report:

"Sphere of Professional activity «Automation and Control" refers to IT specialties. At the same time, it combines both knowledge of modern technology and allows you to acquire the skills and abilities of working with various software. Today, almost any area of human activity is impossible without automation and control systems. The trajectory of study «Automation and control in the fuel and power energy complex» designed for students who are more predisposed to technology. At the same time, the educational program is designed in such a way that, upon completion of the training, acquired knowledge and skills will make it possible to work successfully not only in the energy sector, the oil and gas industry, metallurgy, but also in almost any industry that requires automation and control of production processes. The trajectory of study « Automation and informatization in control systems » designed for students with a predisposition to programming. At the same time, along with the study of subjects related to programming, students will gain knowledge, abilities and skills in working with computer equipment, measuring instruments, data collection and transmission devices and various means of automation."

For the Bachelor's degree programme Radio Engineering, Electronics and Telecommunications, Almaty University of Power Engineering and Telecommunications (AUPET) has presented the following profile in the Self-Assessment Report:

"This program prepares students for work as professionals in the field of radio engineering, electronics and telecommunications with theoretical and practical knowledge, skills and abilities necessary for their implementation in professional activities, which are competitive specialists in demand in the domestic and international labor markets."

For the Bachelor's degree programme Electrical Engineering Almaty University of Power Engineering and Telecommunications (AUPET) has presented the following profile in the Self-Assessment Report:

"Training of highly qualified personnel for the national and global electric power industry, with innovative theoretical and practical knowledge, skills and abilities necessary in professional activities. The educational program will contribute to improving the efficiency of the functioning of the electric power industry and all electric power divisions of the economic sectors."

For the Master's degree programme Automation and Control, Almaty University of Power Engineering and Telecommunications (AUPET) has presented the following profile in the Self-Assessment Report:

"Training of highly qualified specialists in this field, development of the design and operation of automation systems for technical objects and technological processes, organization of work on the creation of automatic control systems."

For the Master's degree programme Radio Engineering, Electronics and Telecommunications, Almaty University of Power Engineering and Telecommunications (AUPET) has presented the following profile in the Self-Assessment Report:

"This program prepares masters as highly qualified specialists in the field of radio engineering, electronics and telecommunications with theoretical and practical knowledge, skills and abilities necessary for their implementation in professional activities, which are competitive specialists in demand in the domestic and international labor markets."

For the Master's degree programme Electrical Engineering Almaty University of Power Engineering and Telecommunications (AUPET) has presented the following profile on the programme's homepage:

"The educational program is aimed at training highly qualified and competitive specialists in the production, transmission and distribution of electricity, who have theoretical and practical knowledge, skills and abilities to conduct research and transfer knowledge to students, capable of independent thinking and providing progressive scientific and technical, socio-economic and the cultural development of society."

C Expert Report for the ASIIN Seal

1. The Degree Programme: Concept, content & implementation

Criterion 1.1 Objectives and learning outcomes of a degree programme (intended qualifications profile)

Evidence:

- Self-Assessment Report
- Study plans of the degree programmes
- Module descriptions
- Homepage AUPET: https://aues.edu.kz/en (access October 27th 2023)
- Homepage Ba Automation and Control: https://aues.edu.kz/en/bachelor/edu-program-one?id=18 (access October 27th 2023)
- Homepage Ba Radio Engineering, Electronics and Telecommunications: https://aues.edu.kz/en/bachelor/edu-program-one?id=12 (access October 27th 2023)
- Homepage Ba Electrical Engineering: https://aues.edu.kz/en/bachelor/edu-program-one?id=8 (access October 27th 2023)
- Homepage Ma Automation and Control: https://aues.edu.kz/en/pages?id=57 (access October 27th 2023)
- Homepage Ma Radio Engineering, Electronics and Telecommunications: https://aues.edu.kz/en/pages?id=26 (access October 27th 2023)
- Homepage Ma Electrical Engineering: https://aues.edu.kz/en/pages?id=21 (access October 27th 2023)
- Discussions during the audit

Preliminary assessment and analysis of the experts:

The experts base their assessment of the learning outcomes on the information provided in the module descriptions and in the Self-Assessment Report of all six degree programmes

under review. For all programmes, Almaty University of Power Engineering and Telecommunications (AUPET) has described Learning Outcomes (LO), which cover a number of specific competences students should acquire in their respective degree programme.

The experts refer to the Subject-Specific Criteria (SSC) of the Technical Committee 2 - Electrical Engineering/Information Technology as a basis for judging whether the intended learning outcomes of the Bachelor's degree programme Automation and Control, the Bachelor's degree programme Radioengineering, the Bachelor's degree programme Electrical Engineering, as well as the Master's degree programme Automation and Control, the Master's degree programme Radioengineering, and the Master's degree programme Electrical Engineering as defined by AUPET correspond with the competences as outlined by the SSC. They come to the following conclusions:

The Bachelor's degree programme Automation and Control is designed to prepare the graduates for working in the field of automation and management of technical systems related to the application of information technology. To this end, students should acquire basic knowledge in the field of mathematics, natural sciences, and engineering. Additionally, they should acquire the ability to conduct experiments according to specified methods with the processing and analysis of results, to apply standard test methods in automation, and to conduct a preliminary feasibility study of design solutions. Moreover, they should be able 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. Finally, they should be familiar with applying 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.

Graduates of the Bachelor's degree programme Radio Engineering, Electronics and Telecommunications should be capable of professional growth and mobility, possess key and professional competencies in the field of telecommunications, as well as being able to solve professional tasks of an engineer in the field of radio engineering, electronics and telecommunications. To this end, students should acquire basic knowledge in the field of mathematics, natural sciences, engineering as well as of the theory of radiation and radio waves reception and the most common types of antenna-feeder devices. Additionally, they should understand electronic system design and installation as well as have a profound level of knowledge in the field of digital and electronic technologies. Moreover, they should be able to use application software packages for calculations, modeling and automation of electronic devices and systems design works and understand the principles of construction and functioning of analog and digital signal processing devices in the field of speech, sound

and image transmission in order to be able to apply modern methods in designing communication and navigation systems.

Graduates of the programme can find suitable jobs as communication, process and design engineers, as developers of equipment for neural network processing and control and technical methods of information protection and information security.

The goal of the Bachelor's degree programme Electrical Engineering is to train qualified specialists in the field of electric power transmission systems and networks, relay protection and automation, with knowledge, skills and abilities sufficient to solve production-related tasks. To this end, students should acquire basic knowledge in the field of mathematics, natural sciences, and engineering as well as about technical facilities and equipment in accordance with production technologies and safety standards. Additionally, graduates should be familiar with using modern information technologies and with collecting and analysing data for designing technical equipment in accordance with standards, specifications and other regulatory documents. Moreover, they should be able to develop projects on electric stations and networks, and be familiar with relay protection, automation of electric power systems, renewable energies, electric cable technology, and electric drives.

Graduates of the programme are usually employed as electrical engineers, electrical system maintenance specialists, power system dispatchers, power system operation specialists, or energy security engineers.

Supplementing the subject-related qualification objectives, Bachelor's students should have adequate competences in oral and written communication skills, be capable of working autonomously as well as in a team-oriented manner, and be able to conduct research activities. Furthermore, they should have trained their analytical and logical abilities, be able to apply information and communication technology, and show a social and academic attitude. Finally, students should acquire language skills and should develop a strategy for life-long learning.

In the Bachelor's programmes, students can choose a field of specialisation for their third and fourth year of studies (see Criterion 1.3). This is certainly useful, as the students can better follow their individual interests this way. However, the experts point out that no separate intended learning outcomes for any of the specialisations exist. This deficit needs to be solved and AUPET needs to draft specific learning outcomes for each specialisation in the Bachelor's degree programme and to publish them on the programme's homepage. In addition, the Diploma Supplement should make transparent what specialisation the student has chosen and also the additional specific learning outcomes should be mentioned there.

As described in the Self-Assessment Report, graduates of the Master's degree programme Automation and Control should able to carry out analytical and scientific work with the involvement of modern information technologies and to apply methods of calculating elements and nodes of automation and control systems. Additionally, they should be qualified to carry out design work, to use modern information and computer technologies, and be familiar with using current methods for developing of energy-saving and environmentally friendly automation and control systems. Moreover, they should be able to develop, installation, and operate automation systems and be familiar with modern IT technology and software for the automation of technological and business processes.

The goal of the Master's degree programme Radio Engineering, Electronics and Telecommunications is the formation of a highly qualified scientific persons, who are capable of performing professional activities and of solving scientific problems and tasks in the field of communications and communication technologies. During their studies, students will gain knowledge in the field of modern management tools, mathematical, engineering and technical calculations, as well as competencies in the field of finance and entrepreneurial skills.

The research work is associated with new developments in the field of communication networks and switching systems, ensuring stable and uninterrupted operation of radio communication systems and devices, including satellite, radio relay and mobile communication systems. Additionally, attention is paid to improving the performance of data transmission systems and devices; the development of electronic and computer object management systems, and effective methods of information transformation.

The Master's degree programme Electrical Engineering is aimed at the formation of highly qualified scientific persons, who are capable of performing professional activities and of solving scientific problems and tasks in the field of electrical engineering. During their studies, students will gain knowledge in the field of modern management tools, mathematical, engineering and technical calculations, as well as competencies in the field of finance and entrepreneurial skills.

During their studies, students will gain knowledge of the methods of modeling complex multidimensional systems and the basics of artificial intelligence, as well as competencies in the field of creating automated data collection systems and practical applications of artificial intelligence systems. Additionally, they should know about engineering problems in the electric power industry and the main causes of electricity losses in electric networks, as well as gain competencies in the field of high voltage engineering and the use of energy-

saving technologies in power supply systems. Moreover, they should be competent in designing cable lines used for power supply of communities and industrial enterprises and have sufficient skills in designing automation and relay protection systems.

Research in the Master's degree programme Electric Engineering focuses on methods of improving the reliability of power supply and electric drive systems, problems of stable operation of electrical equipment, energy savings and current methods of generating electricity.

In addition, students of all three Master's degree programmes should acquire social competences, such as abstraction ability, analytical thinking, capacity for teamwork, ability to communicate, international and intercultural experience, and are therefore especially prepared to take on leadership responsibilities. Moreover, they should have gained insights into current research applications of modern technologies across the various engineering disciplines and be able to apply this knowledge through conducting a research project. Finally, they should be able to work in teams and effectively communicate research findings. The Master's programmes are designed to furnish students with a professional qualification that empowers them for many areas of activity in specialist institutions and the private sector, for example in research, engineering companies, and public institutions.

Based on the results of monitoring professional standards in electrical engineering and information technology and on discussions with leading experts from these fields, competency matrices were designed for each of the six programmes under review that make transparent, which learning outcomes should be achieved by what module.

In order to verify that the degree programmes are aligned with the EUR-ACE® Framework Standards and Guidelines (EAFSG) for engineering programmes, the experts analyse the submitted study plan, intended learning outcomes, and module descriptions (see Appendix). The EUR-ACE® Framework Standards and Guidelines requires that engineering programmes cover the following seven competence areas: Knowledge and Understanding, Engineering Analysis, Engineering Design, Investigations, Engineering Practice, Making Judgements Communication and Team-working, and Lifelong Learning. As can been seen from the provided documents, the degree programmes under review cover all the required competence areas and the experts perceive during the audit discussions with teachers and students that the mentioned competences are conveyed in the respective courses.

In summary, the experts are convinced that the intended qualification profiles of all programmes under review allow graduates to take up an occupation, which corresponds to their qualification. The degree programmes are designed in such a way that they meet the goals set for them. The objectives and intended learning outcomes of all degree programmes under review are reasonable and well founded.

The experts conclude that the objectives and intended learning outcomes of the Bachelor's degree programme Automation and Control, the Bachelor's degree programme Radio Engineering, Electronics and Telecommunications, the Bachelor's degree programme Electrical Engineering, as well as the Master's degree programme Automation and Control, the Master's degree programme Radio Engineering, Electronics and Telecommunications, and the Master's degree programme Electrical Engineering adequately reflect the intended level of academic qualification (EQF 6 for the Bachelor's and EQF 7 for the Master's degree programmes and correspond sufficiently with the ASIIN Subject-Specific-Criteria (SSC) of the Technical Committee 2 – Electrical Engineering/Information Technology.

Criterion 1.2 Name of the degree programme

Evidence:

- Self-Assessment Report

Preliminary assessment and analysis of the experts:

AUPET uses the more general term "Electrical Engineering", because it better fits the programmes' intended outcomes. "Electrical Power Engineering" is certainly an important part of the degree programme but the intended learning outcomes are more general and better fit an "Electrical Engineering" programme. This was verified by AUPET by comparing their programmes with similar programmes at other universities in Europe and by discussing this with international experts. However, AUPET needs to pay attention to only using this name especially in all official documents and their English translation and on the programme's homepage. Otherwise, external persons will be confused about the content and learning outcomes of the programme.

The experts point out that AUPET needs to pay more attention to correctly and systematically using the same English translation for the programmes and awarded degrees. For example, the name of the Electrical Engineering programmes in Kazakh and Russian translate as "Electric Power Engineering", so this does not correspond. In addition, the awarded Bachelor's and Master's degrees also differ. The word by word translation from Russian and Kazakh would mean "Bachelor of Technique and Technology", but AUPRT uses the English translation of "Bachelor of Engineering and Technology". These discrepancies should be solved.

Besides these issues, the experts confirm that the English translation and the original Kazakh/Russian names of all degree programmes under review correspond with the intended aims and learning outcomes of the respective degree programme.

Criterion 1.3 Curriculum

Evidence:

- Self-Assessment Report
- Study plans of the degree programmes
- Module descriptions
- Homepage AUPET: https://aues.edu.kz/en (access October 27th 2023)
- Homepage Ba Automation and Control: https://aues.edu.kz/en/bachelor/edu-program-one?id=18 (access October 27th 2023)
- Homepage Ba Radio Engineering, Electronics and Telecommunications: https://aues.edu.kz/en/bachelor/edu-program-one?id=12 (access October 27th 2023)
- Homepage Ba Electrical Engineering: https://aues.edu.kz/en/bachelor/edu-program-one?id=8 (access October 27th 2023)
- Homepage Ma Automation and Control: https://aues.edu.kz/en/pages?id=57 (access October 27th 2023)
- Homepage Ma Radio Engineering, Electronics and Telecommunications: https://aues.edu.kz/en/pages?id=26 (access October 27th 2023)
- Homepage Ma Electrical Engineering: https://aues.edu.kz/en/pages?id=21 (access October 27th 2023)
- Discussions during the audit

Preliminary assessment and analysis of the experts:

AUPET is structured in following institutes (faculties):

- Institute of Natural Sciences and Humanities (Department of Mathematics, Department of Physics and Electrical Engineering, Department of Electrical Machines and Electric Drive, Department of Electrical Engineering)
- Institute of Energy and Green Technologies (Department of Thermal Power Engineering, Department of Electric Power Engineering, Department of Social Disciplines, Department of Languages)
- Institute of Communication and Space Engineering (Department of Space Engineering, Department of Telecommunication, Department of Electronic Engineering)
- Institute of Automation and Information Technology (Department of IT-Engineering, Department of Cybersecurity, Department of Automation and Control)

Each semester is equivalent to 15 weeks of learning activities. Besides these learning activities, there is usually one week for midterm exams and two weeks for final exams.

All three Bachelor's degree programmes under review are designed for four years with 240 ECTS points and are offered as a full-time programmes. The structure of the curricula is similar for all three programmes. It includes General Education Modules (GEM) with 56 ECTS points, Basic Modules (BM) with 112 ECTS points, Major Modules (MM) with 60 ECTS points, and the "Final Attestation" with 12 ECTS points. All areas, besides the "Final Attestation", include compulsory courses as well as electives.

The General Education Modules are not subject-specific and include courses such as "Modern History of Kazakhstan", "Philosophy", "Information and Communication Technologies", "Foreign Language", and "Physical Training". These courses are usually offered in the first semesters of the Bachelor's programmes and all Bachelor's students at AUPET (and all other Kazakh universities) have to take them – irrespective of their concrete study programmes.

The Basic Modules cover the major areas of engineering, information technology, computer sciences, and related natural sciences. The Major Modules are more advanced courses, which are offered from the fifth semester. They include specific modules, which focus on the respective technical and engineering area of the degree programme.

The inclusion of the course "Basics of scientific research and academic writing" in the curriculum prepares students for the final project, where students need to verify their ability to set a research problem, solve it experimentally, and apply appropriate mathematical methods of analysis.

The first year of studies focuses on General Education Modules and introductory courses to natural sciences, informatics, and engineering. During their second year, Bachelor's students continue studying the disciplines of general education and basic modules. Additionally, a significant number of modules is devoted to the theoretical foundations of electrical engineering and computer science. In the third year, the share of electives increase and students can follow their own subject specific interests. In the seventh and eighth semester, students take more advanced courses according to their chosen field of specialisation and conduct the "Final Attestation", for which 12 ECTS points are awarded. It is carried out in the form of writing and defending a thesis (final project).

The Bachelor's degree programme Automation and Control offers the five specialisations "Automation and informatization in control systems", "Automation and control in the fuel and energy complex", "Oil industry automation systems", "Automation and business pro-

cess management", and "Automation and robotic systems". In the Bachelor's degree programme Radio Engineering, Electronics and Telecommunications students can chose between the two specialisations "Infocommunication Technologies" and "Innovative technologies". The most specialisations are offered in the Bachelor's degree programme Electrical Engineering. Here, students can chose between the six specialisations "System Power Plants", "Electrical networks and systems", "Relay protection of electrical power systems", "Power supply and energy saving of infrastructure facilities", "Renewable Sources of Energy", and "Electromechanical converters with digital control". Students chose their electives and usually the topic for their final project according to their specialization. If requested, students can change their area of specialisation. This sometimes happens, for example, after students have conducted their internship and notice that their chosen field does not fit their expectations. However, students, who change their specialisation, might be required to take some additional courses from earlier semesters, which might result in additional costs and a prolongation of studies.

The general structure of the Bachelor's programmes is depicted in the following table:

Name of module cycles	Ba Automation and Control			Ba Radio Engineering, electronics and Telecommunications			Ba Electrical Engineering		
	ECTS credits	Specific weight, %	Amount of modules	ECTS credits	Specific weight, %	Amount of modules	ECTS credits	Specific weight, %	Amount of modules
GEM	56	23	9	56	23	14	56	23	13
BM	112	47	23	112	47	24	112	47	24
MM	60	25	12	60	25	18	60	25	12
Final attestation	12	5	1	12	5	1	12	5	1
Total	**240**	**100**	**45**	**240**	**100**	**57**	**240**	**100**	**45**

Table 1: Curricular Structure Bachelor's Programmes, Source: SAR AUPET

The list of modules of the university requirements (compulsory courses) and electives is centrally determined by the university. At the same time, the labour market needs, employers' expectations, and a balance between theoretical and practice-oriented modules are taken into account. The internship (work placement) in the third year last for four weeks and for eight weeks in the fourth year of the Bachelor's programmes.

As automation and information technologies are rapidly being introduced into all production areas and into technical systems new modules have been introduced to the Bachelor's degree programme Automation and Control that are common to all specializations:

- Software implementation of engineering tasks in C++

- C++ programming technologies in automation tasks
- Systems of industrial Pneumoautomatics and Electropneumoautomatics
- Development of Siemens automation systems
- Development of Schneider Electric automation systems
- National Instruments technologies in automation measurement tasks.

At the same time, three new specialisations (in addition to the already existing specialisations “Automation and informatization in control systems”, and "Automation and control in the fuel and energy complex") were introduced into the curriculum for new students in the academic year 2021/22: “Oil industry automation systems”, “Automation and business process management”, and “Automation and robotic systems”.

Also the curriculum of the Bachelor’s degree programme Radio Engineering, Electronics and Telecommunications was updated in order to follow the development of new technologies and the ever changing demand of the labour market. As the telecommunications industry is one of the most dynamically developing sectors in in Kazakhstan students need to be introduced with these new developments such as 5G Networks, Internet of Things, and SDN technologies. To this end, the new modules “Special issues of radio engineering and telecommunications”, “Communication networks and voice switching systems”, “SDN/NFV networks”, “Radio systems and mobile communication networks”, and “Radio transceivers” were introduced into the curriculum.

In a similar way, several new modules were added to the Bachelor’s degree programme Electrical Engineering. This concerns courses such as “Computer network technologies in electric power engineering”, “Interfaces of computer systems in electric power engineering”, “Algorithmization and programming fundamentals”, “Logical foundations of digital control systems”, “Mathematical foundations of digital control systems”, “Fundamentals of digital technology”, “Fundamentals of microprocessor technology”, “Fundamentals of building SCADA systems in the electric power engineering”, “Theoretical foundations of electrical installations of non-traditional and renewable energy”, “Comprehensive assessment of renewable energy resources”, and “Design of small power supply systems using renewable energy sources”.

The three Master’s degree programmes under review are designed for two years with 120 ECTS points and offered as a full-time programmes. The curricula of the Master’s degree programmes include lectures and seminars, in which undergraduates discuss the being studied material, analyse, and solve relevant problems.

The structure of both Master’s programmes is as follows:

- Basic Modules (35 ECTS points), which consist of university components (20 ECTS points) and electives (15 ECTS points);
- Major Modules (49 ECTS points), which consist of university components (31 ECTS points) and electives (18 ECTS points);
- Research Work (24 ECTS points);
- Final Attestation (12 ECTS points).

The general structure of the Master's degree programmes is shown in the table below:

Name of modules cycles	Ma Automation and Control"			Ma Radio Engineering, Electronics and Telecommunications			Ma Electrical Engineering		
	ECTS credits	Specific weight, %	Number of Modules	ECTS credits	Specific weight, %	Number of Modules	ECTS credits	Specific weight, %	Number of Modules
BM	19	16	7	35	29	8	19	16	7
MM	49	41	16	49	41	10	49	41	16
MSRW	24	20	1	24	20	4	24	20	1
Final attestation	12	10	1	12	10	1	12	10	1
Total	**120**	**100**	**28**	**120**	**100**	**23**	**120**	**100**	**28**

Table 2: Curricular Structure Master's Programmes, Source: SAR AUPET

Based on the feedback from employer and students, several changes have been implemented in the curricula of the Master's degree programmes within the last few years.

For example, in 2021 four new modules "Methods for estimating measurement uncertainty", "Industrial networks of distributed automation networks", "Industrial network technologies", and "Methods of modern theory of automatic control" were added to the curriculum of the Master's degree programme Automation and Control. These changes are the result of discussions with leading experts from the electric power and digital technologies industries.

The Bachelor's degree programmes include lectures, seminars, and laboratory classes. The theoretical foundation of the different engineering disciplines is presented in lectures during which students are explained the basic methods and concepts. In seminars, students discuss the material being studied and solve relevant tasks. In laboratory classes, students gain practical skills to work with specific laboratory equipment and modern methods of engineering and computer science.

The members of the teaching staff explain on demand of the experts that they offer possible topics for the final projects according to their own research projects. All members of the teaching staff supervise theses. In addition, students can also develop their own concepts for their theses (Bachelor's and Master's) and it is possible to conduct the thesis outside AUPET.

In the discussion with the experts, the employers express their satisfaction with the qualification profile of the graduates of all programmes under review. They point out that AUPET, especially in the area of engineering and telecommunications is one of the best universities in Kazakhstan and that there is a high demand for its graduates.

The experts also discuss with the university's management how the different and sometimes conflicting interests of the stakeholders (e.g. students and employers) can be balanced. The university' management explains that this is no easy task but they try to fulfill all demands by involving all groups in the discussion in order to make sure that the theoretical foundations as well as the practical application are well balanced in every degree programmes. The experts gain the impression that this balancing process so far works fine and that students as well as employers are satisfied with the content and scientific demand of the degree programmes under review.

The experts discuss with the programme coordinators what courses are taught in English. They learn that to improve students' English proficiency AUPET offers a few courses in the Bachelor's programmes (e.g. Calculus and History of Kazakhstan) in English since the beginning of this academic year. However, only some students (17) have enrolled in this classes, the rest is studying all courses in either Russian or Kazakh. During the discussion with the experts, the students state that the system is not very flexible and that they had to decide at the time of enrolment if they want to study in English or not, additionally not all students were informed about this possibility. For this reason, the experts recommend to make the opportunity to attend some classes in English better known among the Bachelor's students and to encourage them to choose this option and allow them to take classes in English even if they have not decided to do so at the time of enrolment. Another point of discussion is the observation that the Master's programmes are only offered in Kazakh and Russian. As English is the "lingua franca" in sciences and engineering, the experts suggest that the Master's programmes should offer some classes in English and give students the opportunity to practise their active English speaking skills, for example by presenting English papers. In general, the English proficiency of students and teachers should be improved.

After analysing the module descriptions and the study plans, the experts confirm that all degree programmes under review are divided into modules and that each module is a sum of coherent teaching and learning units. All practical lab work and internships are well integrated into the curriculum and the supervision by AUPET guarantees for their respective

quality in terms of relevance, content, and structure.

In summary, the experts confirm that the choice of modules and the structure of the curriculum ensure that the intended learning outcomes of the respective degree programme can be achieved.

International Mobility

AUPET provides some opportunities for students to conduct internships and exchange programmes abroad. Students who take part in student exchanges through cooperation programmes can gain recognition of the acquired credits after signing a learning agreement. The transfer of credits is carried out by the Registrar's Office on the basis of the student's application and the presentation of supporting documents in coordination with the Department of Academic Affairs.

The Department for International Cooperation and Academic Mobility (DICAM)of AUPET is responsible for managing and coordinating the international activities such as coordinating and managing student mobility programmes, developing and maintaining relationships with partner institutions and organisations around the world, recruiting and admitting international students, providing support and assistance to international students during their time at AUPET, such as helping with housing, visa issues, and other practical matters.

As described in the Self-Assessment Report, students from Electrical Engineering went to Poznan Technical University, Poland, Czech Technical University, Prague, Qadir Khazar University, Turkey, University of Oviedo, Spain, University of Lorraine, France, and Anhalt University of Applied Sciences, Germany. Students from Automation and Control went to Lodz Technical University, Poland, Poznan Technical University, Poland, and the University of Genoa, Italy. The international cooperations are similar for students from Radio Engineering, Electronics and Telecommunications. Here, students went to Poznan Technical University, Poland, Anhalt University of Applied Sciences, Germany, Qadir Khazar University, Turkey, and University of Cassino and Southern Lazio, Italy.

AUPET promotes students' academic mobility and supports them in studying abroad, albeit for limited, but long periods - from semester to academic year, and, secondly, during internships. The list of international cooperation partners can be seen on AUPET's homepage (https://ic.aues.kz/en/site/vuz).

The experts point out that AUPET did not provide any information on the double degree programme with Moscow Power Engineering Institute. Consequently, it remains unclear, how many students from which degree programme participate at this cooperation if there are incoming students from Moscow and how the double degree programme is organised.

For this reason, the experts ask AUPET to submit detailed information about the double degree programme with Moscow Power Engineering Institute.

Incoming students from neighbouring countries such as Uzbekistan, Kyrgyzstan, and Tajikistan usually study in Russian or Kazakh. However, the number of international students studying at AUPET is still very low (24 in the academic year 2022/23) and the university's management want to increase that number significantly within the next few years. To support this, the university's strategic plan includes the goal of offering all programmes in English by 2028. As a beginning, 17 Bachelor's students started in the academic year 2023/24 to study some courses like calculus and history of Kazakhstan in English.

The following table shows the number of students from the six degree programmes under review that took part at an academic mobility programme in the academic year 2019/20:

Programme	**Level**	**No. of students**
Electrical Engineering	Bachelor	8
	Master	5
Automation and Control	Bachelor	5
	Master	0
Radio Engineering, Electronics and Telecommunications	Bachelor	2
	Master	7

Table 3: Students' Academic Mobility in 2019/20, Source: SAR AUPET

The students confirm during the discussion with the experts that some opportunities for international academic mobility exist and that the credits acquired abroad are recognised at AUPET. However, the number of undergraduate and graduate students who participate in international exchange programmes is still low, as the available places in the exchange programmes are limited and there are restrictions due to a lack of sufficient financial support, which hinders students from joining the outbound programmes. National scholarships are available, but they are highly competitive, so only a few students receive them.

The experts understand these problems and see that academic mobility was severely impacted by the COVID-19 pandemic, but the restrictions have been resolved and traveling and studying abroad is easily possibly again. To this end, it would be useful to actively en-

courage students to take part at long term (one or two semesters) academic mobility programmes (e.g. ERASMUS+) in order to study or conduct research projects at universities abroad.

To promote academic mobility it would be useful to assign one teacher in each department as an "International Coordinator", who encourages students' to join international mobility programmes by informing them directly about the existing possibilities and by advising them how to organise and finance a stay abroad.

In summary, the experts appreciate the efforts to foster international mobility and support AUPET and the departments to further pursuing this path.

Criterion 1.4 Admission requirements

Evidence:

- Self-Assessment Report
- AUPET Admission Regulation
- Order of the Minister of Education and Science of the Republic of Kazakhstan on October 31, 2018 № 600
- Discussions during the audit

Preliminary assessment and analysis of the experts:

The admission procedure for the Bachelor programmes is constituted by regulations issued by the Kazakh Ministry of Education and Science and is conducted through a nationwide unified exam after completing the high school or professional school. The Unified National Test (UNT) includes the examination of Kazakh and Russian, Mathematics, History of Kazakhstan and one elective subject, depending on the chosen specialty. Depending on national demand the Ministry of Education and Science defines a limited amount of scholarships for each Bachelor's programme offered to those with the highest score. A state grant includes free tuition and a scholarship for living expenses. If a student has good grades in his first semesters at the University, she or he can apply during the studies for a state grant. It is also possible to enroll on a fee-paid basis; however, the required minimum score of the Unified National Test must still be met. Enrollment is carried out separately for each degree programme and study language (English, Kazakh, or Russian).

For admission to the Master's programmes applicants need to have a Bachelor's degree from a similar scientific background and have to pass an entrance exam, called comprehensive test (CT). Persons with a Master's degree and at least nine months of work experience are allowed to apply for doctoral studies and taking the entrance exam. Students applying

for a Master's degree programme must first pass a test of foreign language (usually English) and then a subject specific test (written exam). The sum is the admission points that form the basis of the decision about the admission. Acceptance of applications for Master's programmes is carried out online by the University Admissions Committee. National scholarships for each degree programme are offered to those with the best results in the entrance exam. Students with a different scientific background might be given some prerequisites in order to make up for some missing competencies. This means, students with a Bachelor's degree from a different area have to take additional courses before they can start with the Master's programme.

The maximum intake per year is around 250 students in the Bachelor's degree programme Automation and Control, and 200 students in the Bachelor's degree programme Radio Engineering, Electronics and Telecommunications. The Bachelor's degree programme Electrical Engineering has a significantly higher capacity. Here, approximately 600 new students are admitted every year. On the hand, the Master's programmes admit much less students. The Master's degree programme Automation and Control has an annual capacity of around 50 students and approximately 70 new students are admitted to the Master's degree programme Radio Engineering, Electronics and Telecommunications every year. Similar to the bachelor's degree programmes, the capacity of the Master's degree programme Electrical Engineering is significantly higher than in the other two master's programmes. Here, around 100 new students are annually admitted.

The number of newly enrolled students in the six programmes under review for the last three academic years is depicted in the following table:

Academic year	Bachelor's degree program			Master's degree program		
	admission	Total number	graduation	admission	Total number	graduation
1	2	3	4	5	6	7
"Automation and Control"						
2021-2022	233	985		34	69	
2020-2021	395	1011	137	39	50	9
2019-2020	271	795	122	11	31	18
"Electrical Engineering"						
2021-2022	621	1974		19	63	
2020-2021	575	1797	245	54	114	51
2019-2020	703	1513	174	50	92	38
"Radio Engineering, Electronics and Telecommunications"						
2021-2022	215	663		15	60	
2020-2021	175	605	93	25	76	26

2019-2020	174	597	99	45	87	37

Table 4: Statistical data on enrolled students, Source: SAR AUPET

The experts observe that the number of graduates in all degree programmes under review is below the number of newly admitted students. The programme coordinators explain that students drop out because their knowledge of natural sciences and technical subjects from high school is not sufficient and their expectations differ from the high scientific demand of the programmes. According to the statistical data, which was provided during the audit, on average 25 % to 40 % of the Bachelor's students drop out of the engineering programmes. The share of drop-out is much lower in the Master's programmes because graduate students are much better prepared and know what to expect. From the experts' point of view, drop-out rates in this range are acceptable and not unusual for engineering programmes. However, the experts point out that AUPET should gain the impression that the numbers provided by AUPET should place a stronger emphasis on the accurate collection of statistics on the number of dropouts and the average duration of studies. If any anomalies are found, AUPET should verify for what reasons the students drop out of the programmes and why their studies are prolonged.

As explained by AUPET, the Bachelor's programmes are taught in three languages (English, Kazakh, and Russian). However, only a few new students (17) from the Bachelor's degree programme Automation and Control and the Bachelor's degree programme Electrical Engineering have started to study some selected courses (e.g. Calculus and History of Kazakhstan) in English this academic year. Most of the Bachelor's students study either in Russian or in Kazakh. The Master's programmes are only offered in Kazakh and Russian. The number of students enrolled according to the teaching language is shown in the table below:

Degree programme	Russian language	Kazakh language
Ba Automation and Control	242	560
Ba Radio Engineering, Electronics and Telecommunications	71	358
Ba Electrical Engineering	342	973
Ma Automation and Control	24	46
Ma Radio Engineering, Electronics and Telecommunications	25	3
Ma Electrical Engineering	32	3

Table 5: Number of students according to the teaching language, Source: AUPET

High school graduates in Kazakhstan do not always have a high English proficiency in English, so the demand for programmes taught in English is not very high. Moreover, in Almaty there are several other universities offering degree programmes in English and new students who are more fluent in English choose these programmes and do not necessarily enrol at AUPET.

AUPET has recognised this deficit and has started offering some courses in English and training the teaching staff in English. The experts appreciate these efforts and encourage AUPET to further pursuing this path and to teach more courses in English and to improve the teachers' English proficiency. This goes hand in hand with inviting more international guest lecturers that can give classes in English and with increasing the students' academic mobility. This implies attracting more incoming international students and encouraging Kazakh students to study abroad.

Several students (Bachelor, Master) receive scholarships, which are based on the academic merits during the studies. Nevertheless, it is also possible to enroll on a payment basis. According to the Self-Assessment Report the current tuition fee for all six programmes under review is 920.500 Tenge (1830€) for Bachelor's students and Master's students per year.

In Kazakhstan, the demand for university graduates is determined by a national order. This plan includes how many state grants can be awarded each year for specific subjects at certain national universities. The high school graduates who achieve the highest scores on the UNT receive a state grant and can choose the subject and the university where they want to study. A state grant includes free tuition and a scholarship for living expenses. If a student has good grades in her/his first semesters at the university, she or he can apply during the studies for a state grant. It is also possible to enroll on a fee-paid basis. Enrollment is carried out separately for each degree programme and study language.

In summary, the experts find the terms of admission to be binding and transparent. They confirm that the admission requirements support the students in achieving the intended learning outcomes.

Criterion 1.5 Work load and credits

Evidence:

- Self-Assessment Report
- Study plans
- Module descriptions

- Discussions during the audit

Preliminary assessment and analysis of the experts:
AUPET applies the European Credits Transfer System (ECTS) for measuring the students' total workload. The experts confirm that ECTS points are awarded for all mandatory parts of the degree programmes, including work practices (internships). The workload includes contact hours and time for independent work.

The Bachelor's degree programmes encompass 240 ECTS and one ECTS credit is equal to 30 hours of students' total workload. The Master's degree programmes encompass 120 ECTS points. Details on the students' total workload in hours are presented in the module descriptions of each degree programme.

The standard period of study 4 years (8 semesters) for the Bachelor's degree programmes, and 2 years (4 semesters) for the Master's degree programmes.

In summary, the experts conclude that the total work load of the degree programmes is adequate and that there is no structural pressure on the quality of teaching and the level of education due to the work load. The students express their general satisfaction with the amount and the distribution of their work load. The estimated time budget is realistic, and the students can usually complete the respective degree programme without exceeding the standard study period.

Criterion 1.6 Didactic and Teaching Methodology

Evidence:

- Self-Assessment Report
- Study plans
- Module descriptions
- Discussions during the audit

Preliminary assessment and analysis of the experts:
During the classes, active and interactive teaching methods (e.g. lectures, discussions, reports, presentations, and group work) are applied. AUPET wants to encourage the students to gain knowledge from different scientific areas and wants them to be able to solve specific problems through an interdisciplinary approach. This should ultimately contribute to the transition from a teacher centered to a student oriented teaching method. In order to involve all students in the learning process and to develop their thinking and analytical

skills, the teaching staff uses several methods of training and gives assignments on different levels of complexity.

The most common method of learning in the Bachelor's degree programmes is class session, with several courses having integrated laboratory work. Lecturers generally prepare presentations to support the teaching process. At Bachelor level, the students first gain theoretical knowledge and have more practical classes in their further studies. At Master level, students conduct more individual scientific research. In general, the following teaching methods are used in the degree programmes: lectures; seminars, laboratory classes, internships, small group activities, and final thesis.

With individual or group assignments, such as discussions, presentations, or written tasks, students are expected to improve their academic as well as their soft skills. Laboratory work covers laboratory preparation, pre- or post-tests, laboratory exercises, reports, discussions, and presentations. In addition, practical activities should enable students to be acquainted with academic research methods.

In the Master's degree programmes, more student centred learning models are applied in order to improve students' analytical and scientific skills. To this end, in most courses didactic methods such as cooperative learning, case studies, and project based learning are applied. In general, the focus in the Master's degree programmes is more on self-organised learning and research oriented teaching and learning methods.

In summary, the expert group considers the teaching methods and instruments to be suitable to support the students in achieving the intended learning outcomes. In addition, they confirm that the study concepts of all programmes under review comprise a variety of teaching and learning forms as well as practical parts that are adapted to the respective subject culture and study format. It actively involves students in the design of teaching and learning processes (student-centred teaching and learning).

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

The experts emphasise that it is necessary to draft and publish separate learning outcomes for each specialisation in the Bachelor's programmes. In its comment, AUPET only refers to the Master's programmes, but here no specialisations are offered.

The experts are content that AUPET will pay more attention to correctly and systematically using the same English translation for the programmes and awarded degrees. This especially concern the Electrical Engineering programmes.

As the experts are convinced that the English proficiency of students and teachers should be improved, they support the university's plan to have English groups in all programs by 2025. They are also glad to read that the English Club is now running, this will help students to practise their active English speaking skills.

Since the students' academic mobility is rather low and they were not well informed about the existing opportunities at AUPET, the experts still think that it would be useful to to assign one teacher in each department as an "International Co-ordinator", who encourages students' to join international mobility programmes. Just opening a media channel might not be sufficient to encourage and support students to spend some time during their studies abroad.

In order to verify the quality of the degree programmes it is very useful to carefully analyse the reasons, why students drop out of the programmes. Establishing an independent expert to this respect is certainly a good idea and the experts a keen to see the results.

The experts consider criterion 1 to be mostly fulfilled.

2. Exams: System, concept and organisation

Evidence:

- Self-Assessment Report
- Module descriptions
- AUPET Academic Policy
- AUPET Rules for the final tests and the rating of students
- AUPET Rules for current control of progress, interim and final attestation of students
- Discussions during the audit

Preliminary assessment and analysis of the experts:
According to the Self-Assessment Report, there is a period for midterm exams and a period for the final exams. The form of the exams for each module is specified in the module descriptions. Periods of examinations are scheduled in the academic calendar. During the examination period students take exams according to the approved schedule. There is a comprehensive exam in each module, it is conducted by the teachers of all disciplines of the module and there is a joint examination score, which is set in the official transcript and on the online platform (https://portal.aues.kz/).

Midterm examinations are obligatory and carried out in accordance with the academic calendar. Form and content of midterm examinations are determined by the teacher of each module. The sum of all points, for the midterm exams and the ongoing monitoring, are entered into the electronic journal by the teacher.

During the examination period the students must take all exams according to the schedule in strict accordance with the individual study plan. In some cases (due to illness, family emergency and other similar reasons) students can get an exceptions from this strict examination plan. The final grade is composed of the admission points (60 %) and the grade of the final exam (40 %). The students can see their results on AUPET's online platform.

The grades for the exams range from A to F, and/or between 4.00 and 0.00. In order to compensate for a final examination that has not been passed, a student can have a re-sit or must repeat the course in the next semester or in the short summer semester. A failed exam can only be repeated once. The summer semester is aimed at students who have performance deficits and have failed or missed some exams. An additional fee is charged for each credit point to be made up. Students who object to the final grade of their courses are allowed to file a complaint. The details of the procedure are described in the Academic Policy.

Students who fail too many credits may lose their state grant and they have to repeat the academic term. The academic advisors and the teaching staff try to help the students to make up time lost by e.g. illness during the semester so that every student has a chance to pass the final exam.

The final exams are conducted in various forms. Oral exams are applied in a number of modules, tests are PC based; and most final exams are written exams. A detailed examination plan is handed out to the students at the start of each semester.

During the audit, students express their wish to introduce more projects in the Bachelor's programmes and solve real problems instead of written exams. In some course, such work is already being carried out, however, further development would be useful.

The experts inquire about the Bachelor's and Master's theses and would like to know, whether these are done at the university or externally at companies or research institutions; they also ask about the involved quality management. They learn that several students, especially in the Master's degree programmes, do their final thesis at private companies. The quality of external research activities is checked by the supervisor, and one supervisor of the final thesis must be a member of the teaching staff.

As described in the Self-Assessment Report, students at AUPET need to attend at least 80 % of the classes, otherwise, they may not be admitted to take part at the courses' final

exam. Make-up exams are offered for students that could not participate, for example in cases of illness or other eligible reasons. The experts emphasise that 80 % required attendance is quite high even in comparison to other Kazakh universities. In the discussion with the experts, the students point out that more advanced senior students should have more flexibility to decide if they want to attend a lecture or not. The experts explicitly support this point of view and recommend to give senior Bachelor's students in their third and fourth year of studies more freedom with respect to attending lectures.

Every student in the programmes under review is required to do a final project (Bachelor's and Master's thesis). The Bachelor's thesis is a scientific work report written by students in the Bachelor's programme that focuses on a specific and usually consists of literature study, practical research, data analysis and presentation in figures or tables, and writing the thesis under the supervision of a teacher. Students can choose topics for their thesis according to the areas offered by the research groups of the different departments. In addition, students can develop their own ideas and look for a suitable supervisor. It is also possible to conduct the thesis outside AUPET in the industry or at a research institute.

The Master's thesis is an academic paper, which includes an independent in-depth study of a scientific topic and which creates innovation or provides new contributions to the scientific or technological development of respective scientific area, in this case biology or neurosciences. The Master's thesis is conducted with the guidance of the thesis advisor.

As part of the on-site visit, the experts also inspect sample examinations as well as Bachelor's and Master's theses from all degree programmes under review. Overall, they are satisfied with the quality of the examinations and theses. However, they notice that the literature references in the theses are often outdated and that current scientific publications are not taken into consideration. This deficit should be addressed.

In summary, the experts confirm that the different forms of examination used are competence-oriented and are suitable overall for verifying the achievement of the intended learning outcomes as specified in the respective module descriptions. The form of examination is determined individually for each course and published in the respective module description. The forms of examination are based on the main content of the modules and the level is appropriate for the respective degree programme.

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

The experts thank AUPET for explaining that oral exams are no longer being practiced, students have only written exams.

As the final projects are an essential part of each degree programme, the experts are glad that the Departments Heads were instructed to encourage project supervisors to pay more attention to state of the art publications. The experts expect AUPET to provide sample theses with current scientific references in the further course of the accreditation procedure.

The experts consider criterion 2 to be mostly fulfilled.

3. Resources

Criterion 3.1 Staff and Development

Evidence:

- Self-Assessment Report
- Staff Handbook
- Study plans
- Module descriptions
- Discussions during the audit

Preliminary assessment and analysis of the experts:

At AUPET, the staff members have different academic positions. There are professors, associate professors, senior lecturers, and lecturers. The academic position of each staff member is based on research activities, publications, academic education, supervision of students, and other supporting activities. For example, a full or an associate professor needs to hold a PhD degree. The responsibilities and tasks of a staff member with respect to teaching, research, and supervision depend on the academic position. In addition, there are non-academic staff members consisting of librarians, technicians and administrative staff. Full professors and associate professors need to have a PhD degree, AUPET has established the position of "Professor of Practise" in order to attract teachers with a professional background but without a PhD degree. Moreover, AUPET offers the position of "Research Professor", who teach less (270 hours per year) but focus on research.

The number of professors, lecturers, and technical staff members in the different degree programmes according to their academic position and the share of teachers with a PhD degree is depicted in the following table:

Academic Position	Bachelor			Master		
	RET	AU	EE	RET	AU	EE

Professor	7	6	11	3	7	10
Associate Professor	23	30	33	5	19	20
Senior Lecturer	11	18	45	1	10	6
Lecturer (Assistant)	-	1	12	-	1	-
Total	**41**	**55**	**101**	**9**	**37**	**36**
Technical Staff (laboratory technicians, engineers and heads of laboratories)	9	8	5	6	8	5
Share of teachers with a PhD in %	40	41	42	78	81	86

Table 6: Statistical data on teaching and their academic position, Source: SAR AUPET

The teaching staff is supplemented by individual lecturers from industry and individual international visiting professors. In addition, technical staff, such as laboratory assistants and technicians, are employed to carry out the practical laboratory work.

The experts point out that the share of teachers with a PhD is relatively low by international standards. Especially in the Master's programmes, every teacher should have a PhD or an equivalent academic qualification.

Approximately 60 % of the teachers have long term contracts (3 years) and about 40 % have short term contracts (1 year), this is typical for a private university in Kazakhstan. Some teachers have a higher teaching load and conduct less research activities, others have a lower teaching load and more time for research activities. This depends on the teacher's individual contract.

Online lectures are offered by teachers from international universities, which was established as a procedure during the COVID-19 pandemic. Currently, there also some international guest lecturers coming to AUPET for a limited time. Additionally, PhD students need an international supervisor and when these experts come to AUPET they are also asked to deliver some lectures. Moreover, professionals from companies are regularly invited to give lectures on specific topics.

The experts discuss with AUPET's management how new staff members are recruited. They learn that every year the departments announce their vacancies to AUPET's management, which subsequently announces the vacancies.

When hiring, priority is given to young Master's graduates and PhD's who have studied at renown universities with publications in internationally ranked journals, which are included in Web of Science and Scopus databases.

Newly hired teachers and persons involved in the educational process on a part-time basis undergo a mandatory interview with the Vice Rector for Academic Affairs. During the interview, teachers get acquainted with the requirements of the university to the academic staff, the rules of internal order and the peculiarities of the educational process in the university.

The experts emphasise that all teachers should be familiar with the current state of technical knowledge and that they should not present outdated information in the lectures or laboratory sessions. Students mentioned this issue during the discussion with the experts. This goes along with the experts' observation that several literature references in the theses were outdated and that current scientific publications were not taken into consideration.

In summary, the experts confirm that the composition, scientific orientation and qualification of the teaching staff are suitable for successfully implementing and sustaining both degree programmes.

Staff Development

The experts discuss with the members of the teaching staff the opportunities to spend time abroad and to participate in international projects. They learn that there are several international cooperations (see criterion 1.3) and that there is a special fund for financing the participation at international conferences. In addition, the members of the teaching staff can visit international partners that are involved in their research activities.

The members of the teaching staff mention that there is no internal qualification programme at AUPET in place that offers courses to improve the professional and didactic skills of the teachers. Instead, teachers can take part at courses offered by private companies.

In general, the experts gain the impression that several opportunities for teachers exist to spend time abroad and to participate in international projects. The teachers confirm this positive assessment and state their satisfaction with the existing opportunities.

One important issue that the experts observe during the discussion with the teaching staff is the fact that no internal qualification programme exists at AUPET. No specific courses are offered to teachers who want to further improve their professional and didactic skills. Although the staff members can participate on their own initiative and costs in trainings offered, for example, by external private providers, these focus on content-related issues rather than didactical/pedagogical questions. However, didactical and professional training for teachers is an important part of university services and should be offered directly by AUPET itself, especially for young teachers who have not much teaching experience and who should be able to further develop their didactic and professional skills. To this end, the

experts emphasise that teachers need to have the opportunity to further develop their professional and didactic skills and AUPET needs to better support the teachers in using corresponding offers.

Student Support

AUPET provides an extensive support system for all students (Bachelor's and Master's); it includes consultations with advisors about the individual educational plan and the study progress. Furthermore, the advisor conducts educational work with the assigned students to improve their academic performance and to attract them to participate in social life at the university.

In addition, the students can contact their advisor any time for assistance in academic questions. The members of the teaching staff are available on any issues regarding the degree programmes and offer advice on particular modules, as well as on required papers or reports.

Students with a degree from Technical Colleges only have to study for three years in the Bachelor's programmes and sometimes it is not clear if they are treated as first year or second year students. To this end, university administration should take notice of these students and provide all necessary information, including the advisory system, for them.

The expert group notices that there are enough resources available to provide individual assistance, advice, and support for all students. The support system helps the students to achieve the intended learning outcomes and to complete their studies successfully and without delay.

Criterion 3.2 Funds and equipment

Evidence:

- Self-Assessment Report
- Visitation of the facilities
- Discussions during the audit

Preliminary assessment and analysis of the experts:

According to AUPET's management, approximately 90 % of the budget for the teaching and learning processes is provided by the Kazakh government and 10 % are derived from tuition fees (self-paying students). Third party funding is usually spent on research activities. AUPET has a good and strong co-operation with private companies not only with the oil

and gas sector but also with the telecommunication industry and they jointly conduct several research projects. Additionally, graduates donate money to the “Trustee Fund”, which is used for supporting students, for example by providing additional funds for stays abroad or for purchasing new instruments for laboratory work.

The departments can apply for additional funds for purchasing expensive and sophisticated instrument for conducting research projects. The university’s management forwards these applications to the Kazakh Ministry of Education and Science, which decides on the funding.

In the area of automation and control the following laboratories exist: "Technical means of automation"; "Hardware and software means of control systems"; "Modeling and research of control systems"; “Information technologies in automation systems”, “Theoretical Fundamentals of Heat Engineering”, “Heat Power Plants", “Gas and Steam Turbines"; "Automated systems of control for technological processes"; and “Boiler units and plants".

For radio engineering, electronics and telecommunications AUPET has the following laboratories: "Radiomontazhnik"; "Object-oriented programming and mobile technologies"; "Infocommunication Technologies”, "Virtualization and Cloud Technologies", "Cloud to IT Platforms”; "Open Software"; "Fundamentals of Info-communication networks and systems"; "Modeling of telecommunication networks and processes"; "High-speed optical communications systems"; "Space and ground-based radiocommunication systems"; "Aerial Feeder Devices and Radio Wave Propagation";

In the area of electrical engineering the following laboratories exist: "Electro-technological installations"; "Electrical Apparatus"; "Electrical equipment installation and adjustment"; "Electrical Safety in Electrical Installations"; “Light technology and light sources”; "IEK Group Electrical Equipment", "Relay protection and automatics"; "Electricity supply"; and "Renewable sources of energy".

In addition, there are several laboratories that were equipped in cooperation with different private companies such as the “Schneider Electric competence center for industrial automation; “Honeywell Research and Training Center for design and implementation of control systems”; and “SIEMENS training and qualification center in the field of industrial automation, SCADA, MES and EPR – systems”.

AUPET also cooperates with several research institutions in Almaty and other cities, so that students and teachers can use the facilities there e.g. for conducting practical work, research activities, and theses. This includes, for example, the “National Instruments Center for Measurement and Automation of Scientific Research”.

During the audit, the expert group also visits the laboratories in order to assess the quality

of the infrastructure and the technical equipment. In general, the laboratories are functional for the purposes of the programmes. The equipment with computers and professional software is adequate. There is sufficient space in the laboratories and instrumental setups for teaching courses to small student groups. The experts observe that AUPET has a lot of well-equipped labs sponsored or supported by different companies. As a consequence, the students are able to work with state of the art software in modern laboratories.

From the experts' point of view the infrastructure is sufficient for teaching the students and sufficient instruments and equipment is available for conducting research activities. This positive impression is confirmed by the students as well as the teachers who express their satisfaction with the facilities and technical equipment. However, the lab work for conducting basic research activities could be increased. Companies often use specialised software for their needs but student have to learn to understand the basic concepts behind the specialized software to be able to switch to other software programmes in a short time. This can also be supported by questions fostering the understanding of the concepts behind the used instruments during the lab work.

The students express their general satisfaction with the available resources and conditions of studying, thereby confirming the positive impression of the expert group. The students also express their satisfaction with the library and the available literature there. Remote access via VPN is possible. However, the experts notice that the access to current scientific e-books and papers is limited. For this reason, AUPET should provide full access for students and teachers to current scientific publications, for example by providing access to IEEE Xplore.

With respect to the IT-infrastructure, the experts suggest that AUPET should offer Education Roaming (eduroam), which is an initiative that provides employees and students of participating universities and organisations with Internet access at the sites of all participating organisations using their own username and password. This facilitates academic mobility for teachers and students and enables them to access the internet at every participating institution without any restrictions.

The experts conclude that there are sufficient funds and equipment and that the infrastructure (laboratories, library, seminar rooms etc.) complies with the requirements for sustaining the degree programmes.

The experts also see during the audit that students can use and operate the instruments in the laboratories by themselves after being trained and instructed by either senior students or lab technicians. The experts especially appreciate the well equipped and numerous laboratories with sufficient instruments so that the experiments can be conducted by groups of two to four students. This also enables AUPET to give students a comprehensive practical

education of students with small classes and is in line with the programmes clear focus on applied engineering and telecommunication sciences.

In summary, the expert group judges the available funds, the technical equipment, and the infrastructure (laboratories, library, seminar rooms etc.) to comply – besides the mentioned restrictions – with the requirements for adequately sustaining the degree programmes.

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

The experts understand that AUPET offers technical majors and puts a special emphasis on professional experience during the hiring process of new teachers. However, teachers should also have a higher academic qualification than their students and a PhD degree and professional experience do not necessarily exclude each other.

Offering a "Winter training school" for faculty training is step in the right direction and the experts expect AUPET to permanently offering training courses for teachers so that they can improve their professional and didactic skills.

The experts consider criterion 3 to be mostly fulfilled.

4. Transparency and documentation

Criterion 4.1 Module descriptions

Evidence:

- Self-Assessment Report
- Module descriptions
- Homepage AUPET: https://aues.edu.kz/en (access October 27th 2023)
- Homepage Ba Automation and Control: https://aues.edu.kz/en/bachelor/edu-program-one?id=18 (access October 27th 2023)
- Homepage Ba Radio Engineering, Electronics and Telecommunications: https://aues.edu.kz/en/bachelor/edu-program-one?id=12 (access October 27th 2023)
- Homepage Ba Electrical Engineering: https://aues.edu.kz/en/bachelor/edu-program-one?id=8 (access October 27th 2023)

- Homepage Ma Automation and Control: https://aues.edu.kz/en/pages?id=57 (access October 27th 2023)
- Homepage Ma Radio Engineering, Electronics and Telecommunications: https://aues.edu.kz/en/pages?id=26 (access October 27th 2023)
- Homepage Ma Electrical Engineering: https://aues.edu.kz/en/pages?id=21 (access October 27th 2023)
- Discussions during the audit

Preliminary assessment and analysis of the experts:
The students, as all other stakeholders, have access to the module descriptions via the respective programme's homepage.

After studying the module descriptions of all programmes under review, the experts confirm that the module description include all necessary information about the respective module such as, module title, persons responsible for the module, teaching methods, awarded credits and students' work load, learning outcomes, content, admission and examination requirements, forms of exams, and recommended literature.

However, the experts point out that no the module handbooks do not include the module descriptions of the final project (thesis).

Criterion 4.2 Diploma and Diploma Supplement

Evidence:

- Self-Assessment Report
- Sample Transcript of Records for each degree programme
- Sample Diploma Certificate for each degree programme

Preliminary assessment and analysis of the experts:
The experts confirm that the students of all degree programmes under review are awarded a Diploma after graduation. The Diploma consists of a Diploma Certificate and a Transcript of Records.

On the other hand, the experts emphasise that AUPET also needs to issue a Diploma Supplement to every graduate, the document should be aligned with the European Template and make the students' individual academic achievements transparent. This includes information about the chosen specialisation and the respective learning outcomes.

Criterion 4.3 Relevant rules

Evidence:

- Self-Assessment Report
- All relevant regulations as published on the university's webpage

Preliminary assessment and analysis of the experts:
The experts confirm that the rights and duties of both AUPET and the students are clearly defined and binding. All rules and regulations are published on the university's website and the students receive the relevant course material at the beginning of each semester. This includes a syllabus and exam schedule.

However, the experts point out that all programmes' homepages should include the essential information about the respective study programme such as the learning outcomes, the length and awarded ECTS points, the general content, and a link to the module handbook. Especially the homepages of the Master's programmes do not offer a lot information and should be updated.

In addition, the study plan for the specialisation "Automation and business process management" of the Bachelor's degree programme Automation and Control was not provided and is missing in the respective module handbook.

Finally, the information on students' workload of the work practise (internship) and the theses is missing in the respective study plans and should be added.

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

The experts that AUPET for providing updated module handbooks and the missing study plan for the specialisation "Automation and business process management" of the Bachelor's degree programme Automation and Control. They confirm that module descriptions for the final projects were added.

The experts point out that it is not enough to issue a Diploma Supplement only upon request. All graduates need to be awarded a Diploma Supplement automatically upon graduation.

The experts consider criterion 4 to be mostly fulfilled.

5. Quality management: quality assessment and development

Evidence:

- Self-Assessment Report
- AUPET Academic Policy
- Discussions during the audit

Preliminary assessment and analysis of the experts:

AUPET applied for international accreditation, because it is their goal to align the educational programmes with international standards and foster the competiveness of the graduates not only on the national but also on the international job market. To this end AUPET is highly interested in receive an external view on their teaching and learning processes. The six programmes under review represent the core subjects of the university and that is why they were selected first for international accreditation.

The experts discuss the quality management system at AUPET with the representatives of the Rector's Office and the programme coordinators. They learn that there is an institutional system of quality management aiming at continuously improving the degree programmes. This system relies on internal as well as external quality assurance. Internal quality assurance encompasses all activities focused on implementing measures for improving the teaching and learning quality at AUPET.

The members of the Academic Council and the Scientific and Methodological Council include to teachers, students, and employers. The Scientific-Methodical Council of AUPET has 23 members, three of them are students, one Bachelor', one Master's, and one PhD student. In a similar way, of the 35 members of the Acadmic Council, also three are students. The Rector chairs the Academic Council and the vice rector for Academic Affairs chairs the Scientific and Methodological Council.

The experts discuss with the university's management about the difference between the Scientific and Methodological Council and the Academic Council. They learn that the Academic Council is similar to a University Senate and focuses on the overall academic and research activities, whereas the Scientific and Methodological Council is more concerned with administrative tasks and the concrete implementation of the learning and teaching processes. These councils also exist in every Institute (Faculty) of AUPET.

There is also a Board of Trustees at AUPET, which mainly consists of graduates from the industry and they discuss the needs of the labour market with AUPET's management and give suggestions and recommendations.

The organisational structure of AUPET is shown in the diagram below:

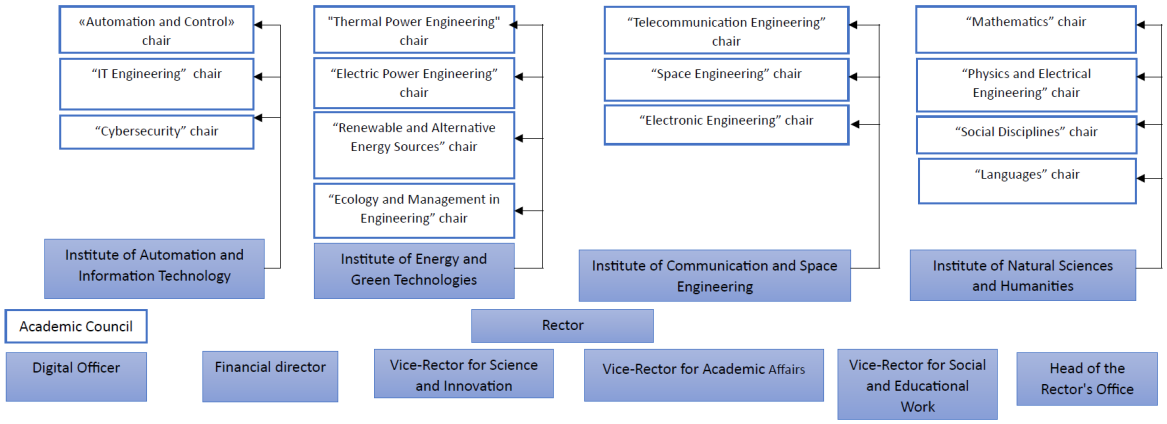

Diagram1: Organisational Structure AUPET, Sources: SAR AUPET

Monitoring and evaluation of the quality of educational services at AUPET are carried out by the Department of Academic Affairs. Reports on the results are provided to the Vice-Rector for Academic Affairs, for revising the curricula, quality assurance, and admission of students. O department level, the results of the course questionnaires are discussed in the Academic Excellence Committee, which is a subunit of the Scientific and Methodological Council. As described in the Self-Assessment Report, the commission makes decisions on the content and conditions of implementation of degree programs, on the assessment policy and other academic issues, and consider the results of a student survey for compliance with the quality of educational programmes or modules.

However, no official regulation on the tasks and composition of this committee exists. For example, it is not clear if there are students' members in the Academic Excellence Committee. To this end, AUPET needs to draw up and publish an official regulation on the tasks and composition of the Academic Excellence Committee.

AUPET carries out a detailed analysis and regularly monitors the results of the educational programmes through evaluation by the graduates, employers, and students. The internal quality management system includes surveys by students, graduates and the teaching staff. Students have the chance to give a feedback on the study conditions, the study process organisation, and the content of the degree programmes. The surveys are conducted at the end of each semester and are accessible via AUPET's online platform.

There is also a survey undertaken by the employers, who usually give a feedback to AUPET about the quality and employability of the graduates

During the discussion with the experts, students state that they are not informed about the results of the course questionnaires. Consequently, the experts expect AUPET to inform students directly about the results of the course questionnaires and make transparent what

measures are taken in case of criticism. The feedback loops need to be closed. For example, the satisfaction surveys could be conducted some weeks before the end of the semester, so that teachers can inform their students about the results and what improvement might be possible before the end of the semester. Additionally, students report that in case of complaints the specific teacher is changed, which does not really solve the problem because the teacher will teach some other courses. Instead, teachers should get the chance to improve their didactic skills.

Moreover, the peers observe that most students are not well informed about their representatives and their tasks in the different councils of the university. AUPET should make this information transparent, so that students can directly address their fellow students who are members in the different councils and better participate in further developing the degree programmes.

To promote employment, AUPET has the Career Center, which is responsible for employers' involvement for example by conducting a job fair twice a year. Additionally, students and graduates are continuously informed about employment opportunities and professional internship placements. Critical thinking and communication skills are highly demanded by employers and AUPET tries to teach more soft skills to the students, for example by offering more group projects and company based case studies. Representatives from the industry are also invited to thesis presentations so that they are well informed about students' skills and research interests. In general, AUPET is well informed about the employment status of their graduates and they keep close ties and a tight network with them.

In the discussion with the experts, the company representatives give positive feedback on both Bachelor's and Master's curricula. While appreciating the high qualification of the graduates, they observe far fewer female applicants compared to males and express a desire for more gender diversity. Providing necessary support from career advisors of AUPET would help more female graduates successfully transit to relevant industry positions. Such outcomes could positively influence admission rates and retention of female students within the programmes.

In summary, the expert group confirms that the quality management system is suitable to identify weaknesses and to improve the degree programmes. However, there is still room for improvement. Students should be better informed and not all feedback loops are closed.

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

The experts do not doubt that there are active student members in the different committees at AUPET. However, form the discussion with the students they gain the impression that in would be useful of better informing students are about their representatives.

The experts consider criterion 5 to be mostly fulfilled.

D Additional Documents

Before preparing their final assessment, the panel asks that the following missing or unclear information be provided together with the comment of the Higher Education Institution on the previous chapters of this report:

- Module descriptions for the Bachelor's and Master's thesis
- Study plan for the specialisation "Automation and business process management" in the Bachelor Automation and Control
- Detailed information on the double degree programme with the Moscow Power Engineering Institute.

E Comment of the Higher Education Institution (25.12.2023)

AUPET provides the following statement:

“Documents and parts of the documents mentioned in section D were included into the module handbooks that are sent with following comments.

1) The experts pointed out that no separate intended learning outcomes for any of the specialisations exist.

Following the recommendations of the expert group university placed description for all specializations within educational programs being audited. Additional details on master programs were placed at the homepages.

2) The experts point out that AUPET needs to pay more attention to correctly and systematically using the same English translation for the programmes and awarded degrees.

University verifies that name of the Educational program “Electrical Engineering” was written with a mistake (because of poor translation) on homepage of the Master degree. The mistake was removed, and name of the program is presented in the same way on different sources. After the visit of the expert group analysis for the spelling of the awarded degree in English was completed. According to that university concludes that degree awarded will from now be “bachelor of Engineering” and “master of Engineering”.

3) Expert pointed out that students don’t have an opportunity to choose some classes in English without changing basic language of instruction.

Current Academic policy doesn’t restrict students in choosing the language of delivery. Any discipline can be added to the individual study plan in any of three languages. Kazakh and Russian languages cover all courses, however English language is present only for the courses where instructor is fluent in English. Faculty staff is being taught English classes and more English-speaking faculty staff will join AUPET team in the nearest future according to the Development Strategy of AUPET, which plans to have English groups in all programs by 2025. English club is functioning now at the university, which is also a good opportunity for students to practice the language.

Also experts mentioned that master degree programs should include classes where master students will study in English and practice their English. University will gradually increase

the number of teaching staff skilled to deliver classes in English, upgrade English fluency among current staff and promote English classes on both (bachelor and master) levels.

4) The experts point out that AUPET did not provide any information on the double degree programme with Moscow Power Engineering Institute.

In 2018 AUPET has signed agreement with the Moscow Power Engineering Institute. Agreement regulates double degree program “Management in technical systems” (delivered by Moscow Power Engineering Institute). In 2022 20 graduates of AUPET were given two diplomas, one from AUPET for technical majors, second from Moscow Power Engineering Institute (degree in Economics). 11 students from 20 have completed Electrical engineering program at AUPET, 4 – Automation and control, 1 – Radio engineering, electronics and telecommunications, and 4 from other majors. The agreement does not cover specific program of AUPET. Any student who wants to apply for the double degree can study and earn the diploma of the Moscow Power Engineering Institute.

5) Experts suggested to encourage students to take part in academic mobility (exchange) programs and even to have special staff in each department who will promote academic mobility.

As university already has the International Cooperation Department there is no obvious reason to assign special coordinator for each department, but university puts emphasis on hiring highly skilled professionals for the present department. To inform students and share latest news on available programs International Cooperation Department has created a single media channel where students will be informed about the possibilities:
- academic mobility (including Erasmus);
- admissions abroad (for master’s/doctoral studies);
- participation in international projects;
- admission to double-diploma training programs.

The international cooperation department provides support in planning academic mobility, applying for programs, writing motivation letters, and preparing for an interview.

6) Experts were concerned that statistics on the number of dropouts and the average duration of studies was abnormal.

High dropout rates were the result of the strategy when the university wasn’t fully following credit technology of education. Students were dismissed for having failed prerequisite courses. Current academic policy is more flexible and gives opportunity for students to improve their academic achievements.

AUPET puts a strong emphasis on student dropout rates. To analyze the situation and monitor if students struggle in academic process starting from the November independent expert is running special program Students' Academic Voice of "Energo" Representation (SAVER). Volunteer students can become a member of SAVER. The program aims to become a bridge between students and AUPET authorities. SAVER can present student society and share their ideas about improving academic process, about problems that students are facing and others.

Also starting from January academic advising (consulting) center will be functioning to help students to get acquainted with the academic policy, credit technology of education. Academic advisors will assist students in preparing their study plan, navigate in the information system during registration period, plan academic mobility and etc.

7) Experts put emphasize on professional development of faculty staff and suggested to invite more international guest lecturers.

Development strategy of the University covers both above mentioned aspects. University plans to increase number of international staff, as well as number of local academic staff with diplomas from the best international universities of the world. However, Kazakhstani universities are competitive not only for post-Soviet area, but also on a worldwide scale. That is why even university believes that faculty staff with local degrees but with English fluency can always become best team members. To create environment for staff and students to actively practice their English from the December English speaking Club is functioning at AUPET. Additional two groups of faculty staff will start their English courses from January 2024.

Except English language courses based on the oral recommendations of ASIIN expert group AUPET has almost organized guest lectures for faculty staff on such topics as “Constructivism: practical aspects”, “Teaching sustainable development goals with the use of AR&VR”.

8) Oral exams are no longer being practiced at AUPET. Students pass only written exams. Starting from the fall semester 2023 instructors design “zero” variant of the exam ticket, which is given to students before the exam period. As a result, students are familiar with the structure of the exam. After the exam answers sheets are checked and evaluated anonymously (“blind” checking), so that instructors don’t know whose work is being assessed. There is strict recommendation on designing exam tickets. “Zero” variants were analyzed by vice rector on academic affairs. All exam tickets are reviewed by peer instructors.

9) Final attestation at AUPET starting from the following academic year is organized in variety of forms. Before students couldn't choose how they will prove that all learning objectives have been achieved. The only final attestation form was diploma project defense. Starting from the 2023-2024 academic year students can choose if they want to pass complex exam, write an article in journals recommended by the Ministry of science and higher education, run a start-up project, or prepare and defend diploma project. The decision on the type of the final attestation should be taken before pre-diploma internship. However not later than 1 month prior to defense students can change the type of final attestation.

10) Experts pointed out low interest in using modern databases when writing assignments and attestation projects. Heads of the departments were instructed about the necessity to encourage project supervisors to promote state of the art publications from international journals and databases. During "Winter training school" for faculty staff experts from Elsevier will be delivering training. Access to one of the leading databases is planned for 2024 year. AUPET believes that these actions will motivate instructors and students to use newest publications for teaching and learning activities.

11) The experts explicitly support students' wish to have flexible attendance requirements and recommend giving senior Bachelor's students in their third and fourth year of studies more freedom with respect to attending lectures. Current Academic policy gives opportunity for students who have successfully completed all 6 semesters to combine study with work.

12) The experts point out that the share of teachers with a PhD is relatively low by international standards. Especially in the Master's programmes, every teacher should have a PhD or an equivalent academic qualification.

Master degree program in the Republic of Kazakhstan has two different focus groups. Some master's degree programs last 1 or 1.5 years (60 or 90 ECTS credits accordingly) and are more suitable for the audience who want to increase their professional (technical) competency. Scientific-pedagogical master programs are designed for those who want to continue research activities further on PhD programs or start their carrier at university of other educational organizations. For the first group of programs professional experience of instructors is more valuable than PhD or an equivalent academic qualification. For the second group of programs there is state regulation of the Republic of Kazakhstan according to which not less than 70% of faculty must have a PhD or an equivalent academic qualification. As AUPET offers technical majors during the hiring process university puts emphasis on professional experience, not only academic qualification.

13) The experts emphasised that all teachers should be familiar with the current state of technical knowledge and that they should not present outdated information in the lectures or laboratory sessions. Expert suggested AUPET to organize didactical and professional training for teachers.

In order improve the professional and didactic skills of the faculty staff from 4 to 19 January "Winter training school" for faculty is being organized to deliver such topics as "Curriculum design and program evaluation", "Educational technologies: applications and programs for better learning", "Emotional intelligence in teaching process", "Teaching Strategies: Motivation", "Teacher's planer and time management", "Application of Bloom taxonomy for planning the course outcomes", "What is Perry's theory of intellectual development?", "Student-centred teaching and learning" and etc.

During "Winter training school" for faculty staff experts from Elsevier will be delivering training. Access to one of the leading databases is planned for 2024 year. AUPET believes that these actions will motivate instructors and students to use newest publications for teaching and learning activities.

AUPET has almost organized guest lectures for faculty staff on such topics as "Constructivism: practical aspects", "Teaching sustainable development goals with the use of AR&VR".

14) The experts point out that no the module handbooks do not include the module descriptions of the final project (thesis).

Module handbooks were created based on the program description universities must place on the "State register of educational programs". As final attestation is obligatory for any educational program these descriptions do not include the description of final attestation, master thesis. However, based on the requirements of expert team university has added descriptions to module handbooks.

15) Experts pointed out that the university must issue a Diploma Supplement to every graduate.

As AUPET has moved to the new information system university plans to have module for graduates to print it automatically from the system. At present the Diploma Supplement aligned with the European Template is being prepared upon request for graduates.

16) Missing study plan for the specialisation "Automation and business process management" of the Bachelor's degree programme Automation and Control was included into Module handbook.

17) Experts stated that most students were not well informed about their representatives and their tasks in the different councils of the university.

To organize educational process effectively Educational methodological council was re-structured. Most of the functions were given to committees (three committee: “Academic excellence committee”, “Committee for the development of educational programs”, “Committee for methodological work”) where students and faculty staff will discuss current situation, problems, bottle necks and generate recommendations for the Educational methodological council to fix the situation or plan corrective actions. Students were present at the meetings of this committees in the beginning of December. Also abovementioned program Students' Academic Voice of "Energo" Representation will be helpful in gathering feedback on academic process. University believes that active involvement of student society in decision making will not only have a positive impact on university activities, but also will increase students’ motivation, academic loyalty and eventually will bring them to active citizenship position. The composition of committees was approved, all three committees have most active students as a committee member. Tasks and plans of committees are being completed.”

F Summary: Expert recommendations (22.01.2024)

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

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Bachelor Automation and Control	With requirements for one year	EUR-ACE®	30.09.2029
Bachelor Radio Engineering, Electronics and Telecommunications	With requirements for one year	EUR-ACE®	30.09.2029
Bachelor Electrical Engineering	With requirements for one year	EUR-ACE®	30.09.2029
Master Automation and Control	With requirements for one year	EUR-ACE®	30.09.2029
Master Radio Engineering, Electronics and Telecommunications	With requirements for one year	EUR-ACE®	30.09.2029
Master Electrical Engineering	With requirements for one year	EUR-ACE®	30.09.2029

Requirements

For all degree programmes

A 1. (ASIIN 2) Make sure that the literature references in the theses are not outdated and that current scientific publications are taken into consideration.

A 2. (ASIIN 3.1) Teachers need to have the opportunity to further develop their professional and didactic skills and AUPET needs to better support the teachers in using corresponding offers.

A 3. (ASIIN 3.2) Provide full access for students and teachers to current scientific publications.

A 4. (ASIIN 4.2) Issue a Diploma Supplement to all graduates.

A 5. (ASIIN 4.3) The homepages need to be updated and should include the essential information about the respective degree programme such as the learning outcomes,

the length and awarded ECTS points, the general content, the study plan, and a link to the module handbook.

A 6. (ASIIN 5) Students need to be informed about the results of the questionnaires and what improvements might be possible, the feedback cycles need to be closed.

A 7. (ASIIN 5) Draw up and publish an official regulation on the tasks and composition of the Academic Excellence Committee.

For the Bachelor's programmes

A 8. (ASIIN 1.1) Draft and publish separate learning outcomes for each specialisation.

Recommendations

For all degree programmes

E 1. (ASIIN 1.3) It is recommended to increase the English proficiency of students and teachers.

E 2. (ASIIN 1.3) It is recommended to better foster students' academic mobility and to encourage them to spend some time during their studies abroad.

E 3. (ASIIN 1.3) It is recommended to assign one teacher in each department as an "International Coordinator", who encourages students' to join international mobility programmes.

E 4. (ASIIN 1.6) It is recommended to offer Education Roaming (eduroam) at AUPET.

E 5. (ASIIN 3.1) It is recommended to increase the share of teachers with a PhD.

E 6. (ASIIN 3.1) It recommend to verify that all teachers are familiar with the current state of scientific knowledge and are not presenting any outdated information.

E 7. (ASIIN 5) It is recommended to better inform students are about their representatives in the different councils of AUPET.

For the Bachelor's programmes

E 8. (ASIIN 1.3) It is recommended to give senior Bachelor's students in their third and fourth year of studies more freedom with respect to attending lectures.

G Comment of the Technical Committee 02 – Electrical Engineering/Information Technology (01.03.2024)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee discusses the accreditation procedure and follows the assessment of the experts without change.

Assessment and analysis for the award of the EUR-ACE label:

The Technical Committee deems that the intended learning outcomes of the degree programmes do comply with the engineering specific parts of Subject-Specific Criteria of the Technical Committee 02 – Electrical Engineering/Information Technology.

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

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Bachelor Automation and Control	With requirements for one year	EUR-ACE®	30.09.2029
Bachelor Radio Engineering, Electronics and Telecommunications	With requirements for one year	EUR-ACE®	30.09.2029
Bachelor Electrical Engineering	With requirements for one year	EUR-ACE®	30.09.2029
Master Automation and Control	With requirements for one year	EUR-ACE®	30.09.2029
Master Radio Engineering, Electronics and Telecommunications	With requirements for one year	EUR-ACE®	30.09.2029
Master Electrical Engineering	With requirements for one year	EUR-ACE®	30.09.2029

H Decision of the Accreditation Commission (22.03.2024)

Assessment and analysis for the award of the ASIIN seal:

The Accreditation Commission discusses the procedure and decides to follow the assessment of the experts and the Technical Committee. All requirements and recommendations are approved as proposed.

Assessment and analysis for the award of the EUR-ACE label:

The Accreditation Commission confirms that the EUR-ACE label can be awarded to all six degree programmes.

The Accreditation Commission decides to award the following seals:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Bachelor Automation and Control	With requirements for one year	EUR-ACE® upon confirmation by the ENAEE administrative council	30.09.2029
Bachelor Radio Engineering, Electronics and Telecommunications	With requirements for one year	EUR-ACE® upon confirmation by the ENAEE administrative council	30.09.2029
Bachelor Electrical Engineering	With requirements for one year	EUR-ACE® upon confirmation by the ENAEE administrative council	30.09.2029
Master Automation and Control	With requirements for one year	EUR-ACE® upon confirmation by the ENAEE administrative council	30.09.2029
Master Radio Engineering, Electronics and Telecommunications	With requirements for one year	EUR-ACE® upon confirmation by the ENAEE administrative council	30.09.2029

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Master Electrical Engineering	With requirements for one year	EUR-ACE® upon confirmation by the ENAEE administrative council	30.09.2029

Requirements

For all degree programmes

A 1. (ASIIN 2) Make sure that the literature references in the theses are not outdated and that current scientific publications are taken into consideration.

A 2. (ASIIN 3.1) Teachers need to have the opportunity to further develop their professional and didactic skills and AUPET needs to better support the teachers in using corresponding offers.

A 3. (ASIIN 3.2) Provide full access for students and teachers to current scientific publications.

A 4. (ASIIN 4.2) Issue a Diploma Supplement to all graduates.

A 5. (ASIIN 4.3) The homepages need to be updated and should include the essential information about the respective degree programme such as the learning outcomes, the length and awarded ECTS points, the general content, the study plan, and a link to the module handbook.

A 6. (ASIIN 5) Students need to be informed about the results of the questionnaires and what improvements might be possible, the feedback cycles need to be closed.

A 7. (ASIIN 5) Draw up and publish an official regulation on the tasks and composition of the Academic Excellence Committee.

For the Bachelor's programmes

A 8. (ASIIN 1.1) Draft and publish separate learning outcomes for each specialisation.

Recommendations

For all degree programmes

E 1. (ASIIN 1.3) It is recommended to increase the English proficiency of students and teachers.

E 2. (ASIIN 1.3) It is recommended to better foster students' academic mobility and to encourage them to spend some time during their studies abroad.

E 3. (ASIIN 1.3) It is recommended to assign one teacher in each department as an "International Coordinator", who encourages students' to join international mobility programmes.

E 4. (ASIIN 1.6) It is recommended to offer Education Roaming (eduroam) at AUPET.

E 5. (ASIIN 3.1) It is recommended to increase the share of teachers with a PhD.

E 6. (ASIIN 3.1) It recommend to verify that all teachers are familiar with the current state of scientific knowledge and are not presenting any outdated information.

E 7. (ASIIN 5) It is recommended to better inform students are about their representatives in the different councils of AUPET.

For the Bachelor's programmes

E 8. (ASIIN 1.3) It is recommended to give senior Bachelor's students in their third and fourth year of studies more freedom with respect to attending lectures.

Appendix: Programme Learning Outcomes and Curricula

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Automation and Control:

Code	**Learning outcomes Ba Automation and Control**
LO1	To know the state language, Russian and one of the common foreign languages and to use them in professional activities. To be ready for intellectual, cultural, physical and spiritual self-improvement to upgrade one's qualifications throughout their working life.
LO 2	Have a basic knowledge of legal, cultural and ethical norms as well as linguistic, social and economic knowledge, ways and methods of organizing production and compliance with safety, health and environmental regulations, understand the importance and significance of maintaining academic integrity. Understand and practice research methods and features of academic writing.
LO 3	Demonstrate knowledge of sections of higher mathematics, physics, electronics, electrical engineering, and other natural sciences; find relationships between the studied facts, phenomena, theories in these areas and apply them to solve engineering problems in automation and control.
LO 4	Master modern computer, information, communication technologies and software used in the creation and operation of automation systems.
LO 5	Select measuring instruments and automation equipment, measure process parameters, adjust and operate automation components and devices.
LO 6	Have programming skills in high-level languages, microcontroller programming tools and languages, software for modeling and research of automated control systems.
LO 7	Apply in practice knowledge of the main types of linear and nonlinear automatic control systems, their mathematical description and modeling. Perform calculations on the analysis and synthesis of control systems.
LO 8	To know methods of information processing and synthesis of automation systems, methods of design and programming of control systems. To use in practice functionality of Scada-systems.

LO 9	Develop structural, functional and other automation diagrams, analyze reference and normative literature, draw up technical documentation. Develop technical, software, mathematical, algorithmic, information and other support for the automated process control system.
LO 10	Use technical capabilities of microprocessor technology, information receiving and transmitting means and software products to solve automation problems.
LO 11	Analyze and evaluate the state of automation objects, technological processes and productions. Make qualified decisions on the use of automation elements and systems, their installation, adjustment and operation.
LO 12	Have knowledge, skills and abilities to implement a systematic approach to the development and implementation of automation systems and robotization of production processes.

The following **curriculum** is presented:

№	Module code	1-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	2-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	**MAC-B01**	Modern history of Kazakhstan	GEM(CC)	5	45	15	30	0	St.E	1	**MAC-B08**	Physics	BM (UC)	5	45	30	0	15	E
2	**MAC-B03**	Foreign language 1	GEM(CC)	5	45	0	45	0	E	2	**MAC-B03**	Foreign language 2	GEM(CC)	5	45	0	45	0	E
3	**MAC-B04**	Kazakh (Russian) language 1	GEM(CC)	5	45	0	45	0	E	3	**MAC-B04**	Kazakh (Russian) language 2	GEM(CC)	5	45	0	45	0	E
4	**MAC-B02**	Mathematics 1	BM (UC)	5	45	15	30	0	E	4	**MAC-B02**	Mathematics 2	BM (UC)	5	45	30	0	15	E
5	**MAC-B06**	Information and communication technology (in English)	GEM(CC)	5	45	15	0	30	E	5	**MAC-B09**	Training Practice. Designing in AutoCAD, Solid Works / Computer Graphics Basics	BM (UC)	3	30	0	30	0	E
6	**MAC-B07**	Algorithms and data structures	BM (UC)	3	30	15	0	15	E	6	**MAC-B10-1/ MAC-B10-2**	Software implementation of engineering problems in C++/C++ Programming technologies in automation issues	BM (EC)	5	45	15	0	30	E
7	**MAC-B05**	Physical education	GEM(CC)	2	30	0	30	0	Gr.E	7	**MAC-B05**	Physical education	GEM(CC)	2	30	0	30	0	Gr.E
Total for the 1st semester				**30**	**285**	**60**	**180**	**45**	**1St.E, 5E, 1 Gr.E**		**Total for the 2nd semester**			**30**	**285**	**75**	**150**	**60**	**6 E, 1 Gr.E**
Total for a week					**19**	**4**	**12**	**3**			**Total for a week**				**19**	**5**	**10**	**4**	
2-year of study																			
№	**Module code**	**3-semester, 15 weeks**	**Cycle**	**ECTS**	**academ. hours**	**including**			**form of control**	**№**	**Module code**	**4-semester, 15 weeks**	**Cycle**	**ECTS**	**academ. hours**	**including**			**form of control**
						lec	**prac**	**lab**								**lec**	**prac**	**lab**	
1	**MAC-B11**	Module of socio-political knowledge (political science, sociology)	GED(CC)	5	45	30	15	0	E	1	**MAC-B17**	Philosophy	GEM(CC)	5	45	30	15	0	E
2	**MAC-B12-1/ MAC-B12-2**	Mathematical basis of automation / Mathematical methods in automation issues	BM (EC)	5	45	15	15	15	E	2	**MAC-B18-1/ MAC-B18-2**	Metrology, standardization, certification and quality management/Metrology and measurements	BM (EC)	5	45	15	15	15	E
3	**MAC-B13**	Theoretical basis of electrical engineering	BM (UC)	5	45	15	15	15	E	3	**MAC-B19**	Module of socio-political knowledge (culturology, psychology)	GEM(CC)	3	30	15	15	0	E
4	**MAC-B05**	Physical education	GEM(CC)	2	30	0	30	0	Gr.E	4	**MAC-B05**	Physical education	GEM(CC)	2	30	0	30	0	Gr.E
5	**MAC-B14-1/ MAC-B14-2**	Advanced physics / Special issues of physics	BM (EC)	3	30	15	0	15	E	5	**MAC-B20**	Electronics	BM (UC)	5	45	15	0	30	E
6	**MAC-B15-1**	Basics of collecting and transmitting information	BM (EC)	5	45	15	0	30	E	6	**MAC-B21-1/ MAC-B21-2**	Elements and devices of automation / Technical means of automation	BM (EC)	5	45	15	0	30	E
7	**MAC-B16-1/ MAC-B16-2**	Database design / Database management systems	BM (EC)	5	45	15	0	30	E	7	**MAC-B22**	Industrial practice 1	BM (UC)	5					Gr.E
Total for the 3rd semester				**30**	**285**	**105**	**75**	**105**	**6 E, 1 Gr.E**		**Total for the 4th semester**			**30**	**240**	**90**	**75**	**75**	**5 E, 2 Gr.E**
Total for a week					**19**	**7**	**5**	**7**			**Total for a week**				**16**	**6**	**5**	**5**	

Specialization: Automation and informatization in control systems

3-year of study

№	Module code	5-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	6-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	**MAC-B23**	Linear and non-linear automatic control systems	BM (UC)	7	60	15	15	30	E	1	**MAC-B29**	Systems of industrial pneumoautomatics and electropneumoautomatics	BM (EC)	5	45	15	0	30	E
2	**MAC-B24-1/ MAC-B24-2**	Computer networks in control systems/Industrial networks and interfaces	BM (EC)	5	45	15	0	30	E	2	**MAC-B30**	Software engineering	MM (EC)	5	45	15	0	30	E
3	**MAC-B25**	Information security in control systems	BM (EC)	5	45	15	0	30	E	3	**MAC-B31**	Automation of control objects	MM (EC)	5	45	15	0	30	E
4	**MAC-B26-1/ MAC-B26-2**	Programming of digital technology and microcontrollers / PLC software	BM (EC)	5	45	15	0	30	E	4	**MAC-B32-1/ MAC-B32-2**	Microprocessor complexes in control systems / Basics of distributed control systems	MM (EC)	5	45	15	0	30	E
5	**MAC-B27-1/ MAC-B27-2**	Technical measuring instruments / Technological measurements and devices	BM (EC)	3	30	15	0	15	E	5	**MAC-B33**	Modeling and identification of control objects	MM (UC)	5	45	15	0	30	E
6	**MAC-B28**	System software and programming	BM (EC)	5	45	15	0	30	E	6	**MAC-B34**	Industrial practice 2	BM (UC)	5					Gr.E
Total for the 5th semester				**30**	**270**	**90**	**15**	**165**	**6 E**		**Total for the 6th semester**			**30**	**225**	**75**	**0**	**150**	**5 E, 1 Gr.E**
Total for a week					**18**	**6**	**1**	**11**			**Total for a week**				**15**	**5**	**0**	**10**	

4-year of study

№	Module code	7-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	8-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	**MAC-B35**	Calculation of automatic control systems	MM (UC)	5	45	15	0	30	E	1	**MAC-B41**	Module of the university component of GED (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GEM (UC)	5	45	15	30	0	E
2	**MAC-B36**	Building SCADA systems	MM (UC)	5	45	15	0	30	E	2	**MAC-B42**	Basics of scientific research and academic writing	BM (UC)	3	30	15	15	0	E
3	**MAC-B37**	Information technologies in control systems research	MM (EC)	5	45	15	0	30	E	3	**MAC-B43-1/ MAC-B43-2/ MAC-B43-3**	Siemens automation systems development / Schneider Electric automation systems development / National Instruments technologies in automation measurement tasks	MM (EC)	3	30	15	0	15	E
4	**MAC-B38**	Reliability of control systems	MM (EC)	5	45	15	0	30	E	4	**MAC-B44**	Undergraduate practice	MM (UC)	7					Gr.E
5	**MAC-B39**	Typical design solutions for control systems	MM (UC)	5	45	15	0	30	E	5	**MAC-B45**	FA (Writing and defending of graduation diploma, project)		12					DGD
6	**MAC-B40**	Automated control systems for production processes	MM (EC)	5	45	15	0	30	E										
Total for the 7th semester				**30**	**270**	**90**	**0**	**180**	**6 E**		**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**3 E, 1 Gr.E, DGD**
Total for a week					**18**	**6**	**0**	**12**			**Total for a week**				**7**	**3**	**3**	**1**	
Total credits and academ. hours				**240**	**1965**	**630**	**540**	**795**	**1 St.E, 42E, 7 Gr.E, DGD**										

Specialization: Automation and control in the fuel and energy complex

3-course

№	Module code	5-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	6-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	**MAC-B23**	Linear and non-linear automatic control systems	BM (UC)	7	60	15	15	30	E	1	**MAC-B29**	Systems of industrial pneumoautomatics and electropneumoautomatics	BM (EC)	5	45	15	0	30	E
2	**MAC-B24-1/ MAC-B24-2**	Computer networks in control systems/Industrial networks and interfaces	BM (EC)	5	45	15	0	30	E	2	**MAC-B47**	Energy saving and energy audit of the enterprise	MM (EC)	5	45	15	0	30	E
3	**MAC-B25**	Information security in control systems	BM (EC)	5	45	15	0	30	E	3	**MAC-B48**	Automation of energy facilities	MM (EC)	5	45	15	0	30	E
4	**MAC-B26-1/ MAC-B26-2**	Programming of digital technology and microcontrollers / PLC software	BM (EC)	5	45	15	0	30	E	4	**MAC-B32-1/ MAC-B32-2**	Microprocessor complexes in control systems / Basics of distributed control systems	MM (EC)	5	45	15	0	30	E
5	**MAC-B27-1/ MAC-B27-2**	Technical measuring instruments / Technological measurements and devices	BM (EC)	3	30	15	0	15	E	5	**MAC-B33**	Modeling and identification of control objects	MM (UC)	5	45	15	0	30	E
6	**MAC-B46**	Technological bases of heat energy production	BM (EC)	5	45	15	0	30	E	6	**MAC-B34**	Industrial practice 2	BM (UC)	5					Gr.E
Total for the 5th semester				**30**	**270**	**90**	**15**	**165**	**6 E**		**Total for the 6th semester**			**30**	**225**	**75**	**0**	**150**	**5 E, 1 Gr.E**
Total for a week					**18**	**6**	**1**	**11**			**Total for a week**				**15**	**5**	**0**	**10**	

4-course

№	Module code	7-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	8-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	**MAC-B35**	Calculation of automatic control systems	MM (UC)	5	45	15	0	30	E	1	**MAC-B41**	Module of the university component of GED (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GEM (UC)	5	45	15	30	0	E
2	**MAC-B36**	Building SCADA systems	MM (UC)	5	45	15	0	30	E	2	**MAC-B42**	Basics of scientific research and academic writing	BM (UC)	3	30	15	15	0	E
3	**MAC-B49**	Automation systems software	MM (EC)	5	45	15	0	30	E	3	**MAC-B43-1/ MAC-B43-2/ MAC-B43-3**	Siemens automation systems development / Schneider Electric automation systems development / National Instruments technologies in automation measurement tasks	MM (EC)	3	30	15	0	15	E
4	**MAC-B50**	Diagnostics of thermal power facilities and control systems	MM (EC)	5	45	15	0	30	E	4	**MAC-B44**	Undergraduate practice	MM (UC)	7					Gr.E
5	**MAC-B39**	Typical design solutions for control systems	MM (UC)	5	45	15	0	30	E	5	**MAC-B45**	FA (Writing and defending of graduation diploma, project)		12					DGD
6	**MAC-B51**	Methods for protecting equipment of automated systems	MM (EC)	5	45	15	0	30	E										
Total for the 7th semester				**30**	**270**	**90**	**0**	**180**	**6 E**		**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**3 E, 1 Gr.E, DGD**
Total for a week					**18**	**6**	**0**	**12**			**Total for a week**				**7**	**3**	**3**	**1**	
Total credits and academ. hours				**240**	**1965**	**630**	**540**	**795**	**1 St.E, 42E, 7 Gr.E, DGD**										

Specialization: Automation and robotic systems

3-course

№	Module code	5-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	6-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	**MAC-B23**	Linear and non-linear automatic control systems	BM (UC)	7	60	15	15	30	E	1	**MAC-B29**	Systems of industrial pneumoautomatics and electropneumoautomatics	BM (EC)	5	45	15	0	30	E
2	**MAC-B24-1/ MAC-B24-2**	Computer networks in control systems/Industrial networks and interfaces	BM (EC)	5	45	15	0	30	E	2	**MAC-B65**	Mechanics of industrial robotic systems	MM (EC)	5	45	15	0	30	E
3	**MAC-B25**	Information security in control systems	BM (EC)	5	45	15	0	30	E	3	**MAC-B66**	Information and measuring means of mass production	MM (EC)	5	45	15	0	30	E
4	**MAC-B26-1/ MAC-B26-2**	Programming of digital technology and microcontrollers / PLC software	BM (EC)	5	45	15	0	30	E	4	**MAC-B32-1/ MAC-B32-2**	Microprocessor complexes in control systems / Basics of distributed control systems	MM (EC)	5	45	15	0	30	E
5	**MAC-B27-1/ MAC-B27-2**	Technical measuring instruments / Technological measurements and devices	BM (EC)	3	30	15	0	15	E	5	**MAC-B33**	Modeling and identification of control objects	MM (UC)	5	45	15	0	30	E
6	**MAC-B64**	Automation and basics of robot control	BM (EC)	5	45	15	0	30	E	6	**MAC-B34**	Industrial practice 2	BM (UC)	5	0				Gr.E
Total for the 5th semester				**30**	**270**	**90**	**15**	**165**	**6 E**		**Total for the 6th semester**			**30**	**225**	**75**	**0**	**150**	**5 E, 1 Gr.E**
Total for a week					**18**	**6**	**1**	**11**			**Total for a week**				**15**	**5**	**0**	**10**	

4-course

№	Module code	7-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	8-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	**MAC-B35**	Calculation of automatic control systems	MM (UC)	5	45	15	0	30	E	1	**MAC-B41**	Module of the university component of GED (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GEM (UC)	5	45	15	30	0	E
2	**MAC-B36**	Building SCADA systems	MM (UC)	5	45	15	0	30	E	2	**MAC-B42**	Basics of scientific research and academic writing	BM (UC)	3	30	15	15	0	E
3	**MAC-B67**	Software control of flexible manufacturing systems	MM (EC)	5	45	15	0	30	E	3	**MAC-B43-1/ MAC-B43-2/ MAC-B43-3**	Siemens automation systems development / Schneider Electric automation systems development / National Instruments technologies in automation measurement tasks	MM (EC)	3	30	15	0	15	E
4	**MAC-B68**	Control systems for executive mechanisms of automated production	MM (EC)	5	45	15	0	30	E	4	**MAC-B44**	Undergraduate practice	MM (UC)	7					Gr.E
5	**MAC-B39**	Typical design solutions for control systems	MM (UC)	5	45	15	0	30	E	5	**MAC-B45**	FA (Writing and defending of graduation diploma, project)		12					DGD
6	**MAC-B69**	Design of control systems for robotic complexes	MM (EC)	5	45	15	0	30	E										
Total for the 7th semester				**30**	**270**	**90**	**0**	**180**	**6 E**		**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**3 E, 1 Gr.E, DGD**
Total for a week					**18**	**6**	**0**	**12**			**Total for a week**				**7**	**3**	**3**	**1**	
Total credits and academ. hours				**240**	**1965**	**630**	**540**	**795**	**1 St.E, 42E, 7 Gr.E, DGD**										

Specialization: Oil industry automation systems

3-course

№	Module code	5-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	6-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	**MAC-B23**	Linear and non-linear automatic control systems	BM (UC)	7	60	15	15	30	E	1	**MAC-B29**	Systems of industrial pneumoautomatics and electropneumoautomatics	BM (EC)	5	45	15	0	30	E
2	**MAC-B24-1/ MAC-B24-2**	Computer networks in control systems/Industrial networks and interfaces	BM (EC)	5	45	15	0	30	E	2	**MAC-B53**	Automation of technological processes of production, preparation and transportation of oil	MM (EC)	5	45	15	0	30	E
3	**MAC-B25**	Information security in control systems	BM (EC)	5	45	15	0	30	E	3	**MAC-B54**	Processes and apparatus for oil refining	MM (EC)	5	45	15	0	30	E
4	**MAC-B26-1/ MAC-B26-2**	Programming of digital technology and microcontrollers / PLC software	BM (EC)	5	45	15	0	30	E	4	**MAC-B32-1/ MAC-B32-2**	Microprocessor complexes in control systems / Basics of distributed control systems	MM (EC)	5	45	15	0	30	E
5	**MAC-B27-1/ MAC-B27-2**	Technical measuring instruments / Technological measurements and devices	BM (EC)	3	30	15	0	15	E	5	**MAC-B33**	Modeling and identification of control objects	MM (UC)	5	45	15	0	30	E
6	**MAC-B52**	Technology of production, preparation and storage of commercial oil	BM (EC)	5	45	15	0	30	E	6	**MAC-B34**	Industrial practice 2	BM (UC)	5					Gr.E
Total for the 5th semester				**30**	**270**	**90**	**15**	**165**	**6 E**		**Total for the 6th semester**			**30**	**225**	**75**	**0**	**150**	**5 E, 1 Gr.E**
per week					**18**	**6**	**1**	**11**			**per week**				**15**	**5**	**0**	**10**	

4-course

№	Module code	7-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	8-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	**MAC-B35**	Calculation of automatic control systems	MM (UC)	5	45	15	0	30	E	1	**MAC-B41**	Module of the university component of GED (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GEM (UC)	5	45	15	30	0	E
2	**MAC-B36**	Building SCADA systems	MM (UC)	5	45	15	0	30	E	2	**MAC-B42**	Basics of scientific research and academic writing	BM (UC)	3	30	15	15	0	E
3	**MAC-B55**	Automation of petrochemical production processes	MM (EC)	5	45	15	0	30	E	3	**MAC-B43-1/ MAC-B43-2/ MAC-B43-3**	Siemens automation systems development / Schneider Electric automation systems development / National Instruments technologies in automation measurement tasks	MM (EC)	3	30	15	0	15	E
4	**MAC-B56**	Reliability and safety of automation systems	MM (EC)	5	45	15	0	30	E	4	**MAC-B44**	Undergraduate practice	MM (UC)	7					Gr.E
5	**MAC-B39**	Typical design solutions for control systems	MM (UC)	5	45	15	0	30	E	5	**MAC-B45**	FA (Writing and defending of graduation diploma, project)		12					DGD
6	**MAC-B57**	Process control systems	MM (EC)	5	45	15	0	30	E										
Total for the 7th semester				**30**	**270**	**90**	**0**	**180**	**6 E**		**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**3 E, 1 Gr.E, DGD**
Total for a week					**18**	**6**	**0**	**12**			**Total for a week**				**7**	**3**	**3**	**1**	
Total credits and academ. hours				**240**	**1965**	**630**	**540**	**795**	**1 St.E, 42E, 7 Gr.E, DGD**										

Specialization: Automation and business process management

3-course

№	Module code	5-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	6-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MAC-B23	Linear and non-linear automatic control systems	BM (UC)	7	60	15	15	30	E	1	MAC-B29	Systems of industrial pneumoautomatics and electropneumoautomatics	BM (EC)	5	45	15	0	30	E
2	MAC-B24-1/ MAC-B24-2	Computer networks in control systems/Industrial networks and interfaces	BM (EC)	5	45	15	0	30	E	2	MAC-B59	Management Accounting and Audit	MM (EC)	5	45	15	0	30	E
3	MAC-B25	Information security in control systems	BM (EC)	5	45	15	0	30	E	3	MAC-B60	Financial management	MM (EC)	5	45	15	0	30	E
4	MAC-B26-1/ MAC-B26-2	Programming of digital technology and microcontrollers / PLC software	BM (EC)	5	45	15	0	30	E	4	MAC-B32-1/ MAC-B32-2	Microprocessor complexes in control systems / Basics of distributed control systems	MM (EC)	5	45	15	0	30	E
5	MAC-B27-1/ MAC-B27-2	Technical measuring instruments / Technological measurements and devices	BM (EC)	3	30	15	0	15	E	5	MAC-B33	Modeling and identification of control objects	MM (UC)	5	45	15	0	30	E
6	MAC-B58	Innovation management and marketing	BM (EC)	5	45	15	0	30	E	6	MAC-B34	Industrial practice 2	BM (UC)	5					Gr.E
Total for the 5th semester				**30**	**270**	**90**	**15**	**165**	**6 E**		**Total for the 6th semester**			**30**	**225**	**75**	**0**	**150**	**5 E, 1 Gr.E**
Total for a week					**18**	6	1	11			**Total for a week**				**15**	**5**	**0**	10	

4-course

№	Module code	7-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	8-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MAC-B35	Calculation of automatic control systems	MM (UC)	5	45	15	0	30	E	1	MAC-B41	Module of the university component of GED (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GEM (UC)	5	45	15	30	0	E
2	MAC-B36	Building SCADA systems	MM (UC)	5	45	15	0	30	E	2	MAC-B42	Basics of scientific research and academic writing	BM (UC)	3	30	15	15	0	E
3	MAC-B61	Information Technology and Business Process Management	MM (EC)	5	45	15	0	30	E	3	MAC-B43-1/ MAC-B43-2/ MAC-B43-3	Siemens automation systems development / Schneider Electric automation systems development / National Instruments technologies in automation measurement tasks	MM (EC)	3	30	15	0	15	E
4	MAC-B62	Mathematical modeling and design of business process management systems	MM (EC)	5	45	15	0	30	E	4	MAC-B44	Undergraduate practice	MM (UC)	7					Gr.E
5	MAC-B39	Typical design solutions for control systems	MM (UC)	5	45	15	0	30	E	5	MAC-B45	FA (Writing and defending of graduation diploma, project)		12					DGD
6	MAC-B63	Automation of internal production planning	MM (EC)	5	45	15	0	30	E										
Total for the 7th semester				30	270	**90**	**0**	**180**	**6 E**		**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**3 E, 1 Gr.E, DGD**
Total for a week					**18**	6	**0**	**12**			**Total for a week**				7	**3**	3	**1**	
Total credits and academ. hours				240	1965	630	540	795	**1 St.E, 42E, 7 Gr.E, DGD**										

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Radio Engineering, Electronics and Telecommunications:

"LO-1. Demonstrate and apply basic mathematical, physical, and other natural science knowledge as well as theoretical foundations of electrical engineering, electrical circuits, and electromagnetic waves in an interdisciplinary context to solve problems.

LO-2. Calculate and select measuring instruments. Ability to use electronic and microprocessor base in telecommunication and radio engineering systems.

LO-3. Use modern computer, information technology, digital technology and software in telecommunications, demonstrate simulation skills in telecommunications networks, skills to protect telecommunications networks.

LO-4 Develop structural and functional diagrams of multichannel, mobile, broadband, and satellite information transmission systems; ability to select optimal design solutions at all stages of the design process. Will be able to participate in the development and design of elements of telecommunications networks

LO-5. Demonstrate the ability to acquire new, broaden and deepen previously obtained knowledge, skills and competencies in various areas of life, necessary for successful implementation in the field of professional activity, including at the intersection of different areas of activity and fields of science.

LO-6. Demonstrate skills in planning, design, implementation and operation of telecommunications networks and systems, their technical, information and software using CAD.

LO-7. Demonstrate skills in installation, setup, adjustment, and pilot testing of certain types of complex devices, systems, and networks in the laboratory and on-site.

LO-8 Analyze the production unit results, develop organizational, technological and reporting documentation and make presentations of the results using modern technical means.

LO-9 Master the basics of social, linguistic, and economic knowledge, methods and techniques of planning and organization of production, have a scientific understanding of management, marketing, finance, possess the skills to make economic and organizational decisions in conditions of uncertainty and risk."

The following **curriculum** is presented:

1-year of study																			
№	Module code	1-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	2-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MRET-B1	Module of socio-political knowledge (sociology, political science)	GED(CC)	5	45	30	15	0	E	1	MRET-B8	Modern history of Kazakhstan	GED(CC)	5	45	15	30	0	St.E
2	MRET-B2	Physical education	GED(CC)	2	15	0	15	0	GT	2	MRET-B9	Physical education	GED(CC)	2	15	0	15	0	GT
3	MRET-B3	Foreign language 1	GED(CC)	5	45	0	45	0	E	3	MRET-B10	Foreign language 2	GED(CC)	5	45	0	45	0	E
4	MRET-B4	Kazakh (Russian) language 1	GED(CC)	5	45	0	45	0	E	4	MRET-B11	Kazakh (Russian) language 2	GED(CC)	5	45	0	45	0	E
5	MRET-B5	Mathematics 1	BD(UC)	5	45	15	30	0	E	5	MRET-B12	Mathematics 2	BD(UC)	5	45	30	15	0	E
6	MRET-B6	Information and communication technology (in English)	GED(CC)	5	45	15	0	30	E	6	MRET-B13	Training Practice. Designing in AutoCAD, Solid Works	BD(UC)	3	30	0	30	0	GT
7	MRET-B7-1	Basics of IP-telephony and streaming technologies	BD(EC)	3	30	15	0	15	E	7	MRET-B14	Bases of algorithmization and programming	BD(UC)	5	45	15	0	30	E
	MRET-B7-2	Basics of building intellectual information systems																	
	Total for 1 semester			30	270	75	150	45	6E, 1GT		Total for 2 semester			30	270	60	180	30	1St.E, 4E, 2GT
	Total for a week:				18	5	10	3			Total for a week:				18	4	12	2	

2-year of study																			
№	Module code	1-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	2-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MRET-B15	Philosophy	GED(CC)	5	45	30	15	0	E	1	MRET-B22	Physical education	GED(CC)	2	15	0	15	0	GT
2	MRET-B16	Module of socio-political knowledge (culturology, psychology)	GED(CC)	3	30	15	15	0	E	2	MRET-B23-1	Physics of electromagnetic waves	BD(EC)	4	30	15	15	0	E
											MRET-B23-2	Optics and quantum physics							
3	MRET-B17	Physical education	GED(CC)	2	15	0	15	0	GT	3	MRET-B24-1	System software	BD(EC)	3	30	15	0	15	E
											MRET-B24-2	Object-oriented programming							
4	MRET-B18-1	Special chapters of mathematics	BD(EC)	5	45	15	30	0	E	4	MRET-B25-1	Basics of radio engineering and telecommunications	BD(EC)	5	45	30	15	0	E
	MRET-B18-2	Probability theory and elements of mathematical statistics									MRET-B25-2	Basics of telecommunication systems							
5	MRET-B19	Physics	BD(UC)	5	45	30	0	15	E	5	MRET-B26	Theory of electrical circuits in telecommunications	BD(EC)	5	45	15	15	15	E
6	MRET-B20	Algorithmic programming languages in telecommunications	BD(UC)	6	45	15	0	30	E	6	MRET-B27	Industrial Practice (Radio mounting)	BD(UC)	5					GT
7	MRET-B21-1	Theory of electrical circuits	BD(EC)	4	30	15	0	15	E	7	MRET-B28-1	Telecommunication networks	BD(EC)	6	45	15	0	30	E
	MRET-B21-2	Design of radio engineering systems									MRET-B28-2	Computer networks							
	Total for the 3rd semester			30	255	120	75	60	6E, 1GT		Total for the 4th semester			30	210	90	60	60	5E, 2GT
	Total for a week				17	8	5	4			Total for a week				14	6	4	4	
3-year of study																			
№	Module code	1-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	2-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MRET-B29	Database design	BD(EC)	5	45	15	0	30	E	1	MRET-B35	Theory of transmission of electromagnetic waves and antenna-feeder devices	BD(UC)	7	60	15	15	30	E
2	MRET-B30-1	Digital devices and microprocessors	BD(EC)	5	45	15	15	15	E	2	MRET-B36	Digital communication technologies	BD(EC)	5	45	15	15	15	E
	MRET-B30-2	Digital and microprocessor circuit design																	
3	MRET-B31-1	Circuit design in telecommunications	BD(EC)	5	45	15	0	30	E	3	MRET-B37	Information security methods in telecommunications	MM(UC)	3	30	15	0	15	E
	MRET-B31-2	Microelectronics in telecommunications																	
4	MRET-B32	Electrical communication theory	BD(UC)	5	45	15	15	15	E	4	MRET-B38	Computer modeling of telecommunication systems	MM(UC)	5	45	15	15	15	E
5	MRET-B33	Basics of digital signal processing	MM(UC)	5	45	15	0	30	E	5	MRET-B39	Wireless communication technologies	MM(UC)	5	45	15	15	15	E
6	MRET-B34	Optical communication systems in telecommunications	MM(UC)	5	45	15	15	15	E	6	MRET-B40	Industrial Practice	BD(UC)	5					GT
	Total for the 5rd semester			30	270	90	45	135	6E		Total for the 6th semester			30	225	75	60	90	5E, 1GT
	Total for a week				18	6	3	9			Total for a week				15	5	4	6	

4-year of study																			
Infocommunication technologies																			
№	Module code	1-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	2-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MRET-B41	Communication networks and voice switching systems	MM(EC)	5	45	15	15	15	E	1	MRET-B53	Module of the university component of GED (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GED(UC)	5	45	15	30	0	E
2	MRET-B42	Packet switching technology	MM(EC)	5	45	15	15	15	E	2	MRET-B54	Basics of scientific research and academic writing	BD(UC)	3	30	15	15	0	E
3	MRET-B43	SDN/NFV networks	MM(EC)	5	45	15	15	15	E	3	MRET-B55	Special issues of radio engineering and telecommunications	BD(UC)	3	30	15	15	0	E
4	MRET-B44	Radio systems and mobile communication networks	MM(EC)	5	45	15	15	15	E	4	MRET-B56	Undergraduate practice	MM(UC)	7					GT
5	MRET-B45	Multiservice networks of subscriber access	MM(EC)	5	45	15	15	15	E	5	MRET-B57	Final attestation. Writing and defending of graduation diploma (project)	FA	12					Defence GD
6	MRET-B46	Transport telecommunication networks	MM(EC)	5	45	15	15	15	E										
	Total for the 7th semester			30	270	90	90	90	6E		Total for the 8th semester			30	105	45	60	0	3E, 1GT
	Total for a week:				18	6	6	6			Total for a week:				7	3	4	0	
Innovative technologies																			
№	Module code	1-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	2-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MRET-B47	Radio receiving and transmitting devices	MM(EC)	5	45	15	15	15	E	1	MRET-B53	Module of the university component of GED (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GED(UC)	5	45	15	30	0	E
2	MRET-B48	Satellite and radio relay transmission systems	MM(EC)	5	45	15	15	15	E	2	MRET-B54	Basics of scientific research and academic writing	BD(UC)	3	30	15	15	0	E
3	MRET-B49	Communication systems design	MM(EC)	5	45	15	15	15	E	3	MRET-B55	Special issues of radio engineering and telecommunications	BD(UC)	3	30	15	15	0	E
4	MRET-B50	Video surveillance systems and space tracking systems	MM(EC)	5	45	15	15	15	E	4	MRET-B56	Undergraduate practice	MM(UC)	7					GT
5	MRET-B51	Mobile telecommunications	MM(EC)	5	45	15	15	15	E	5	MRET-B57	Final attestation. Writing and defending of graduation diploma (project)	FA	12					Defence GD
6	MRET-B52	Multichannel telecommunication systems	MM(EC)	5	45	15	15	15	E										
	Total for the 7th semester			30	270	90	90	90	6E		Total for the 8th semester			30	105	45	60	0	3E, 1GT
	Total for a week:				18	6	6	6			Total for a week:				7	3	4	0	
Total credits and class hours				240	1875	645	720	510											

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Electrical Engineering:

LO1	To have the basics of legal and ethical standards knowledge and be able to use them in professional activities. Will be able to independently build and implement promising areas of intellectual, cultural, physical, professional self-development and self-improvement. Scientifically substantiate objective knowledge of the history of Kazakhstan.
LO 2	To have the basics of social, linguistic and economic knowledge, methods and techniques of planning and organizing production and complying with safety, health and environmental regulations. Demonstrate the ability to apply the rules and regulations of industrial and environmental safety, industrial sanitation, fire safety and labor protection.
LO 3	Demonstrate and apply basic mathematical, physical, and other natural science knowledge as well as theoretical foundations of electrical engineering, electrical circuits, and electromagnetic field.
LO 4	Correctly calculate and select means of electrical measurements, automatic control systems, characteristics of electronic devices, main and backup types of protection of high and ultra-high voltage power lines, based on complex devices of relay protection and automation of microprocessor complexes.
LO 5	The ability to use modern computer, information technology, digital equipment and software in the power industry, and demonstrate skills in computer networks.
LO 6	Carry out calculation of parameters, characteristics, selection of electric machines, digital systems of automated electric drive and switching electrical apparatus, know the features of modern electrical materials and possess the skills of working with high-voltage technology.
LO 7	Will be able to participate in the development and design of power plant elements and power complexes based on renewable energy sources. Apply monitoring systems for wind and solar radiation energy.
LO 8	Determine effective production and technological modes of heat and power facilities operation, make decisions in the field of energy and resource conservation. Apply practical skills of saving energy resources and increasing energy efficiency, skills of engineering calculation methods of energy units and systems, providing the most efficient methods of production and reasonable use of energy.
LO 9	Carry out independently the installation, repair, adjustment, testing and operation of electrical equipment of power plants, power grids and power supply systems of

	all types of enterprises, diagnostics of electromechanical systems of semiconductor energy converters with digital control, digital relay protection terminals
LO 10	To be proficient in the design of power plants, electrical networks, relay protection of electrical networks and power supply systems of enterprises and lighting installations for indoor and outdoor lighting. Be able to analyze the normal and emergency modes and determine possible options for performance and triggering parameters of digital relay protection and automation.

The following curriculum is presented:

1-course																		
	Code of the module	1st semester 15 weeks		ECTS	number of acad. hours	of which			form of control	Code of the module	2nd semester. 15 weeks		ECTS	number of acad. hours	of which			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE-B1	Modern history of Kazakhstan	GEM(UC)	5	45	15	30		St.E	MEE-B8	Physics 1	BM(UC)	5	45	30		15	E
2	MEE-B2	Foreign language 1	GEM(UC)	5	45		45		E	MEE-B9	Foreign language 2	GEM(UC)	5	45		45		E
3	MEE-B3	Kazakh (Russian) language 1	GEM(UC)	5	45		45		E	MEE-B10	Kazakh (Russian) language 2	GEM(UC)	5	45		45		E
4	MEE-B4	Mathematics 1	BM(UC)	5	45	15	30		E	MEE-B11	Mathematics 2	BM(UC)	5	45	30	15		E
5	MEE-B5	Philosophy	GEM(UC)	5	45	30	15		E	MEE-B12	**Practical practice.** Designing in AutoCAD, Solid Works / Computer Graphics Basics	BM(UC)	3	30		30		E
6	MEE-B6-1	Introduction to the specialty	BM(EC)	3	30	30			E	MEE-B13	Information and communication technology (in English)	GEM(UC)	5	45	15		30	E
	MEE-B6-2	Introduction to electrical engineering																
7	MEE-B7	Physical education	GEM(UC)	2	15		15		GT	MEE-B14	Physical education	GEM(UC)	2	15		15		GT
Total for the 1st semester				**30**	**270**	**90**	**180**	**0**	**1St.E, 5E, 1GT**	**Total for the 2nd semester**			**30**	**270**	**75**	**150**	**45**	**6E, 1GT**
per week						**6**	**12**	**0**		**per week**					**5**	**10**	**3**	

2-course																		
	Code of the module	3rd semester. 15 weeks		ECTS	number of acad. hours	of which			form of control	Code of the module	4th semester. 15 weeks		ECTS	number of acad. hours	of which			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE-B15	Bases of algorithmization and programming	BM(UC)	5	45	15	15	15	E	MEE-B23	Physical education	GEM(UC)	2	15		15		GT
2	MEE-B16	Theoretical basis of electrical engineering (I)	BM(UC)	5	45	15		30	E	MEE-B24	Module of socio-political knowledge (political science, sociology)	GEM(UC)	5	45	30	15		E
3	MEE-B17-1	Safety rules in electrical installation	MM(EC)	3	30	15		15	E	MEE-B25	Module of socio-political knowledge (culturology, psychology)	GEM(UC)	3	30	15	15		E
	MEE-B17-2	Electrical safety																
4	MEE-B18	Physical education	GEM(UC)	2	15		15		GT	MEE-B26	Theoretical basis of electrical engineering (II)	BM(UC)	5	45	15		30	E
5	MEE-B19	Physics 2	BM(UC)	5	45	15		30	E	MEE-B27-1	Heat engineering and basis of heat power engineering	BM(EC)	5	45	15	15	15	E
										MEE-B27-2	Fundamentals of heat supply							
6	MEE-B20-1	Theory of automatic control	BM(EC)	4	30	15		15	E	MEE-B28-1	Analysis of electrical circuits and electromagnetic field	BM(EC)	5	45	15	15	15	E
	MEE-B20-2	Automatic control systems								MEE-B28-2	The theory of nonlinear circuits and electromagnetic field							
7	MEE-B21-1	Use of renewable energy sources	BM(EC)	3	30	15		15	E	MEE-B29	Work placement internship	BM(UC)	5					GT
	MEE-B21-2	Alternative energy and energy saving technologies																
8	MEE-B22-1	Electroctechnical materials and products	BM(EC)	3	30	15		15	E									
	MEE-B22-2	Electrotechnical materials science																
Total for the 3rd semester				**30**	**270**	**105**	**30**	**135**	**7E, 1GT**	**Total for the 4th semester**			**30**	**225**	**90**	**75**	**60**	**5E, 2GT**
per week						**7**	**2**	**9**		**per week**					**6**	**5**	**4**	

3-course																		
	Code of the module	5th semester. 15 weeks		ECTS	number of acad. hours	of which			form of control	Code of the module	6th semester. 15 weeks		ECTS	number of acad. hours	of which			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE-B30-1	Computer network technologies in electrical engineering	BM(EC)	5	45	15	15	15	E	MEE-B36	Electric power supply	MM(UC)	5	45	15	15	15	E
	MEE-B30-2	Interfaces of computer systems in electrical engineering																
2	MEE-B31	Electrical machines	BM(UC)	5	45	15		30	E	MEE-B37-1	Electric drive	MM(EC)	5	45	15		30	E
										MEE-B37-2	Electromechanical energy converters							
3	MEE-B32-1	Electromechanical and electromagnetic transient processes	BM(EC)	5	45	15	15	15	E	MEE-B38-1	Electrical power stations	BM(EC)	5	45	15	15	15	E
	MEE-B32-2	Operating modes of synchronous generators								MEE-B38-2	Basic and auxiliary equipment of electrical power stations							
4	MEE-B33-1	Electrical networks and systems	BM(EC)	5	45	15	15	15	E	MEE-B39-1	High Voltage Engineering	MM(EC)	5	45	15	15	15	E
	MEE-B34-2	Transmission of electrical energy								MEE-B39-2	Insulation of electrical equipment and high voltage electrical installations							
5	MEE-B34-1	Electrical devices and measuring technology	MM(EC)	5	45	30		15	E	MEE-B40-1	Logical foundations of digital control systems	BM(EC)	5	45	15	15	15	E
	MEE-B34-2	Switching devices and measurement of electrical quantities								MEE-B40-2	Mathematical foundations of digital control systems							
6	MEE-B35-1	Fundamentals of relay protection in electric power systems	MM(EC)	5	45	15	15	15	E	MEE-B41	Work placement internship	BM(UC)	5					GT
	MEE-B35-2	Element base of relay protection																
Total for the 5th semester				**30**	**270**	**105**	**60**	**105**	**6E**	**Total for the 6th semester**			**30**	**225**	**75**	**60**	**90**	**5E +1GT**
per week						**7**	**4**	**7**		**per week**					**5**	**4**	**6**	

4-course

System power stations

	Code of the module	7th semester. 15 weeks		ECTS	number of acad. hours	of which			form of control	Code of the module	8th semester. 15 weeks (including FA)		ECTS	number of acad. hours	of which			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE - B42-1	Labor Protection	BM(EC)	5	45	15	15	15	E	MEE - B67	Module of the university component of GEM (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GEM(UC)	5	45	15	30		E
	MEE - B42-2	Industrial Safety																
2	MEE-B43	Installation and repair of electric equipment of power stations	MM(UC)	5	45	15		30	E	MEE-B68	Basics of scientific research and academic writing	BM(UC)	3	30	15	15		E
3	MEE-B44	Designing of electrical power stations	MM(UC)	5	45	15	30		E	MEE - B69-1	Fundamentals of digital technology	BM(EC)	3	30	15		15	E
										MEE - B69-2	Fundamentals of microprocessor technology							
4	MEE-B45	Electrical energy storage	MM(UC)	5	45	15	30		E	MEE-B70	Pre-graduation internship	MM(UC)	7					GT
5	MEE-B46	Operation of electrical equipment of power plants	MM(UC)	5	45	15	30		E	MEE-B71	FA (Writing and defending of graduation thesis, project or preparing and passing a comprehensive exam)		12					
6	MEE-B47	Basics of building SCADA systems in the electrical engineering	MM(UC)	5	45	15		30	E									
Total for the 7th semester				**30**	**270**	**90**	**105**	**75**	**6E**	**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**4E+1GT**
	per week					**6**	**7**	**5**		**per week**					**3**	**3**	**1**	

Electrical networks and systems

	Code of the module	7th semester. 15 weeks		ECTS	number of acad. hours	of which			form of control	Code of the module	8th semester. 15 weeks (including FA)		ECTS	number of acad. hours	of which			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE - B42-1	Labor Protection	BM(EC)	5	45	15	15	15	E	MEE - B67	Module of the university component of GEM (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GEM(UC)	5	45	15	30		E
	MEE - B42-2	Industrial Safety																
2	MEE-B48	Operation, maintenance and repair of electrical equipment of electrical networks	MM(UC)	5	45	15		30	E	MEE-B68	Basics of scientific research and academic writing	BM(UC)	3	30	15	15		E
3	MEE-B49	Design of electrical networks and systems	MM(UC)	5	45	15	30		E	MEE - B69-1	Fundamentals of digital technology	BM(EC)	3	30	15		15	E
										MEE - B69-2	Fundamentals of microprocessor technology							
4	MEE-B50	Calculations of modes in electrical networks	MM(UC)	5	45	15	30		E	MEE-B70	Pre-graduation internship	MM(UC)	7					
5	MEE-B51	Transition processes in electrical engineering	MM(UC)	5	45	15	30		E	MEE-B71	FA (Writing and defending of graduation thesis, project or preparing and passing a comprehensive exam)		12					
6	MEE-B47	Basics of building SCADA systems in the electrical engineering	MM(UC)	5	45	15		30	E									
Total for the 7th semester				**30**	**270**	**90**	**105**	**75**	**6E**	**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**4E**
per week						**6**	**7**	**5**		**per week**					**3**	**3**	**1**	

Electric power supply and energy saving of infrastructure facilities

	Code of the module	7th semester. 15 weeks		ECTS	number of acad. hours	of which			form of control	Code of the module	8th semester. 15 weeks (including FA)		ECTS	number of acad. hours	of which			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE - B42-1	Labor Protection	BM(EC)	5	45	15	15	15	E	MEE - B67	Module of the university component of GEM (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship,	GEM(UC)	5	45	15	30		E
	MEE - B42-2	Industrial Safety																
2	MEE-B52	Energy-saving technologies at industrial facilities and infrastructure	MM(UC)	5	45	15	15	15	E	MEE-B68	Basics of scientific research and academic writing	BM(UC)	3	30	15	15		E
3	MEE-B53	Lighting technology and illumination	MM(UC)	5	45	15	15	15	E	MEE - B69-1	Fundamentals of digital technology	BM(EC)	3	30	15		15	E
										MEE - B69-2	Fundamentals of microprocessor technology							
4	MEE-B54	Design of electric power supply systems	MM(UC)	5	45	15	30		E	MEE-B70	Pre-graduation internship	MM(UC)	7					
5	MEE-B55	Installation, commissioning and operation of electrical equipment	MM(UC)	5	45	15		30	E	MEE-B71	FA (Writing and defending of graduation thesis, project or preparing and passing a comprehensive exam)		12					
6	MEE-B47	Basics of building SCADA systems in the electrical engineering	MM(UC)	5	45	15		30	E									3
Total for the 7th semester				**30**	**270**	**90**	**75**	**105**	**6E**	**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**4E**
per week						**6**	**5**	**7**		**per week**					**3**	**3**	**1**	

Relay protection and emergency automatics of the EPS

	Code of the module	7th semester. 15 weeks		ECTS	number of acad. hours	of which			form of control	Code of the module	8th semester. 15 weeks (including FA)		ECTS	number of acad. hours	of which			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE- B42-1 MEE- B42-2	Labor Protection Industrial Safety	BM(EC)	5	45	15	15	15	E	MEE- B67	Module of the university component of GEM (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GEM(UC)	5	45	15	30		E
2	MEE-B56	Relay protection of electric power systems	MM(EC)	5	45	30	15		E	MEE-B68	Basics of scientific research and academic writing	BM(UC)	3	30	15	15		E
3	MEE-B57	Microprocessor relays and modern high voltage electrical network protection systems	MM(UC)	5	45	15	15	15	E	MEE- B69-1 MEE- B69-2	Fundamentals of digital technology Fundamentals of microprocessor technology	BM(EC)	3	30	15		15	E
4	MEE-B58	Design of relay protection of electrical networks	MM(UC)	5	45	15		30	E	MEE-B70	Pre-graduation internship	MM(UC)	7					
5	MEE-B55	Installation, commissioning and operation of electrical equipment	MM(UC)	5	45	15		30	E	MEE-B71	FA (Writing and defending of graduation thesis, project or preparing and passing a comprehensive exam)		12					
6	MEE-B47	Basics of building SCADA systems in the electrical engineering	MM(UC)	5	45	15		30	E									
Total for the 7th semester				**30**	**270**	**105**	**45**	**120**	**6E**	**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**4E**
per week						**7**	**3**	**8**		**per week**					**3**	**3**	**1**	

Renewable energy sources

	Code of the module	7th semester. 15 weeks		ECTS	number of acad. hours	of which			form of control	Code of the module	8th semester. 15 weeks (including FA)		ECTS	number of acad. hours	of which			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE- B42-1 MEE- B42-2	Labor Protection Industrial Safety	BM(EC)	5	45	15	15	15	E	MEE- B67	Module of the university component of GEM (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship,	GEM(UC)	5	45	15	30		E
2	MEE-B59	Theoretical foundations of electrical installations of non-traditional and renewable energy	MM(EC)	5	45	30		15	E	MEE-B68	Basics of scientific research and academic writing	BM(UC)	3	30	15	15		E
3	MEE-B60	Complex assessment of renewable energy resources	MM(UC)	5	45	30	15		E	MEE- B69-1 MEE- B69-2	Fundamentals of digital technology Fundamentals of microprocessor technology	BM(EC)	3	30	15		15	E
4	MEE-B61	Designing of small power supply systems using RES	MM(UC)	5	45	15	30		E	MEE-B70	Pre-graduation internship	MM(UC)	7					
5	MEE-B55	Installation, commissioning and operation of electrical equipment	MM(UC)	5	45	15		30	E	MEE-B71	FA (Writing and defending of graduation thesis, project or preparing and passing a comprehensive exam)		12					
6	MEE-B47	Information Security and the Basics of Building a SCADA System in the electrical engineering	MM(UC)	5	45	15		30	E									
Total for the 7th semester				**30**	**270**	**120**	**60**	**90**	**6E**	**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**4E**
per week						**8**	**4**	**6**		**per week**					**3**	**3**	**1**	

Electromechanical converters with digital control

	Code of the module	7th semester. 15 weeks		ECTS	number of acad. hours	of which			form of control	Code of the module	8th semester. 15 weeks (including FA)		ECTS	number of acad. hours	of which			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE- B42-1 MEE- B42-2	Labor Protection Industrial Safety	BM(EC)	5	45	15	15	15	E	MEE- B67	Module of the university component of GEM (Basics of ethics and anti-corruption culture, Ecology and life safety, Economics, entrepreneurship, leadership and innovation)	GEM(UC)	5	45	15	30		E
2	MEE-B62	Elements of an automated electric drive	MM(EC)	5	45	15		30	E	MEE-B68	Basics of scientific research and academic writing	BM(UC)	3	30	15	15		E
3	MEE-B63	Electric drive of industrial mechanisms	MM(UC)	5	45	15	15	15	E	MEE- B69-1 MEE- B69-2	Fundamentals of digital technology Fundamentals of microprocessor technology	BM(EC)	3	30	15		15	E
4	MEE-B64	Semiconductor converter devices in the electric drive	MM(UC)	5	45	15		30	E	MEE-B70	Pre-graduation internship	MM(UC)	7					
5	MEE-B65	Information security and digital control systems for electric drives	MM(UC)	5	45	15		30	E	MEE-B71	FA (Writing and defending of graduation thesis, project or preparing and passing a comprehensive exam)		12					
6	MEE-B66	Diagnostics, operation and commissioning of a modern electric drive	MM(UC)	5	45	15		30	E									
Total for the 7th semester				**30**	**270**	**90**	**30**	**150**	**6E**	**Total for the 8th semester**			**30**	**105**	**45**	**45**	**15**	**4E**
per week						**6**	**2**	**10**		**per week**					**3**	**3**	**1**	
	TOTAL CREDITS		**240**		**675**	**705**	**525**											

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master's degree programme Automation and Control:

"LO-1. Demonstrate knowledge of the main stages of the scientific research process. Analyze scientific and technical information, set research objectives, conduct experiments and tests of automation systems, design and present the results of research, critically summarize information.

Demonstrate the ability to organize communication and interaction between project stakeholders, teamwork; make decisions based on assessment of external environmental factors and organizational process assets; ability to manage simple projects independently and participate effectively in a complex project management team.

LO-2. Demonstrate skills and abilities in organizing and planning research work. Master basic methods of data mining, descriptive analysis, correlation, and regression analysis, etc. Use the capabilities of modern computers and information technology in computer modeling of optimal observation and evaluation processes.

LO-3. Use modern methods of automatic control theory to synthesize systems with variable structure, modal control, identification, adaptation, etc. Demonstrate knowledge of current trends in the development of science and technology in the field of control systems with parametric uncertainty. Formulate diagnostic solutions to problems of adaptive control of technological facilities in various industries. Perform calculations competently for automatic control systems.

LO-4. Use knowledge of modern technologies of data transfer between elements of APCS in the design of automation systems. Have the skills to create MES-systems that provide interaction of subsystems to receive and transfer process and control data. Form diagnostic decisions when selecting software units from a library of functions of an industrial controller for specific regulation and control tasks. Demonstrate skills in programming controllers for complex control and regulation tasks and selecting technical means of transferring information when designing a process control system.

LO-5. Use knowledge of GSI, GSS, USPD, ESCD and other regulatory documents when solving technical issues of production. Demonstrate ability to competently perform measurements, verification, and calibration of measuring instruments, calculate errors and uncertainty of measurement results. To possess methods of diagnostics and analysis of reliability of automation systems, taking into account the characteristics of their qualitative and quantitative indicators. Demonstrate skills in developing models for automation systems and designing automation systems using CAD packages.

LO-6. Use the principles of creating control systems and the principles of SCADA-based dispatch centers design when developing hardware and software for complex automation and

control systems based on SPLC. To master the skills of building microprocessor-based control systems (MCS).

LO-7. Demonstrate knowledge of the digital control systems features. To be able to synthesize digital controllers in the automation of production processes. Form solutions for the selection and operation of digital and software and hardware automation, solutions for the design of automation equipment with given characteristics of typical digital elements for the digital technology integration into automation and control systems. Be able to design and create on the basis of microcontrollers and modern SCADA systems of dispatching automation tasks.

LO-8. Demonstrate knowledge of modern mathematical methods of construction and application of neural network systems of automatic control; create control systems based on the theory of artificial intelligence. Master the skills of program and stabilizing optimum control and synthesis of adaptive control systems.

LO-9. Demonstrate knowledge of modern theoretical foundations of construction, analysis and synthesis of technical systems; design techniques of optimal controllers. Master the skills of calculating parameters of control systems, procedures for analytical design of regulators. Formulate solutions for the design of control means and systems with selected quality criteria; develop CAD of various technological objects.

LO-10. Demonstrate the ability for active social mobility, to change the scientific or production profile of their professional activity in the process of changing social-cultural and social conditions of activity. Form problem-solving situations based on communication skills, cognitive and practical abilities. Demonstrate knowledge of the life cycle of project activities, basics of personnel management, production, management, management psychology.

Demonstrate successful conduct of professional activities related to searching, processing, and communicating information in a foreign language. Demonstrate readiness for pedagogical activities in the field of professional training."

The following curriculum is presented:

1-year of study

№	Module code	1-semester, 15 weeks	Cycle	ECTS	class hours	including			form of control	№	Module code	2-semester, 15 weeks	Cycle	ECTS	class hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MAC-M01	History and Philosophy of Science	BM(UC)	3	30	15	15	0	E	1	MAC-M09	Theory and Practice of Project Management	MM(UC)	5	45	30	0	15	E
2	MAC-M02	Foreign Language (professional)	BM(UC)	5	45	0	45	0	E	2	MAC-M10/01	Methods and Models of CAD of Automation Systems in HPE	BM(EC)	5	45	15	0	30	E
3	MAC-M03	Higher School Pedagogy	BM(UC)	5	45	15	30	0	E		MAC-M10/02	Methods and Models of CAD of Automation Systems in EE							
4	MAC-M04	Psychology of Management	BM(UC)	3	30	15	15	0	E	3	MAC-M11/01	Industrial Networks of Distributed Automation Systems	MM(EC)	5	45	15	0	30	E
5	MAC-M05/01	Methods for the Expression of Uncertainty in Measurement	BM(EC)	5	45	15	15	15	E		MAC-M11/02	Industrial Network Technologies							
	MAC-M05/02	Fundamentals of Measurement Uniformity and Technical Regulation								4	MAC-M12/01	Integration of Digital Technology into Automation Control Systems	MM(EC)	5	45	15	0	30	E
6	MAC-M06/01	Theory and Technique of Engineering Experiment	BM(EC)	5	45	15	15	15	E		MAC-M12/02	Dispatch Systems of Automation Tasks							
	MAC-M06/02	Experiment Planning								5	MAC-M13/01	Intelligent Control Systems	MM(EC)	5	45	15	0	30	E
7	MAC-M07/01	Control Systems for Technological Complexes	MM(EC)	3	30	15	0	15	E		MAC-M13/02	Neural Network Technologies							
	MAC-M07/02	Automation of Technical Systems								6	MAC-M08/02	Master's Student Research Work (MSRW), including the completion of a master's thesis		1	30	0	30	0	GT
8	MAC-M08/01	Master's Student Research Work (MSRW), including the completion of a master's thesis		1	30	0	30	0	GT	7	MAC-M14/01	Research practice	MM(UC)	4	120	0	60	60	GT
	Total for 1 semester			30	300	90	165	45	7E, 1GT		Total for 2 semester			30	375	90	90	195	5E, 2GT
	Total for a week				20	6	11	3			Total for a week				25	6	6	13	

2-year of study

№	Module code	1-semester, 15 weeks	Cycle	ECTS	class hours	including			form of control	№	Module code	2-semester, 15 weeks	Cycle	ECTS	class hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MAC-M15	Methods of Modern Theory of Automatic Control	MM(UC)	5	45	15	15	15	E	1	MAC-M08/04	Master's Student Research Work (MSRW), including the completion of a master's thesis		11	330	0	165	165	GT
2	MAC-M16/01	Software for Microprocessor Controllers in Automation Tasks	MM(EC)	5	45	15	15	15	E	2	MAC-M14/02	Research Practice	MM(UC)	7	210	0	0	210	GT
	MAC-M16/02	Libraries of Software Systems for Industrial Controllers								3	MAC-M19	Defense of Master's Thesis	FA	12	360	0	180	180	
3	MAC-M17/01	Synthesis of Optimal Control Systems	MM(EC)	5	45	15	0	30	E										
	MAC-M17/02	Adaptive Identification Technologies																	
4	MAC-M08/03	Master's Student Research Work (MSRW), including the completion of a master's thesis		11	330	0	165	165	GT										
5	MAC-M18	Pedagogical Practice	BM(UC)	4	120	0	120	0	GT										
	Total for the 3rd semester			30	585	45	315	225	3E, 2GT		Total for the 4th semester			30	900	0	345	555	2 GT
	Total for a week				39	3	21	15			Total for a week				60	0	23	37	
Total credits and class hours				120	2160	225	915	1020	15E, 7GT										

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master's degree programme Radio Engineering, Electronics and Telecommunications:

"LO-1 Demonstrate conceptual knowledge in science and professional fields. Create new applied knowledge in a professional area.

LO-2 Demonstrate self-determination of professional activity goals and select adequate methods and means of achieving them. Carry out scientific, innovative activities to acquire new knowledge.

LO-3 Demonstrate improvement and development of own intellectual and cultural level and skills to independently learn new research methods, to change scientific and scientific-production profile of own professional activity

LO-4 Demonstrate knowledge of the life cycle of project activities, rules of software product development, basic business processes of the company, basics of personnel management, production, management, management psychology, information security issues.

LO-5 Demonstrate skills to participate in the creation of projects work for the development of info-communication infrastructure and its individual elements.

LO-6 Demonstrate the ability to organize the examination of design documentation for the construction and building of communication and information infrastructure in accordance with current legislation.

LO-7 Take into account international experience in the matters of technical regulation, metrological assurance and life safety in the development and operation of telecommunication networks and systems.

LO-8 Develop plans and programmes to organise innovation activities at the enterprise, conduct feasibility studies of innovation projects.

LO-9 Use state-of-the-art science and advanced info-communication technologies, methods of theoretical and experimental studies in research work in engineering and technology.

LO-10 Demonstrate research results in the form of reports, abstracts, publications, and public discussions; interpret and present research results, including in a foreign language.

LO-11 Demonstrate the ability to conduct group (seminar and laboratory) classes at a higher education institution, college on special disciplines based on modern pedagogical methods and techniques."

The following curriculum is presented:

1-year of study																			
№	Module code	1-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	№	Module code	2-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MRET-M1	History and philosophy of science	BM(UC)	3	30	15	15	0	E	1	MRET-M9	Scientific and technical problems of radio engineering, electronics and telecommunications	MM(UC)	5	45	15	0	30	E
2	MRET-M2	Foreign language (professional)	BM(UC)	5	45	0	45	0	E	2	MRET-M10	Theory and practice of project management	MM(UC)	5	45	30	15		E
3	MRET-M3	Higher school pedagogy	BM(UC)	5	45	15	30	0	E	3	MRET-M11-1	Algorithms and architectures for digital computing	BM(EC)	5	45	30	15	0	E
4	MRET-M4	Psychology of management	BM(UC)	3	30	15	15	0	E		MRET-M11-2	Machine learning theory							
5	MRET-M5-1	Modern measurement methods in telecommunications	MM(EC)	5	45	15	0	30	E	4	MRET-M12-1	Technologies of digital signal processing in telecommunication systems	BM(EC)	5	45	15	15	15	E
	MRET-M5-2	Modern measurement methods in radio electronics									MRET-M12-2	Technologies of digital signal processing in radio electronic systems							
6	MRET-M6-1	Mathematical processing of measurement results in telecommunication systems	BM(EC)	5	45	15	0	30	E	5	MRET-M13-1	Internet of Things networks and services, M2M	MM(EC)	5	45	15	0	30	E
	MRET-M6-2	Mathematical processing of measurement results in radio electronic systems									MRET-M13-2	IoT with Big Data processing							
7	MRET-M7-1	Theory and practice of innovation in telecommunications	MM(EC)	3	30	30	0	0	E	6	MRET-M14	Research practice	MM(UC)	4	120	0	60	60	GT
	MRET-M7-2	Theory and practice of innovative activity in radio engineering																	
8	MRET-M8	Research work of a master student, including the implementation of a master's thesis		1	30	0	30	0	GT	7	MRET-M15	Research work of a master student, including the implementation of a master's thesis		1	30	0	30	0	GT
	Total for 1 semester			30	300	105	135	60	7E, 1GT		Total for 2 semester			30	375	105	135	135	5E, 2GT
	Total for a week				20	7	9	4			Total for a week				25	7	9	9	

2-year of study																			
№	Module code	1-semester, 15 weeks	Cycle	ECTS	class hours	including			form of control	№	Module code	2-semester, 15 weeks	Cycle	ECTS	class hours	including			form of control
						lec	prac	lab								lec	prac	lab	
1	MRET-M16-1	Research of transport communication networks technologies	MM(EC)	5	45	15	0	30	E	1	MRET-M21	Research practice	MM(UC)	7	210	0	0	210	GT
	MRET-M16-2	Research of modern transport communication networks								2	MRET-M22	Research work of a master student, including the implementation of a master's thesis		11	330	0	165	165	GT
2	MRET-M17-1	Intelligent networks	MM(EC)	5	45	15	15	15	E	3	MRET-M23	Defense of Master's Thesis	FA	12	360	0	180	180	
	MRET-M17-2	Sensor networks																	
3	MRET-M18-1	Convergence of telecommunications services	MM(EC)	5	45	30	15	0	E										
	MRET-M18-2	Modern mobile communication systems																	
4	MRET-M19	Pedagogical practice	BM(UC)	4	120	0	120	0	GT										
5	MRET-M20	Research work of a master student, including the implementation of a master's thesis		11	330	0	165	165	GT										
	Total for the 3rd semester			30	585	60	315	210	3E, 2GT		Total for the 4th semester			30	900	0	345	555	2 GT
	Total for a week				39	4	21	14			Total for a week				60	0	23	37	
Total credits and class hours				120	2160	270	930	960	15E, 7GT										

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master's degree programme Electrical Engineering:

LO 1	Demonstrate the ability to improve and develop his/her intellectual level based on knowledge of philosophy of science, pedagogy of higher education, foreign languages, and management psychology. Independently acquire new knowledge and skills and expand his/her scientific outlook.
LO 2	Analyze scientific and technical problems of electric power industry, scientific information in international networks, model technological processes and organize and conduct scientific experiments, process, and formalize the research results.
LO 3	Demonstrate theoretical and practical knowledge in the field of modern diagnostics and tests of power equipment, improvement of reliability and quality of electricity, as well as in the issues of electromagnetic compatibility in the electrical engineering.
LO 4	Use modern computer and information technologies, digital techniques and software in solving scientific and technical problems of electrical engineering. Have skills of modelling elements of electric power systems and work with Rastr Win, PS CAD and MatLab computer programs.
LO 5	Master the skills of project management for the implementation of means and methods to ensure the stability of electric power systems, modernization of electrical equipment of system and autonomous use, their automatic control and efficient operation.

LO 6	Develop measures for energy and resource saving and the introduction of renewable energy sources in autonomous and system modes. To adapt new energy-saving technologies at the existing power facilities and enterprises of other sectors of economy.
LO 7	Possess knowledge of joint digital automatic control systems in electric power systems and electric drive, programming skills, diagnostics and adjustment of frequency-controlled electric drive, the ability to conduct research on modern electric drive in MATLAB Simulink software package.
LO 8	Demonstrate knowledge of calculation modes of electrical networks operation and ways and means to reduce losses in power systems. Have an idea of the impact of wave processes and overvoltage on electrical equipment and the basics of the emergency automatics development.
LO 9	Have knowledge of scientific management of energy enterprises, the ability to conduct technical and economic analysis of the effectiveness of design solutions, the skills of working with automatic design system and the use of applications in scientific and engineering design calculations.
LO 10	Demonstrate readiness for pedagogical activities and have the skills to conduct classroom instruction, design and write master's theses and research projects.

The following curriculum is presented:

1-year of study																			
	Module code	1-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	Module code	2-semester, 15 weeks	Cycle	ECTS	academ. Hours	including			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE -M01	Foreign language (professional)	BM(EC)	5	45		45		Ex.	MEE-M09	Theory and practice of project management.	MM(UC)	5	45	30	15		Ex.
2	MEE -M02	History of philosophy and science	BM(EC)	3	30	15	15		Ex.	MEE-M10	Research work of a master student, including the implementation of a master's thesis		1	30				Report
3	MEE -M03	Higher School Pedagogy	BM(EC)	5	45	30	15		Ex.	MEE-M11	Research practice	MM(UC)	4	120				Report
4	MEE -M04	Psychology of Management	BM(EC)	3	30	15	15		Ex.	MEE-M12-1	Diagnostics and preventive tests of electrical equipment	BM(EC)	5	45	15	30		Ex.
										MEE-M12-2	Modern methods for assessing the state of electrical equipment insulation							
5	MEE -M05	Research work of a master student, including the implementation of a master's thesis		1	30				Report	MEE-M13-1	Complexes of electric power systems using renewable energy sources with cyclical changes in wind potential	MM(EC)	5	45	30	15		Ex.
										MEE-M13-2	Modern electric drive of oil pumping and compressor stations of oil and gas pipelines		5	45	15	15	15	
										MEE-M13-3	Wave processes and overvoltage in electrical networks.		5	45	15	30		
										MEE-M13-4	Relay protection of distribution networks and overvoltage limitation		7	60	30	15	15	
6	MEE -M06	Scientific and technical problems of electric power industry	MM(UC)	3	30	30			Ex.	MEE-M14-1	Dynamic characteristics of air currents and wind as an energy carrier for system and autonomous energy	MM(EC)	5	45	15		30	Ex.
										MEE-M14-2	Methods of modeling of components of electro technical complexes and systems		5	45	15	15	15	
										MEE-M14-3	Special modes of long-distance power transmission		5	45	15	15	15	
										MEE-M14-4	Anti-emergency operational and automatic control of electric power systems		3	30	15	15		
7	MEE-M7-1	Theory of modeling and scientific experiment	MM(EC)	5	45	15	15	15	Ex.	MEE-M15-1	Power electrical equipment for autonomous and system use installations	MM(EC)	5	45	30	15		Ex.
										MEE-M15-2	Frequency-controlled electric drives in the automatic control system		5	45	15	15	15	
	MEE-M7-2	Fundamentals of modeling and data processing of scientific and engineering experiments.								MEE-M15-3	Tools and methods for ensuring the stability of electrical systems		5	45	30	15		
										MEE-M15-4	Modern problems of power supply of cities and industrial enterprises		5	45	30	15		
8	MEE-M8-1	Solar power and geothermal power	MM(EC)	5	45	30	15		Ex.									
	MEE-M8-2	Energy saving by means of an automated electric drive			45	15		30										
	MEE-M8-3	Main problems of operation of electric networks and systems.			45	30	15											
	MEE-M8-4	Computer-aided design of low and medium voltage electrical networks.			45	15	30											
Total for 1 semester (NCRES)				30	300	135	120	15	7 Ex., 1 Report	Total for 2 semester (NCRES)			30	375	120	75	30	5 Ex., 2 Report
Total for 1 semester (EDAIP)						120	105	45		Total for 2 semester (EDAIP)					90	90	45	
Total for 1 semester (EGS)						135	120	15		Total for 1 semester (EGS)					105	105	15	
Total for 1 semester (PSRP)						120	135	15		Total for 1 semester (PSRP)					120	90	15	
During the week						9	8	1		During the week					8	5	2	

2-year of study																		
	Code module	3-semester, 15 weeks	Cycle	ECTS	academ. hours	including			form of control	Code module	4-semester, 15 weeks	Cycle	ECTS	number of acad. hours	including			form of control
						lec	prac	lab							lec	prac	lab	
1	MEE-M16	Pedagogical practice	BM(UC)	4	120				Report	MEE-M22	Research practice	PD(CS)	7	210				Report
2	MEE-M17	Research work of a master student, including the implementation of a master's thesis		11	330				Report	MEE-M23	Research work of a master student, including the implementation of a master's thesis		11	330				Report
3	MEE-M18-1	Electricity quality and energy saving in the power industry	BM(EC)	4	30	15	15		Ex.	MEE-M24	Registration and defence of the master's project		12	360				DMP
	MEE-M18-2	General quality management: a general approach, and specific application in the field of energy.																
4	MEE-M19-1	Electromagnetic compatibility in the electric power industry	BM(EC)	3	30	15	15		Ex.									
	MEE-M19-2	Influence of strong external electromagnetic fields on the operation modes of secondary circuits of substations.																
6	MEE-M20-1	Methods of analysis and evaluation of reliability in the electric power industry.	BM(EC)	3	30	15		15	Ex.									
	MEE-M20-2	Optimization and reliability in the power industry																
7	MEE-M21-1	Synthesis and automatic control of hybrid electric power systems	MM(EC)	5	45	30	15		Ex.									
	MEE-M21-2	Non linear and digital ACS		5	45	15	15	15										
	MEE-M21-3	Scientific basis for the management of interconnected power systems		5	45	30	15											
	MEE-M21-4	Energy saving in industry		5	45	30	15											
Total for 3 semester (NCRES)				30	585	75	45	15	4 Ex., 2 Report	Total for 4 semester			30	900	0	0	0	2 Report, 1 DMP
Total for 3 semester (EDAIP)						60	45	30										
Total for 3 semester (EGS)						75	45	15										
Total for 3 semester (PSRP)						75	45	15										
During the week						5	3	1		During the week					0	0	0	
										Total for the course (NCRES)			120	2160	330	240	60	16 Ex., 7 Report, 1 DMP
										Total for the course (EDAIP)					270	240	120	
										Total for the course (EGS)					315	270	45	
										Total for the course (PSRP)					315	270	45	