ASIIN Seal & EUR-ACE® Label

Accreditation Report

Bachelor's Degree Programmes
Electrical Power Engineering (Power Supply)
Metallurgy

Master's Degree Programmes
Power Supply (Industrial Enterprises and Cities)
Metallurgy

Provided by
Tashkent State Technical University

Version: 8 December 2023

Table of Content

A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Elektr energetikasi (elektr ta'minoti)	Electrical Power Engineering (Power Supply)	ASIIN, EUR-ACE® Label	/	02
Elektr ta'minoti (sanoat korxonalari va shaharlar)	Power Supply (Industrial Enterprises and Cities)	ASIIN, EUR-ACE® Label	/	02
Metallurgiya	Metallurgy	ASIIN, EUR-ACE® Label	/	
Metallurgiya (rangli metallar)	Metallurgy (non-ferrous metals)	ASIIN, EUR-ACE® Label	/	
Date of the contract: 02.06.2023 **Submission of the final version of the self-assessment report:** 13.09.2023 **Date of the onsite visit:** 04-06.10.2023 **at:** Tashkent State Technical University				
Prof. Dr. Anne Schulz-Beenken, South Westphalia University of Applied Sciences Prof. Dr. Peter Nauth, Frankfurt University of Applied Sciences Dr.-Ing. Nassipkul Dyussembekova, FH Westküste University of Applied Sciences Shukurjonov Kuhinur Doniyor ugli, Chief specialist at the Ministry of mining industry and geology of the Republic of Uzbekistan Davronbek Rasulov, student at Tashkent Institute of Irrigation and Agricultural Mechanization Engineers				

[1] ASIIN Seal for degree programmes; EUR-ACE® Label: European Label for Engineering Programmes

[2] TC: Technical Committee for the following subject areas: TC 02 - Electrical Engineering/Information Technology; TC 05 - Materials Science, Physical Technologies.

Representative of the ASIIN headquarter: Paulina Petracenko	
Responsible decision-making committee: Accreditation Commission for Degree Programmes	
Criteria used: European Standards and Guidelines as of May 15, 2015 ASIIN General Criteria, as of December 07, 2021 Subject-Specific Criteria Technical Committee 02 – Electrical Engineering/Information Technology as of September 23, 2022 Subject-Specific Criteria of the Technical Committee 05 – Materials Science, Physical Technologies as of March 18, 2022	

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Electrical Power Engineering (Power Supply)	Elektroenergetika (elektr ta'minoti) bakalavri / Bachelor in Electrical Power Engineering (Power Supply)		6	Full time	/	8 Semesters	240 ECTS	1971
Power Supply (Industrial Enterprises and Cities)	Elektr ta'minoti (sanoat korxonalari va shaharlar) magistri / Master in Power Supply (Industrial Enterprises and Cities)		7	Full time	/	4 Semesters	120 ECTS	1998
Metallurgy	Metallurgiya bakalavri /Bachelor in metallurgy		6	Full time	/	8 Semesters	240 ECTS	1995
Metallurgy (non-ferrous metals)	Metallurgiya (rangli metallar) magistri / Master in Metallurgy (non-ferrous metals)		7	Full time	/	4 Semesters	120 ECTS	1999

Tashkent State Technical University (TSTU) is one of the oldest universities in Uzbekistan. It has existed in its current form since 1991, following the merger of the Tashkent Polytechnic Institute and the Tashkent Institute of Mechanical Engineering. However, the history of TSTU dates back to 1918.

The university consists of eight faculties and has over 10 000 students. The Department of Energy Supply Engineering was founded in 1971. Due to the diverse research activities of the faculty members of the Department of Energy Supply Engineering, the department has received internal awards for its achievements. In addition, several faculty members received the national award for their outstanding teaching. The Department of Metallurgy was founded in 1963. TSTU notes that today the Department of Metallurgy is one of the leading departments for training metallurgists in Uzbekistan.

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

For the Bachelor's degree programme Electrical power engineering (electrical supply) the institution has presented the following profile on their website:

"The intention of the programme is to train students so that they become qualified specialists in the field of the electric power industry. They should possess knowledge and competencies in demand for work at enterprises and organisations of the power industry related to production, transmission, and consumption of electric power, as well as in design and research organisations of technical profile.

Graduates should have acquired the following competences:

- acquiring skills in searching and analysing normative legal acts and their use in professional activities;
- to possess skills in the automated development of the project of details and parts and assembly units of electric power plants based on the system approach;
- to be able to develop and investigate mathematical, information and simulation models on the subject of performed experimental design and practical works;
- to acquire skills in the development of design and program documentation;
- to develop skills of execution, normalisation and mastering of processes of the power supply system;
- to be able to control the observance of technological discipline in the design of the power supply of consumers;
- to know the development and implementation of measures for the rational use of energy resources in the power supply system;
- to acquire skills in studying special literature, scientific and technical information in the field of electric power engineering, achievements in the field of science and technology achieved abroad and in our republic;
- to know the rules and technology of assembly, adjustment, testing and commissioning of electric power systems and equipment;
- to possess the skills of inspection of power plant equipment, technical condition of structures and equipment and assessment of residual resources.

For the Master's degree programme Power Supply (Industrial Enterprises and Cities) the institution has presented the following profile on their website:

“The goal of the study programme is to train students so that they become highly qualified specialists for scientific and pedagogical activity in all educational institutions, in the Academy of Sciences of the Republic of Uzbekistan and sectorial research institutes, and in educational institutions for retraining and advanced training. Furthermore, graduates should be able to work in technological and design scientific and production institutions, as well as production enterprises engaged in the design, manufacture, assembly, adjustment and operation of power supply systems.

Graduates should have acquired the following competences:

- to acquire skills in carrying out scientific, applied research, processing results of experiments and making on their basis scientifically grounded conclusions, preparing and editing scientific articles, organisation, carrying out scientific seminars, conferences and symposiums, developing scientific projects;

- to know the use of information and pedagogical technologies in pedagogical activity;

- to know the innovative approach to improving the quality and efficiency of education;

- to have skills in project preparation for participation in projects published in the republic and abroad on the results of scientific activity;

- to have skills in project preparation for participation in projects announced by republican, non-governmental and non-commercial organisations;

- to have skills in organisation and management of production;

- to possess skills in carrying out tests on a determination of working parameters of devices of power supply systems of industrial enterprises and cities;

- to acquire skills in performing, normalising and mastering the processes of the power supply system of industrial enterprises and cities;

- to be able to control observance of technological discipline at designing of electric power supply of industrial enterprises and cities;

- to know modern methods of designing power supply, power supply of industrial enterprises and cities;

- to be able to develop and implement measures for rational use of energy resources in the system of power supply of industrial enterprises and cities;

- to possess skills in planning resources necessary for the maintenance of continuity of consumers in the system of power supply of industrial enterprises and cities;

- to have skills in the inspection of power plant equipment, technical condition of structures and equipment and assessment of residual resources of the power supply system of industrial enterprises and cities."

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

"The programme is designed to train students so that they become highly qualified specialists in metallurgy with the knowledge to work at enterprises and organizations in the metallurgical industry in production processes for processing raw materials and creating products based on technological regulations.

Graduates should have acquired the following competences:

- acquisition of skills of search, analysis of normative legal acts and their use in professional activity;
- to acquire skills in automated development based on the system approach in the design of metallurgical plants;
- to be able to develop and study mathematical, information and simulation models on the subject of experimental construction and practical work;
- to have skills in the development of design and programme documentation;
- to be able to master international and professional standards of information technologies, modern paradigms and methodologies, instrumental and computer means in practice, according to the speciality of training;
- acquisition of skills in execution, organisation and mastering of metallurgical processes;
- to be able to control compliance with technological discipline in the design of metallurgical processes for customers;
- to have the skills to observe the code of professional ethics;
- to be able to develop and implement measures for rational utilisation of metallurgical raw materials and resources;
- to acquire skills of resource planning necessary to ensure continuity of work with customers in metallurgy."

For the Master's degree programme Metallurgy (non-ferrous metals) the institution has presented the following profile on their website:

“The goal of the study programme is to train students so that they become highly qualified specialists for scientific and pedagogical activities in all educational institutions of the Academy of Sciences of the Republic of Uzbekistan and sectorial research institutes, for retraining and advanced training institutions, and for technological companies.

Graduates should have acquired the following competences:

- acquire skills in conducting scientific and applied research, processing the results of experiments and making scientifically substantiated conclusions on their basis, preparing and editing scientific articles, organizing, and conducting scientific seminars, conferences, and symposia, developing scientific projects;
- to be able to use information-pedagogical technologies in pedagogical activity;
- to know the innovative approach to improving the quality and efficiency of education;
- to have skills in project preparation for participation in projects published in the republic and abroad on the results of scientific activity;
- to have the qualification of project preparation for participation in projects announced by republican, non-governmental and non-commercial organizations;
- to have skills in production organization and management;
- to acquire skills in carrying out tests on the determination of working parameters of devices of the metallurgical enterprise;
- to acquire skills in performing, organizing and mastering metallurgical processes at metallurgical enterprises;
- to know how to control compliance with technological discipline when designing metallurgical processes at a metallurgical plant;
- to know the rules and technology of installation, adjustment, testing and commissioning of equipment at metallurgical plants;
- to acquire skills in checking the technical condition of metallurgical equipment, structures and assessment of residual resources at metallurgical plants.”

C Expert Report for the ASIIN Seal[4]

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
- Diploma Supplements
- Websites of all study programmes
- Discussion during the audit
- Objective-module-matrix per programme

Preliminary assessment and analysis of the experts:
The experts base their assessment of the learning outcomes on the information provided on the websites, the Diploma Supplements, the objective-module-matrices and in the Self-Assessment Report of the four degree programmes under review.

A detailed description of the programme learning outcomes of all four degree programmes under review can be found at the end of the report.

The experts refer to the Subject-Specific Criteria (SSC) of the Technical Committee Electrical Engineering and Information Technology and the Technical Committee Materials Science, Physical Technologies as a basis for judging whether the intended learning outcomes of the four programmes correspond with the competences as outlined by the SSCs.

After reviewing the documents and carrying out the audit discussions, the auditors confirm that the programme learning outcomes are made transparent to all relevant stakeholders and are described in a clear and concise manner.

[4] This part of the report applies also for the assessment for the European subject-specific labels. After the conclusion of the procedure, the stated requirements and/or recommendations and the deadlines are equally valid for the ASIIN seal as well as for the sought subject-specific label.

With regard to the two Bachelor's programmes, the experts note that the aim of the Bachelor's programmes is to produce graduates who are qualified to work in (local) industry. Thus, the training of students is mainly focused on the standard subjects of two the disciplines. The main aim of the two Master's programmes is to train students for academic careers, but also to produce graduates who are able to take up advanced positions in industry. The experts value the close links that exists between the university and the industry. On the other hand, they see room for improvement in the link with international research and therefore suggest that the programmes should take more account of the latest trends and results in research. This is discussed in more detail in chapter 1.3.

Overall, however, the experts consider that the level in all four programmes is absolutely adequate. They agree that the level of the objectives and intended learning outcomes of the programmes adequately reflects the intended level of the academic qualification (EQF 6 for the Bachelor's programmes and EQF 7 for the Master's programmes). The programmes also sufficiently meet the ASIIN Subject Specific Criteria (SSC) of the Technical Committee on Electrical Engineering and Information Technology and the Technical Committee on Materials Science, Physical Technologies. These state that the content of the metallurgy programmes can be classified as a precursor to the related technologies of materials engineering. All in all, the learning outcomes of the metallurgy programmes show that TSTU offers an interdisciplinary education with a high proportion of chemistry and process knowledge as well as materials engineering.

The auditors also confirm that study programmes are designed in such a way that they meet the goals set for them. In order to verify that the intended learning outcomes of the four degree programmes are covered by the respective curriculum, TSTU has submitted a matrix for each degree programme that shows, in which course which learning outcomes are targeted. The peers can deduce the correlation of the programmes' competence profile with the SSC and see how each course contributes to achieving the intended learning outcomes from the provided Matrix for each programme.

The experts are convinced that the intended qualification profiles of the four programmes under review allow graduates to take up an occupation, which corresponds to their qualification. From the discussion with the employers, who are very satisfied with the qualification profile of the graduates, the experts gain the impression that they are well prepared for entering the labour market and find adequate jobs in Uzbekistan.

Since TSTU also applied for the EUR-ACE® label, the experts check whether the learning outcomes are aligned with the EUR-ACE® Framework Standards and Guidelines (EAFSG) for engineering programmes. 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. The documents illustrate that the degree programmes under review cover all the required competence areas and the peers perceive during the audit discussions with teachers and students that the mentioned competences are conveyed

in the respective courses. They conclude that the intended learning outcomes of all programmes are aligned with the EUR-ACE® Framework Standards and Guidelines (EAFSG).

The experts confirm that the objectives and learning outcomes are regularly analysed and further developed. Students, alumni and industry partners are regularly consulted in this context and contribute to the development process.

In conclusion, the experts believe that the learning outcomes of the four degree programmes adequately reflect the intended level of academic qualification and correspond with the ASIIN Subject-Specific-Criteria (SSC) of the respective technical committees and the EUR-ACE® Framework Standards and Guidelines (EAFSG).

Criterion 1.2 Name of the Degree Programme

Evidence:

- Self-Assessment Report
- Diploma Supplements

Preliminary assessment and analysis of the peers:
The experts confirm that the names of the Bachelor's and Master's degree programmes correspond with the intended aims and learning outcomes as well as the content of the respective degree programme. The titles (both in English and Uzbek) are used consistently in all relevant documents.

Criterion 1.3 Curriculum

Evidence:

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

Preliminary assessment and analysis of the experts:
Content

The two Bachelor's programmes have a duration of four years (8 semesters). The two Master's programmes have a duration of 2 years (4 semesters).

The two Bachelor's programmes follow the same structure: About 60% of each programme consists of theoretical and practical/lab training. Almost 10% are dedicated to internships that is for the duration of altogether 19 weeks students carry out internships at enterprises of their choice. The remaining 30% consist of the final state exam & preparation and holidays. The first year of the two Bachelor's degree programmes is devoted to the study of general education (Uzbek/Russian language, contemporary history of Uzbekistan, mathematics, physics, etc.) and basic courses in electrical engineering and information technology or metallurgy. In the higher levels of the

Bachelor's degree programmes, students deepen their knowledge in their specialised fields. In the Bachelor's programme Electrical Power Engineering, these are electrical safety and reliability, electrical grids and systems, energy supply, energy management and much more. The Metallurgy degree programme covers, among other things, the theory of hydrometallurgical processes, heat and mass transfer in metallurgical processes and steel production technology. Both Bachelor's degree programmes conclude with a state degree. Yet, as explained in more detail in chapter 2, the degree programmes must be completed with a thesis or project.

What strikes the experts is the large number of subjects and credits allocated to non-technical subjects. These include Uzbek/Russian, Foreign Language/English, Contemporary History of Uzbekistan, Physical Education and Sports, Philosophy, General Pedagogy and Safety in Life Activities/Civil Defence. A total of 32 ECTS out of 240 ECTS are allocated to these non-technical subjects in both Bachelor's programmes. In addition, there are 26 ECTS for the subjects of physics, chemistry and higher mathematics. Thus, 58 ECTS, i.e. about a quarter of the curricula, are allocated to general education. When asked about the reasons for the high proportion of non-technical subjects, the university management explained that these were requirements of the Ministry of Education. During the audit, representatives of the rectorate add that it is part of their mission to contribute not only to the technical but also to the personal development of students. For this reason, they consider these non-technical subjects to be very important in the study programmes. The experts understand and accept the arguments of the university management and welcome the fact that the TSTU also cares about the development of the students as individuals.

However, they emphasise that the technical and professional education should not be neglected for this purpose. In the light of some missing or under-represented elements, they therefore recommend reducing the overall number of non-technical courses. This will allow for the inclusion of new and more relevant subjects, as outlined below.

Overall, the experts gain the impression that the curricula of the two Bachelor’s programmes provide students with a solid education, especially in the fundamental and core subjects of the respective discipline. As already mentioned in chapter 1.3, the Bachelor’s degree in Metallurgy is characterised by its remarkable focus on basic education in the natural sciences, especially chemistry, which forms the basis for many other subjects. In the case of the Bachelor’s programme in Electrical Power Engineering, the experts are particularly impressed by the laboratory equipment and the creative laboratory exercises carried out by the students. As explained in more detail in chapter 3.3, the variety of laboratories and equipment used in the courses enables students to receive a practice-oriented education: By testing and applying their theoretical knowledge directly on the equipment, students can consolidate and deepen their knowledge. Overall, the experts agree that the curricula of the Bachelor’s programmes are of high quality and meet the ASIIN Subject Specific Criteria (SSC) of the Technical Committee Electrical Engineering and Information Technology and the Technical Committee Materials Science, Physical Technologies. The programmes also comply with the EUR-ACE® Framework Standards and Guidelines.

However, the evaluators also see potential for improvement in both Bachelor's programmes. In the Bachelor's programme in Electrical Power Engineering, the evaluators miss the teaching of various programming languages and microcontrollers. In the audit, the experts enquire why these two elements are not covered in the degree programme. The programme coordinators explain that their focus is on industrial electronics and that they teach simple programming skills, e.g. with Matlab. However, in the context of digitalisation as well as design and operation of electrical systems, the experts consider it important that students also learn advanced programming languages and microcontrollers. Therefore, the experts urge the study programme coordinators to include the teaching of programming languages such as C++ and Python as well as microcontrollers in the study programme. The experts also suggest adding new subjects such as energy management and audit of enterprise. The degree programmes also use the DigSilent PowerFactory program for the grid simulations. The licences for the program were provided by companies. The using of these programmes by the students was experienced during a laboratory visit.

As far as the Bachelor's programme in Metallurgy is concerned, the experts see the lack of programming languages as less critical, but still relevant. They therefore recommend including programming languages such as C++ and Python as well as microcontrollers in the curriculum.

In the Master's programmes, students deepen and expand their knowledge and skills. Both Master's programmes are structured in the same way: 80% of the programme consists of compulsory courses. 30% is devoted to scientific activity. This 30% is roughly divided into three parts: The preparation, execution and defence of the Master's thesis, pedagogical work and the scientific practice. The remaining half of the compulsory courses are mainly of technical modules. In the case of the Master's degree programme in Energy Supply these modules include relay protection and automation of the energy supply system as well as quality indicators of electrical energy. In the Master's degree programme in Metallurgy, students study subjects such as New Technologies in Nonferrous Metallurgy and Thermodynamics and Kinetics of Metallurgical Processes. 20% of each programme consists of elective modules, which allow students to deepen their knowledge in an area of their choice.

The experts conclude that the curricula of the two Master's programmes correspond with the ASIIN Subject Specific Criteria (SSC) of the Technical Committee Electrical Engineering and Information Technology and the Technical Committee Materials Science, Physical Technologies, and comply with the EUR-ACE® Framework Standards and Guidelines. After reading the module descriptions, inspecting the laboratories, and carrying out the audit discussions, in which they learn about the various research activities of teachers and Master's students, the experts assess the degree programmes as being at a high level.

However, they note a discrepancy in the assessment of the exemplary Master's theses: The level of the exemplary Master theses does not correspond to the level indicated by the module descriptions, the laboratories, and the research work at the two faculties. As explained in more detail in chapter 2, the auditors therefore recommend that the scientific level of the Master's theses be raised.

As mentioned above, the examiners note that the four programmes focus on "classical" topics of the two disciplines and predominantly use scientific literature by Uzbek and Russian scholars rather than international research. As a result, the four programmes provide a solid education in the basic and standard subjects, but only marginally address current and innovative issues. These include the aforementioned digitalisation, but also sustainability.

Since the fields of energy technology and metallurgy are closely related to the topics of the environment and environmental crisis, the experts however believe that these topics should be more closely linked in the four degree programmes. The experts welcome the fact that, for example, renewable energies such as solar energy are included in the energy engineering courses. In general, they remark that current research and industry in Uzbekistan is increasingly focused on solar energy. Nevertheless, the experts note that sustainability and renewable energies play only a subordinate role in all four study programmes examined. For example, they miss courses on microcontrollers, semiconductors and smart grids. This observation is reflected in the statements of the industry representatives who would like TSTU to offer more courses on environmental aspects and smart grids in particular. For this reason, they recommend strengthening teaching and research on green energy in all four degree programmes, especially in two programs “Electrical power engineering”. They suggest aligning the programmes with ESG (environmental, social and governance) principles and incorporating them into the TSTU strategy. For example, the ecological footprint of the different technologies and applications for power generation and consumption could be explained as well as strategies to minimize it. Social principles could aim at how to select and design technologies regarding affordability for poorer people.

Overall, the auditors recommend that more international research should be incorporated into the four programmes, by bringing the curricula, internships and research of the two faculties into line with the latest research findings and technologies. The experts recognise the excellent skills of the teaching staff involved in the two programmes and believe that greater consideration of international research would bring both the faculty's research and the programmes up to an internationally competitive level.

As mentioned before, both of the Bachelor’s programmes include mandatory practical time (19 weeks) in the industry. This is divided in four sections: In the second semester students spend 120 hours in a company, in the fourth semester 180 hours, in the sixth semester 180 hours and in the eight semester 60 hours. In addition, students have to write reports about their practical time in the industry. In the two Master’s programmes, students have to carry out an industrial internship of five weeks in their second year.

When discussing the internship with the industry partners of TSTU during the audit, they state that they are generally satisfied with the organization of the internship and the students’ performance. However, they suggest extending the internship in the Bachelor’s programmes that is carried out at the end of the first year: Instead of four weeks, they suggest extending the duration of the internship to eight weeks. The industry representatives explain that in the short period of four weeks they only manage to introduce the students to the different mechanisms at the company.

The students confirm that during the first internship they simply observe the procedure. The experts can understand the suggestion of the industry representatives and therefore recommend elongating the duration of the internship in the two Bachelor's programmes.

In the audit discussion, the experts learn that none of the present industry representatives was invited to give a guest lecture or has delivered a guest lecture at TSTU. Yet, they express their interest in giving a lecture in the study programmes under review. Similarly, the students express their wish to attend more guest lecturers from both industry representatives and international researchers. Therefore, the experts recommend inviting more guest lecturers to the four study programmes. In addition to the value of imparting further technical knowledge, the experts see the importance of guest lectures in allowing industry representatives to communicate directly with students about the skills and competences that are relevant to industry and the labour market.

The importance of one skill that was repeatedly mentioned by industry representatives, but also by students, graduates, teachers and university management, was the ability to speak foreign languages, especially English in all four programmes. During the audit discussions, the experts learned that the importance of foreign languages has already been recognised at many levels, which is why there have been several changes in the education system in recent years. For example, the Ministry of Education recently introduced a law requiring children to learn English at school from an early age. In 2022, the ministry also stipulated that applicants for a master's degree in Uzbekistan must have a foreign language certificate of at least B2 level. In this context, TSTU has introduced foreign language modules totalling 8 ECTS in its Bachelor's programmes and 4 ECTS in its Master's programmes. Depending on whether the student's mother tongue is Uzbek or Russian, they will also study the other language (6 ECTS). The experts welcome the inclusion of foreign languages in the curricula. However, during the audit they find that these courses are not sufficient, as almost no student is able to communicate in English. The same phenomenon is observed among all university staff. At the same time, every group the experts meet during the audit is aware of the importance of speaking English, be it to study abroad, to pursue an academic career and be part of the international scientific community or to work in a global company. All TSTU members show a strong interest in participating in the international platform for exchange and discussion. In particular, the experts are impressed by the eagerness of the undergraduate and postgraduate students to develop themselves and study or even work abroad. The experts note this gap between TSTU's ambitions to be internationally competitive and the current lack of English skills among TSTU members and recommend the development of further strategies to improve the English skills of students and teachers. They also suggest establishing an open access to international sources such as the IEEE membership for the professional development of students and staff.

Structure of the programme

As already explained, the two Bachelor's programmes each consist of about 60 % theoretical and practical/practical training,10 % internships and the remaining 30 % state exams, exam preparation and holidays. 23% is allocated to elective subjects. In the two Master's programmes, students can choose elective subjects amounting to 20%. About 30% of the modules in the Master's programmes are devoted to scientific activity. In all four degree programmes, students must complete compulsory internships.

The peers confirm that all degree programmes under review are divided into modules and that each module is a sum of coherent teaching and learning units. The internships are well integrated into the study programmes. However, as mentioned above, the evaluators recommend extending the duration of the internship in the Bachelor's degree programmes. The technical modules build on each other coherently and ensure that students achieve the respective learning outcomes of the study programme.

However, in the case of the foreign language modules in Bachelor's programmes, the experts do not see the logic of the modular structure. The first language module is taught in the second semester and the second module in the fourth semester. In other words, the experts wonder why the language modules are not taught directly one after the other, but why there is a semester break in between. This creates an unnecessary break in the students' studies, which could make it difficult for them to continue their studies in the fourth semester. For this reason, experts call for foreign language modules to be built up consecutively.

Student mobility

According to TSTU's self-assessment report, the university cooperates with universities around the world. Exemplary partner universities include the Moscow Energy Institute, Chungnam National University, Belarus National Technical University, Dresden Technical University, Helmut Schmidt University and Rochester Institute of Technology. The Department of Metallurgy cooperates in particular with Wuhan University of Technology, Yeungnam University (Korea) and Diliman Philippine University (Philippines). A semester abroad is planned after the first year of study. The experts note that the number of students who go abroad is low and mostly limited to Russia and Eastern Europe due to language barriers. In the Bachelor's programme in Electrical Power Engineering, for example, two students studied in South Korea and five in Russia between 2018 and 2023. In the Bachelor's programme Metallurgy, one student studied in South Korea, five in Russia, one in Belarus and one in China.

In the audit discussion, students confirm that they are aware of the opportunities for mobility and that they have not heard of any problems with the recognition of credits. Many students express a desire to study or undertake a placement abroad. At the same time, however, they are reluctant to go abroad, partly because of language barriers. In view of the low mobility figures and the great interest among students in going abroad, the experts recommend improving the opportunities for student mobility in order to increase international exchange.

Periodic Review of the Curriculum

According to the self-assessment report, the curricula of all four programmes are regularly reviewed, taking into account feedback from all stakeholders. At the regular faculty meeting, teachers discuss any proposals for new modules, as well as the name and content of new modules. The revised curriculum is then reviewed by the Faculty's Academic Methodology Council and finally approved by the University Council. If the proposed changes receive sufficient votes, they are approved and implemented in the educational process. The experts are pleased that there is a systematic process in place to regularly review and develop the programmes.

Criterion 1.4 Admission Requirements

Evidence:

- Self-Assessment Report
- Website of the University
- Discussions during the audit
- Law “On Education” No. ZRUz-637
- Decree of the President of the Republic of Uzbekistan “On the organisation of admission to study in state higher educational institutions” No. UP-60
- “On Adopting the Regulations on the Procedure for Admission to Studies, Transfer, Readmission and Exclusion of Students at Higher Educational Institutions”
- “Regulations on the procedure for admission to institutions of higher education, transfer, reinstatement and exclusion of students”
- "Decision on the Approval of the Rules for Admission to Higher Education Institutions, Transfer, Readmission and Exclusion of Students"

Preliminary assessment and analysis of the experts:
The university’s admission regulations are published on the university’s website.

The admission to the Bachelor’s and Master’s programmes are mainly regulated by the state and determined by the Law “On Education” No. ZRUz-637 and Decree of the President of the Republic of Uzbekistan “On the organisation of admission to study in state higher educational institutions” No. UP-60.

Admission to Bachelor's degree programmes is additionally regulated by the Decision of the Cabinet of Ministers of the Republic of Uzbekistan No. RP-393 “On Adopting the Regulations on the Procedure for Admission to Studies, Transfer, Readmission and Exclusion of Students at Higher Educational Institutions”. Applicants for Bachelor's degree programmes must have a certificate of graduation from a secondary school or a diploma of graduation from a college (vocational school). Practical/vocational experience is not required. Applicants must also pass a state examination administered by the State Testing Centre.

When applying for admission to higher education, applicants choose the subject they wish to study. Admission to higher education institutions is based on the results of the state examination.

Applicants with the highest scores are recommended for state scholarships within the pre-announced allocation of scholarship places. In the next group, applicants are recommended by the State Commission for enrolment on a contractual basis within the allotted places. The University may admit applicants with lower marks than those recommended for state scholarships. These students may study on a paid basis, known as a “super contract”. However, applicants with less than 25% of the maximum possible points cannot be admitted to study. At the same time, a special decree of the President of the Republic of Uzbekistan established special quotas for the admission of girls, disabled persons and children from low-income families to university education under additional allocations based on a state scholarship.

The examination subjects corresponding to the bachelor's degree programmes of the higher education institutions are approved by the Ministry of Higher Education, Science and Innovation and announced at least six months before the start of the examinations.

The national examination for applicants to the two Bachelor's degree programmes in Electrical Engineering and Metallurgy consists of three compulsory subjects - History of Uzbekistan, Mother tongue - and two profile subjects (in the chosen degree programme) - Physics and Computer Science.

The parameters for admission to state higher education institutions on a fee and contract basis are published annually on the official website of the Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan.

Over the last four years, the number of applicants to the Bachelor of Electrical Power Engineering has decreased from 745 to 405. The number of enrolments has remained about the same at around 100 students per year.

For the Bachelor's degree in Metallurgy, the number of applicants was mostly between 400 and 500 per year, but there was a notable peak in 2020 with almost 1000 applicants. Depending on the number of applicants, the number of students enrolled varied between 71 and 137.

Admission to the Master's programmes is granted to graduates of a Bachelor's programme. According to KMRUz No. 393, "Decision on the Approval of the Rules for Admission to Higher Education Institutions, Transfer, Readmission and Exclusion of Students", admission to the Master's programme is based on a selection procedure based on the results of entrance examinations in the field of education and in English.

However, as of the academic year 2022/2023, admission to the Master's programme at state higher education institutions will be based on the average of the Bachelor's degree and the score of the corresponding national or international foreign language certificate, strictly following the order of scores, while no additional examination will be held.

Admission to Master's degree courses at state higher education institutions takes place twice a year, in August and January. Foreign citizens shall be admitted to educational institutions of the Republic of Uzbekistan on a fee basis in accordance with the procedure established for citizens of

the Republic of Uzbekistan, unless otherwise provided by the legislation of the Republic of Uzbekistan or international treaties. The cost of education at the educational institutions of the Republic of Uzbekistan on the basis of fees and contracts shall be determined by the State Commission on Admission to the Educational Institutions of the Republic of Uzbekistan on the proposal of the Ministry of Higher and Secondary Special Education in consultation with the relevant ministries.

The number of applicants for the Master's degree in Energy Supply has oscillated between 40 and 9 in the last five years. However, there was a peak in 2021 with 108 applicants. The number of first-year students has fluctuated between 24 and 8.

In the Master's programme in Metallurgy, the number of applicants has varied between 5 and 26 in recent years. There was also a peak in 2021 with 65 applicants. The number of enrolments fluctuated between 5 and 18.

Admission of foreign citizens to educational institutions of the Republic of Uzbekistan is carried out on the basis of international agreements of the Republic of Uzbekistan, collective and individual agreements and arrangements. Admission of foreign citizens is carried out on the basis of the results of an interview and registration in accordance with the procedure established by the Ministry of Higher Education, Science and Innovation and the Ministry of School and Pre-school Education of the Republic of Uzbekistan. The regulations are defined in the documents “On Improving the Procedure of Admission and Education of Foreign Citizens to Educational Institutions of the Republic of Uzbekistan”.

The transfer of students and the recognition of credits obtained at another university are handled by the Ministry of Education and are based on the rules set out in the document “Regulations on the procedure for admission to institutions of higher education, transfer, reinstatement and exclusion of students”. The experts recognise that the rules for the recognition of achievements and competences acquired in other higher education institutions are transparent, binding and based on the principles of the Lisbon Convention.

In summary, the auditors 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 Workload and Credits

Evidence:

- Self-Assessment Report
- Study plans
- LUT Degree Regulation
- Module descriptions

- Discussions during the audit
- Decree of the Cabinet of Ministers of the Republic of Uzbekistan No. 824 “On measures to improve the system associated with the organisation of the educational process in higher educational institutions”
- “Regulation on the procedure for introducing a credit-module system into the educational process in higher education institutions”
- Samples of student questionnaire

Preliminary assessment and analysis of the experts:
A credit system has been introduced which assesses student workload and includes both contact hours and time for independent study. This system ensures the inclusion of all required components in the curriculum, with credits being awarded for each module according to the respective workload.

The organisation of the educational process in higher education institutions operating under the credit module system is regulated by two decrees of the Cabinet of Ministers of the Republic of Uzbekistan. The first decree outlines measures to improve the educational system at higher education institutions, while the second decree regulates the introduction of the credit module system into the educational process at these institutions.

At TSTU, one ECTS point corresponds to 30 hours of the student's total workload, including class attendance and independent study. Typically, in both Bachelor’s and Master’s programmes, 40% of a module is dedicated to classroom training, with the remaining 60% allocated for independent student learning.

In terms of academic requirements, undergraduate and graduate students must complete 60 credits in one academic year and achieve a certain grade point average (GPA) in order to move from one academic year to the next. Students need to accumulate 240 credits for a Bachelor's degree and 120 credits for a Master's degree.

Higher education institutions in Uzbekistan have the authority to set the GPA threshold for students to move from one course to another, usually in the range of 2.4 to 3.0. Students who fail to meet this GPA requirement are required to repeat the course. The total duration of study is set at 8 years from the date of admission to the first course for a Bachelor's degree and 4 years from the date of admission to the first course for a Master's degree. This is also the maximum time allowed in the event of non-study related problems that slow down academic progress, such as family circumstances, academic debt from previous subjects, health problems, etc.

The student's educational load is formulated on the basis of the educational plan developed in consultation with the industrial partners and subsequently approved by the Rector of the University. The balance between classroom and independent study time is monitored in accordance with government academic standards.

Student surveys are used to determine the student's academic workload and the appropriate credit allocation. These surveys include a comprehensive set of questions on student workload, and students' answers form the basis for determining the appropriate academic workload and credit allocation.

According to statistics provided by TSTU, on average 90% of the students in the Bachelor's programme Electrical Power Engineering finish their studies in the standard study period of eight semesters. In the Bachelor's programme Metallurgy, even 95% of the students complete their studies within eight semesters. In both Master's programmes programmes, about 93% of the students finish their studies within the designated period of four semesters.

The experts are impressed by the high number of students who complete their studies within the expected time. Overall, they note that TSTU has a clearly defined and well-established credit system and monitoring mechanism of the students' workload. They believe that the estimated workload is realistic and well-founded. The fact that students are expected to achieve 30 ECTS credits per semester underlines the even distribution of the workload over the course of the programmes. When asked about the workload in the four programmes, students indicate that they are generally satisfied with the workload and that there are no structural peaks.

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:

In order to achieve the learning outcomes and to promote student-centred teaching, the TSTU states that a variety of teaching methods and didactic tools are used. The main teaching methods include lectures, seminars, practical sessions and laboratory work. The modular structure generally allocates half of the total study hours to contact hours, with the remaining workload devoted to independent student study. Half (or more) of the contact hours are allocated to lectures and the remaining time is further divided into seminars, practical classes and laboratory sessions.

Practical sessions reinforce theoretical knowledge through practical calculations. These sessions typically involve group activities in classrooms of up to 25 students. Students are required to submit their calculations for assessment at the end of the lesson.

Laboratory classes are limited to a maximum of 12 students to ensure adequate access to equipment and materials. At the end of the laboratory sessions, students are expected to produce reports based on the knowledge gained during the lessons, which are then submitted for assessment. In addition, the Department of Power Engineering and the Department of Metallurgy have

set up branches within manufacturing companies to provide practical and laboratory facilities for students. These real-world environments allow students to apply their knowledge in a practical context.

To complement traditional teaching methods, lecturers at TSTU use digital teaching materials that include presentations, video content and animated videos. These multimedia resources are particularly useful for explaining complex technological concepts and processes.

Introducing students to independent scientific work is an integral part of the programmes. Therefore, each programme includes topics for independent study. Students are expected to carry out independent work on 5-10 specified topics and to present their findings to their supervisors. The departments have also established clubs, such as “Young Power Supply Engineer” and “Young Metallurgist.” These clubs allow students the opportunity to engage in research activities that align with their interests. Simultaneously, students actively participate in the ongoing scientific research conducted within their respective departments. The departments maintain a thematic database comprising technological challenges encountered by enterprises, providing students with the option to select these themes for their research projects. Furthermore, students pursuing Master’s programmes are required to publish one scientific article and one thesis during their studies.

Students have the opportunity to evaluate teaching methods and make suggestions for improvement through course feedback, which takes place every semester.

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 concept of both undergraduate und postgraduate programmes comprises a variety of teaching and learning forms as well as practical parts that are adapted to the respective subject culture and study format. The experts are particularly impressed by the involvement of students in a variety of research projects.

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

In conclusion, the experts see room for improvement in the curricula of all four programmes. While the programmes provide a sound education in the core subjects of the respective discipline according to the EQF level, the experts see a need to modernise the curricula and bring them more in line with the international state of the art. In this context, the experts call for TSTU to include programming languages such as C++ and Python as well as microcontrollers in the curriculum of the bachelor's degree in Electrical Power Engineering. They also recommend that teaching and research on green energy and smart grids be strengthened and aligned with ESG principles. They also suggest that the topics for internships and research activities should be based on the latest developments and technologies in research and industry. In order to strengthen the link

between students and industry, they recommend inviting more guest lecturers from industry and increasing the duration of internships.

In terms of the structure of programmes, they demand that foreign language modules build on each other in a coherent way. They also suggest reducing the high number of non-technical courses.

Furthermore, the experts urge the university to strengthen its internationalisation strategy by improving the English language skills of students and teachers and by increasing the opportunities for students to go abroad.

Criterion not fulfilled.

2. Exams: System, Concept and Organisation

Criterion 2 Exams: System, Concept and Organisation

Evidence:

- Self-Assessment Report
- Module descriptions
- “Regulations on the system of control and evaluation of students’ knowledge in higher education institutions”
- “Regulations on the final state certification”
- Discussions during the audit

Preliminary assessment and analysis of the experts:
The most common examinations forms at TSTU are written and oral exams, which are carried out at the end of the course.

Throughout the semester, the student's performance in practical, seminar, laboratory and independent study classes and their activities in these classes are monitored by the subject teacher. If a student has completed and passed all the assignments assigned during the semester, he/she will be allowed to take the final examination. They must also have attended at least 75% of all classes. The final examination is usually a written or oral examination, depending on the nature of the subject. The final exam constitutes the grade of the module. At TSTU, it is a rule that the final exam is never conducted by the teacher who gave the training, but by another teacher. This is to ensure impartiality and fairness. Students' performance is assessed using a 5-point system. The criteria for evaluating the students' knowledge are developed on the basis of standard evaluation criteria and are reflected in the work programme of the subject, discussed in the Scientific and Methodological Council of the University and approved by the Vice-rector for Academic Affairs.

Some courses are assessed by projects. Here, the project is formed within the framework of the technological tasks of the companies formed at the department. The evaluation of the course work (project) is carried out by a three-member commission.

Students who have not received their permission to take the final examination due to prolonged absence or poor performance during the semester, or if they fail an examination, will receive an academic debt. Students have the right to study these subjects and retake the exam during the holidays or in the next semester. If students decide to repeat a course during the holiday period, they must submit a request to the Teaching and Methodology Department for additional tuition during the so-called “interim semester”. The department in question will then draw up a timetable for these students during the interim semester and allow them to attend classes on payment of an additional tuition fee.

If a student has been unable to attend a class or exam for exceptional reasons such as illness, death of a close relative, etc., the student will be allowed by the Pedagogical and Methodological Department to repeat the missed classes/exams. In addition, TSTU has rules for compensating disadvantages in the case of students with disabilities or special needs.

The examination system as a whole is monitored by the Department of Education Quality Control.

Overall, the experts are satisfied with the examination system. They confirm that the various forms of examination are competence-based and suitable for assessing the achievement of the intended learning outcomes as set out in the module descriptions. They also note positively that the examination forms are regularly reviewed by the faculties and that the whole examination system is monitored to ensure fairness and appropriateness. Students also indicate that they are satisfied with the examination system. They report that they receive all relevant information about examinations, such as examination dates and assessment criteria, at the beginning of the semester. The examination regulations, including compensation for disadvantages, are also made transparent to all concerned. Students also report that they are satisfied with the examination timetable, as no student has more than three examinations per week and care is taken to ensure that there is at least one 'free' day between examinations. When asked about complaint mechanisms, students report that it is not the norm to contact the lecturer directly, but that they should take their concerns directly to the Dean, which works well.

The peers also inspect a sample of examination papers during the audit. They conclude that the level of the exams is adequate and corresponds to the level of the respective degree programme.

The final assessment of students at TSTU at the end of their Bachelor's degree depends on their individual talents, grades and areas of interest. At this point, students have the option of either taking a state examination in compulsory interdisciplinary subjects or defending a diploma project or a final qualification paper. However, only a few selected students with a remarkable GPA are given the opportunity to complete a Bachelor’s thesis or project. The majority of students is finishing their Bachelor’s degree with the final state exam. The exam is organized according to the

schedule of final state examinations drawn up by the Dean of the Faculty or the Department of Pedagogy and Methodology. The format of the final state examination may be either oral or written. In order to be permitted to the final exam, students must have successfully completed all required modules.

The experts find that the samples of the Bachelor thesis correspond to EQF level 6. However, they note critically that only the best students are usually writing a Bachelor thesis. Therefore, they require that all Bachelor students must carry out a final thesis or final project, which demonstrates that all students are able to work independently on a task at the intended level of the degree programme.

In the Master's programmes, the completion of a Master's thesis is a mandatory requirement (18 ECTS plus 12 ECTS for its preparation). The process of preparing for the thesis commences early in the programme, with the Master's thesis topic being assigned to students during the initial semester. When selecting the topic, the department takes into account a number of factors, including industry developments, current advances in fields such as science, education, technology and business, and the specific needs of potential employers. The approval of partner companies is also sought to ensure that topics are relevant to real-world needs. Typically, Master's theses revolve around addressing technological challenges faced by partner companies.

In order to prepare students for the research-intensive nature of the Master's thesis, the first three semesters include three modules (4 ECTS each) designed to equip students with the necessary research skills. In the fourth semester, students begin to carry out the actual project, which is often carried out in collaboration with a company. It is essential, however, that the company chosen is approved by TSTU. Throughout the duration of the Master's project, students are expected to report their progress to their assigned supervisor at the university.

The content of the Master's thesis should systematically document the basic elements of scientific research or scientific and technical solutions. It should detail the implementation process and present the results achieved. The results of the Master's thesis will be communicated in either textual or visual form, with the student explaining the theoretical or practical significance of the chosen topic. The scope and content of the written material and accompanying visual aids are determined by the department responsible for the training of specialists.

Once a student has completed the Master's thesis within the set timeframe, they are required to submit it to the State Attestation Commission. This submission includes the supervisor's assessment, an external review by an expert in the field, and a certificate confirming fulfilment of the personal plan associated with the Master's programme in the relevant specialisation. The final step of the Master's thesis process is a public defence before the State Examination Board and the academic staff, where students present their work for assessment.

As mentioned above, the experts are somewhat disappointed after reviewing the samples of Master's theses. Having seen the excellent laboratories and heard about the immense amount of research being carried out at both faculties, the experts expected high quality Master's theses with

a strong research and analysis section. However, the theses presented are more like theoretical essays where a problem is discussed in the abstract. This theoretical discussion is at a high level, but the experts miss an application of the problem to reality, where measurements are taken to check whether the solution proposed by the students is actually true. Consequently, there is no discussion, analysis or interpretation of the measurement results by the student and no visual representation of the results such as diagrams or simulations. Furthermore, the samples refer only to Uzbek and Russian scientific literature and do not include international literature. The experts therefore recommend raising the scientific level of the Master's thesis so that students can show that they are able to apply the problem to reality and to analyse and interpret the results of their work. The thesis should also take account of international research. The auditors also recommend that the results of every Master's thesis should be published online or in a scientific journal.

The experts also find the presentation of the Master's thesis in the curriculum confusing. The curriculum shows that there is a module entitled “Preparation and Defence of Research Paper and Master’s Thesis”, which covers all four semesters. This vague title does not make it clear what the content of the module is in each semester. In the audit discussions, the experts learn that the first three semesters are intended for the preparation of the Master's thesis, while the actual completion of the thesis is reserved for the last semester. The experts suggest splitting the module into two modules and separating the preparation in the first three semesters from the actual work in the fourth semester in order to clarify the process of the Master's thesis.

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

Overall, the experts are satisfied with the examination system. However, they demand that all bachelor students complete their studies with a thesis or a final project. They also recommend raising the scientific level of the Master's thesis: The theses should show that students are able to apply the problem case in reality and to verify through measurements whether the solution proposed by the students actually applies. Each Master's thesis should include not only a theoretical discussion of the problem, but also an analysis and interpretation of the measurement results.

Criterion partly fulfilled.

3. Resources

Criterion 3.1 Staff and Development

Evidence:

- Self-Assessment Report
- Staff Handbooks for both Departments

- Study plans
- Module descriptions
- Discussions during the audit

Preliminary assessment and analysis of the experts:
According to the self-evaluation report, the academic staff of TSTU consists of professors, associate/assistant professors, senior lecturers and PhD students. There are 21 lecturers for the Bachelor's degree in Electrical Power Engineering and the Master's degree in Energy Supply. Thirteen of these lecturers hold a Ph.D. degree. The remaining lecturers have a Master's degree. In total, there are four full professors and seven assistant professors. In addition, there are two technical staff in the Department of Power Engineering. The Department of Metallurgy has 18 lecturers. Of these, two are full professors, four are Ph.D.s or assistant professors, and the remaining teachers have master's degrees. One teacher is currently studying for a PhD. Two non-doctoral teachers also hold the title of assistant professor due to their many years of research experience and publications. The Department of Metallurgy has four technical staff.

In addition, TSTU has a student affairs department that provides support and assistance to students throughout their studies.

The normal teaching load is 900 hours per academic year. For professors and assistant professors, the teaching load is divided into 600 hours of classroom teaching and 300 hours of supervision of internships, theses, etc. If teachers have additional administrative duties, their teaching load is reduced. Teachers also state in the audit that the more research time a teacher spends, the less teaching time he or she has.

The student-teacher ratio is regulated nationally and is followed by the TSTU with a ratio of 1:16.

Both departments also occasionally invite guest lecturers from abroad. According to the self-evaluation report, there have been eight guest lecturers in the last four years in both the Metal Technology and Power Engineering departments. The lecturers came from countries such as Korea, Russia and Kazakhstan.

Recruitment of new teaching staff is usually organised at the end of each academic year. Applicants must have at least a Master's degree and give a presentation on their subject area. The Faculty Council makes the final decision on whether or not to employ the teacher. Newly recruited junior teachers are assigned mentors who have been working in the department for many years and participate in their teaching. They are also involved in teaching at an early stage and receive extra training from their mentors.

<u>Staff Development</u>

TSTU strongly encourages the continuous development of all teachers in terms of their professional and teaching skills. For example, the university has a training centre where teachers can attend courses to improve their pedagogical skills as well as other skills such as foreign languages.

TSTU even rewards teachers financially who have obtained a foreign language certificate. According to the self-evaluation report, all teachers are required to attend in-service training every three years. TSTU also provides financial support to teachers who wish to pursue doctoral studies or other academic development and research activities. For example, the university supports and finances teachers' publications and reduces their workload if they decide to spend more time on research. During the audit, teachers note that they also have the opportunity to receive financial support from the Ministry of Innovation for research projects. In addition, TSTU encourages teachers to be internationally active, for example by giving guest lectures abroad.

The experts are pleased that teachers are supported by the TSTU in a variety of ways, particularly in terms of foreign language learning. However, the experts note that few teachers are able to communicate in English or another foreign language. For this reason, the experts recommend that more teachers should take advantage of the opportunities available to them to improve their foreign language skills.

In the audit discussions, teachers report that all teachers are actively involved in research activities. They state that the first half of their working day is usually spent teaching, with the rest of the time spent on research. Teachers attend national and international conferences. These include conferences in Russia, the United Arab Emirates, Germany, Turkey, France, Kazakhstan, Azerbaijan and other similar countries. In the last 5 years, the faculty members of the Department of Power Engineering have published more than 200 theses and articles. The teachers also mention that they are in close contact with industry and that every few months they receive topics from companies on which they will conduct research. There are also long-term collaborations and projects with national and international universities. One example is the project on energy synchronization, which is being carried out in cooperation with Helmut Schmidt University.

TSTU also has a regular system for monitoring and evaluating the professional and didactic qualifications of teaching staff. The activities of all teaching staff are evaluated at the end of each academic year using a point system. The evaluation is carried out by the Faculty Council. On the basis of the test results, a decision is made as to whether the teacher will be awarded the next higher title. In accordance with a national regulation, professors and teaching staff are also subject to an assessment test every 5 years. As part of this process, they give open lectures and take tests to determine their level of knowledge in their subject area and foreign languages. Teachers who do not pass the test are no longer allowed to teach at TSTU.

Overall, the experts confirm that the composition, academic orientation and qualifications of the teaching staff are adequate for the successful implementation and continuation of the four programmes. They appreciate the active involvement of teachers in research and are impressed by the number of projects undertaken by both faculties. However, as mentioned above, they suggest that teachers should take more account of the latest developments and technologies in both (international) research and industry in order to be more internationally competitive. In addition, the experts note that the TSTU has an excellent support system for the further development of

teachers, both in terms of didactics and academic performance. Teachers express their satisfaction with the training opportunities at TSTU and the support they receive from the university. Students also indicate that they are satisfied with the level of teaching and supervision as well as with the overall support services offered by TSTU. In conclusion, the experts are confident that with the support system in place at TSTU, the highly motivated and qualified teaching staff will develop to an internationally competitive level.

Criterion 3.2 Funds and equipment

Evidence:

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

Preliminary assessment and analysis of the experts:
The university is located on one campus. In addition to a large number of seminar rooms, lecture theatres and computer rooms, TSTU also has a wide range of laboratories.

For the Bachelor's degree in Electrical Power Engineering and the Master's degree in Power Supply, the laboratories cover topics such as power supply for industrial enterprises, energy storage and control systems, relay protection and automation, and the logic and operation of power supply systems. In cooperation with various industrial companies, the Department of Electrical Power Supply has established a modern "Power Supply" training facility where students can bridge the gap between theory and practice. The department has also acquired state-of-the-art relay protection laboratory equipment. Practical projects are carried out using educational simulators to impart basic power supply knowledge.

Similarly, the Bachelor's and Master's programmes in Metallurgy have a variety of laboratories to facilitate metallurgical ore processing, hydrometallurgy and pyrometallurgy. The Department of Metallurgy also has many links with industry. For example, the Department has established a branch at Toshrangmetzavod LLC for the training of its students. In addition, the Uzbekistan-Japan Youth Innovation Centre at the University has set up an ore preparation laboratory and actively supports research by Masters and PhD students.

The University places great emphasis on the acquisition of educational literature and laboratory equipment to enhance the quality of education. Recent data show a significant increase in the budget allocated to laboratory equipment over the past five years, from 508 million to 18.108 billion.

The university is also home to the Tashkent State Technical University Fundamental Library, named after Islam Karimov. It is one of the largest university libraries in Uzbekistan. In 2007, the library was renamed the Information and Resource Centre (IRC). The library has ten reading rooms with a total of 478 seats. The IRC has a collection of over one million printed and digital publications, including educational, scientific and fictional literature in several languages. It also houses an extensive collection of abstracts and theses from Tashkent State Pedagogical University and TSTU, as well as manuscripts from university scholars and their research groups. The IRC also provides an electronic catalogue and access to a full-text database.

During the audit, the experts visit the facilities and laboratories on campus. They are impressed by the large number of laboratories and the variety of equipment. They note that the equipment, some of which has been built by the teachers and laboratory staff themselves, has a strong didactic character that helps students to understand the technical aspects. For example, manual tools allow students to learn the mechanisms in more detail and step by step. The experts are convinced that the practical work in the laboratories is an excellent complement to the theoretical studies.

In general, the expert group judges that the available resources and infrastructure (library, seminar rooms, etc.) meet the requirements for adequate support of the programmes. They also note that the library has a large collection of (electronic) books and journals. However, as mentioned above, most of the academic literature available to students is in Uzbek or Russian. As a result, this also limits the studies and research carried out by students and teachers at TSTU. Therefore, the students expressed the wish to have more access to international scientific literature. The experts agree with this request and recommend that the amount of international scientific literature provided by TSTU should be increased.

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

In conclusion, the experts are satisfied with the skills of the staff as well as the resources and equipment for all degree programmes under review. As mentioned above, they recommend that teachers improve their English language skills and that the topics of research activities are based on the latest developments and technologies in research and industry.

Criterion fulfilled.

4. Transparency and Documentation

Criterion 4.1 Module Descriptions

Evidence:

- Self-Assessment Report
- Module descriptions
- Websites of all study programmes

Preliminary assessment and analysis of the experts:

After studying the module descriptions the experts confirm that they include all necessary information (course name, course code, students' total workload, awarded ECTS points, grading scale, intended learning outcomes, content, recommended literature, possible prerequisites, name of teacher/teachers in charge, exam methods, and assessment criteria). The students confirm during the discussions that information about the courses are always available online and that details concerning examinations and contents are provided at the beginning of each course by the teaching staff.

When reviewing the module descriptions of the Bachelor's programme in Metallurgy, the auditors note that there are two modules with different titles ("Civil Defence" and "Life Safety"), but with the same content description. The programme coordinators explain during the audit that one module ("Civil Defence") deals with the protection of the civilian population on a large scale, whereas the other module ("Life Safety") refers more to biological and medical knowledge about the safety of a person. The experts therefore request that the differences between the two modules be highlighted in the module descriptions.

Criterion 4.2 Diploma and Diploma Supplement

Evidence:

- Exemplary diploma certificate per study programme
- Exemplary diploma supplement per study programme
- Exemplary transcript of records per study programme

Preliminary assessment and analysis of the experts:
The experts confirm that the students of the four degree programmes will be awarded a diploma/certificate and a diploma supplement upon completion of their studies. Both documents are also issued in English. The Diploma Supplement contains all the necessary information about the degree programme. Instead of a separate Transcript of Records, the Diploma Supplement contains a list of all modules, credits achieved, grades and the cumulative GPA achieved by the student.

Criterion 4.3 Relevant Rules

Evidence:

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

Preliminary assessment and analysis of the experts:
The auditors confirm that the rights and duties of both TSTU and the students are clearly defined and binding. All rules and regulations are published on the university's website and the students receive the course material at the beginning of each semester.

In addition, all relevant information about the degree programmes (e.g., module handbook, study plan, intended learning outcomes) is available on the homepage of the programmes.

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

The experts note that all regulations and course-related information are made transparent for all parties involved. Overall, they consider the criteria relating to transparency to be fulfilled. However, they see a need for clarification in the description of the content of some modules.

Criterion fulfilled.

5. Quality management: quality assessment and development

Criterion 5 Quality management: quality assessment and development

Evidence:

- Self-Assessment Report
- Samples of surveys for students, teachers and industry partners
- Charter of TSTU
- Regulations for the Quality Control
- Discussions during the audit

Preliminary assessment and analysis of the experts:
The central body responsible for quality assurance at TSTU is the Department for Quality Control of Education. The Department's charter is approved by the University Council and the Rector of TSTU. Its main tasks are to assess the conformity of students' knowledge with the state educational standards, to monitor the quality of teaching, to carry out internal certification processes within TSTU, to identify factors that may affect the quality of education and to take corrective measures to mitigate and prevent such problems. As part of its quality management activities, TSTU employs surveys directed at students, teachers, and industry partners.

Students are surveyed twice at the end of each semester. One survey is conducted by the department and assesses students' overall satisfaction with the quality of their education. The other survey is conducted by the lecturers and assesses the students' satisfaction with the courses. The results of the surveys are discussed and analysed in the meetings of the Scientific and Methodological Rectorate of the Institute, chaired by the Dean of the Faculty and the Head of the Department. Ultimately, the results of these surveys are used as a basis for decisions regarding the employment of teachers, since, depending on the results, teachers may need to undergo further training. Any shortcomings identified in the courses are also examined and resolved during these meetings. The Department of Quality Control of Education prepares an analytical report on the basis of the data collected and submits the final conclusions to the Rector of the University and the Vice-Rector for Educational Affairs. In accordance with the Rector's instructions, the results of the survey are made available to the Academic Council, but individual names will not be disclosed and the results will be presented in summary form. The results of the survey will also be communicated to students. In addition to formal evaluations, students are encouraged to provide verbal feedback directly to their teachers, which is then discussed in class.

When asked about their satisfaction with evaluations and general quality management at TSTU, students confirm that evaluations take place regularly and that the results are communicated to them. They state that their critical points are recognised by the university and that changes are made to the programmes on this basis.

Similar to the student evaluation process, annual surveys are conducted with industry partners. They record their recommendations regarding the theoretical training, practical experience and professional practices. In addition, the industry partners explain during the audit interviews that each company has selected a contact person who is regularly contacted by the academic board of TSTU to exchange ideas for further improvement of the programmes. The industry representatives indicated that their suggestions are usually incorporated into the programmes and that they are satisfied with the way they are taken into account in the programmes.

The Department for Quality Control of Education also consults external persons, for example from scientific research institutions, foreign specialists from other universities or other companies, to assess the quality of study programmes.

After collecting all the data, the Department for Quality Control of Education will identify the strengths and weaknesses of the programmes and develop measures for improvement.

The experts gain the impression that the quality system of the TSTU functions well and ensures high quality and continuous further development of the study programmes. The feedback of all stakeholders is taken into account by the programme coordinators and changes are made instantly. They confirm that TSTU regularly monitors and reviews the degree programmes and the modules to ensure that they achieve the objectives set for them and respond to the needs of the students.

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

In summary, the experts are satisfied with the quality management system and believe that it ensures a high level of quality and further development of all four programmes examined.

Criterion fulfilled.

D Additional Documents

No additional documents needed.

E Comment of the Higher Education Institution

TSTU has not issued a statement on the draft report.

F Summary: Expert recommendations (17.11.2023)

The peers summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Electrical Power Engineering (Power Supply)	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029
Power Supply (Industrial Enterprises and Cities)	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029
Metallurgy	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029
Metallurgy (non-ferrous metals)	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029

Requirements

For all programmes

A 1. (ASIIN 4.1) Revise the module descriptions and adapt them to the content actually taught.

For both Bachelor's programmes

A 2. (ASIIN 1.3) Ensure that the foreign language modules build on each other coherently.

A 3. (ASIIN 2) The Bachelor's programmes must finish with a thesis or final project.

For the Bachelor's programme Electrical Power Engineering

A 4. (ASIIN 1.3) Include programming languages such as C++ and Python as well as microcontrollers in the curriculum.

Recommendations

E 1. (ASIIN 1.3) It is recommended that teaching and research on green energy and smart grids be strengthened and aligned with ESG principles.

E 2. (ASIIN 1.3) It is recommended that the number of non-technical courses be reduced.

E 3. (ASIIN 1.3, 3.1) It is recommended to improve the English language skills of students and teachers.

E 4. (ASIIN 1.3) It is recommended to include more guest lecturers from industry in the study programmes.

E 5. (ASIIN 1.3) It is recommended to improve the opportunities for students to go abroad.

E 6. (ASIIN 1.3. 3.1) It is recommended that the topics for internships and research activities are based on the latest developments and technologies in research and industry.

E 7. (ASIIN 3.3) It is recommended to improve access to international scientific literature.

For both Bachelor's programmes

E 8. (ASIIN 1.3) It is recommended to increase the duration of the internship.

For both Master's programmes

E 9. (ASIIN 2) It is recommended to enhance the scientific level of the Master's thesis.

For the Bachelor's programme Metallurgy

E 10. (ASIIN 1.3) It is recommended to include programming languages such as C++ and Python as well as microcontrollers in the curriculum.

G Comment of the Technical Committees

Technical Committee 02 – Electrical Engineering/Information Technology (24.11.2023)

Assessment and analysis for the award of the ASIIN seal:

The TC discusses the case and follows the vote 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**	**Maximum duration of accreditation**	**Subject-specific label**	**Maximum duration of accreditation**
Electrical Power Engineering (Power Supply)	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029
Power Supply (Industrial Enterprises and Cities)	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029

Technical Committee 05 – Materials Science, Physical Technologies (20.11.2023)

Assessment and analysis for the award of the ASIIN seal:

The TC discussed the requirements and recommendations proposed by the expert panel and do not follow completely the assessment of the experts. Considering A4, the TC believes that this requirement shows that the Bachelor's programmes do not correspond to level 6 of the European Qualifications Framework. Furthermore, the TC considers that this requirement can not be fulfilled in one year. Therefore, the TC proposes to suspend the accreditation process for the two Bachelor's programmes. Regarding the Master's degree programmes, the TC discusses the recommendation E7 and E9 and is of the opinion that both are decisive statements and should be upgraded to a requirement. In addition, the TC proposes to add some specifications in A1, E2 and E8.

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 of the Technical Committee 05 – Materials Science, Physical Technologies.

The Technical Committee 05 – Materials Science, Physical Technologies recommends the award of the seals as follows:

Degree Programme	**ASIIN Seal**	**Maximum duration of accreditation**	**Subject-specific label**	**Maximum duration of accreditation**
Metallurgy	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029
Metallurgy (non-ferrous metals)	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029

H Decision of the Accreditation Commission (08.12.2023)

Assessment and analysis for the award of the ASIIN seal:

The Commission discusses the procedure and in particular the changes proposed by TC 05. They agree that access to international literature is essential for the high quality of a programme and the standards of international accreditation and therefore follow the proposal of TC 05 to make this a requirement. In their view, ensuring access to international literature will naturally also raise the standard of Master's theses. The recommendation itself to raise the level of Master's theses is also discussed intensively by the Commission. As the experts are convinced that the level is sufficient, the commission considers the recommendation superfluous and decides to delete it altogether. With regard to the requirement to make the bachelor thesis a compulsory part of the curriculum, the Commission agrees that this is not a major challenge and therefore should not be a reason for suspending the accreditation. As this requirement has been made in several other accreditation cases, the Commission does not see why this case should be treated differently. A requirement is therefore sufficient in this case. Finally, they follow the few other changes to the wording of TC 05.

Assessment and analysis for the award of the EUR-ACE® Label:

The Accreditation Commission deems that the intended learning outcomes of the degree programmes do comply with the engineering specific parts of Subject-Specific Criteria of the Technical Committees 02 and 05.

The Accreditation Commission decides to award the following seals:

Degree Programme	**ASIIN Seal**	**Maximum duration of accreditation**	**Subject-specific label**	**Maximum duration of accreditation***
Electrical Power Engineering (Power Supply)	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029
Power Supply (Industrial Enterprises and Cities)	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation*
Metallurgy	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029
Metallurgy (non-ferrous metals)	With requirements for one year	30.09.2029	EUR-ACE®	30.09.2029

* Subject to the approval of the ENAEE Administrative Council

Requirements and recommendations for the applied labels

Requirements

For all programmes

A 1. (ASIIN 3.3) Ensure access to international scientific literature and databases, for example through IEEE.

A 2. (ASIIN 4.1) Revise the module descriptions and adapt them to the content actually taught. Ensure that modules with different contents do not have the same name.

For both Bachelor's programmes

A 3. (ASIIN 1.3) Ensure that the foreign language modules build on each other coherently.

A 4. (ASIIN 2) The Bachelor thesis must be a mandatory part of the curriculum.

For the Bachelor's programme Electrical Power Engineering

A 5. (ASIIN 1.3) Include programming languages such as C++ and Python as well as microcontrollers in the curriculum.

Recommendations

For all programmes:

E 1. (ASIIN 1.3) It is recommended that teaching and research on green energy and smart grids be strengthened and aligned with ESG principles.

E 2. (ASIIN 1.3) It is recommended that the number of non-technical courses be reduced except the English language courses.

E 3. (ASIIN 1.3, 3.1) It is recommended to improve the English language skills of students and teachers.

E 4. (ASIIN 1.3) It is recommended to include more guest lectures from industry in the study programmes.

E 5. (ASIIN 1.3) It is recommended to improve the opportunities for students to go abroad.

E 6. (ASIIN 1.3. 3.1) It is recommended that the topics for internships and research activities are based on the latest developments and technologies in research and industry.

For both Bachelor's programmes

E 7. (ASIIN 1.3) It is recommended to increase the duration of the internship and to enable that it be held consecutively.

For the Bachelor's programme Metallurgy

E 8. (ASIIN 1.3) It is recommended to include programming languages such as C++ and Python as well as microcontrollers in the curriculum.

Appendix: Programme Learning Outcomes and Curricula

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

“LO 1 Able to competently express your speeches in Russian and foreign languages

LO 2 A way of using information and pedagogical technologies in pedagogical activity and effectively using engineering and technical knowledge in conducting scientific research and developing energy solutions

LO 3 Capable of participating in scientific seminars, conferences, and symposiums, developing research projects; acquiring skills in conducting scientific and applied research, processing experimental results, and making scientifically justified conclusions based on them, as well as preparing and editing scientific articles

LO 4 Able to calculate and select types of protection and automation of power supply systems based on complex relay protection devices and automation of microprocessor complexes using the theory of control and regulation of processes in power plants and techni ques, as well as intelligent methods for solving energy problems that ensure the reliability of power supply and nominal quality indicators electricity

LO 5 Capable of diagnosing and monitoring work relay protection devices and electrical automation of power supply systems using modern microprocessor devices, as well as design relay protection and automation of power supply systems, having the skills to work with digital technology and microprocessor systems

LO 6 Able to conduct energy surveys during the operation of electrical equipment of power supply systems, carrying out metrological verification of the primary means of measuring parameters and monitoring the quality of functioning and management of electrical facilities, observing energy efficiency and reliability of power supply systems

LO 7 Able to develop and implement measures for the rational use of energy resources in the system power supply of industrial enterprises and cities using methods of optimization, regulation, management, and ensuring the reliability of the power supply

LO 8 Ability to use modern methods of designing power supply systems for industrial enterprises and cities and their feasibility study, using modern methods of reactive power

compensation and calculation of electrical loads, as well as the ability to control compliance with regulatory standards in the energy sector during design."

The following **curriculum** is presented:

Curriculum for Bachelor's EP BA 60710600 - Electrical Power Engineering (Power Supply)							
1 semester	**2 semester**	**3 semester**	**4 semester**	**5 semester**	**6 semester**	**7 semester**	**8 semester**
O'RT1206 Uzbek (Russian) Language 4 prac. 4 ECTS	O'RT1206 Uzbek (Russian) Language 2 prac. 2 ECTS	EEQ2306 Computational Techniques for Energy Systems 2 lec., 1 prac., 1 lab. 6 ECTS	MS2404 Metrology and Standardization 2 lec., 1 prac., 1 lab. 4 ECTS	FAL3504 Philosophy 2 lec, 2 sem. 4 ECTS	SIM3604 Field of Economics and Management 2 lec., 2 prac., 4 ECTS	XFX4704 Safety in Life Activities 2 lec., 2 prac., 4 ECTS	
MKG1104 Engineering and Computer Graphics 2 lec., 2 prac. 4 ECTS	XT1408 Foreign Language 4 prac. 4 ECTS	EM2308 Electric Machines 3 lec., 2 prac., 2 lab. 8 ECTS	XT1408 Foreign Language 4 prac. 4 ECTS	EKA3504 Ecology 2 lec., 1 prac., 1 lab. 4 ECTS	UPIS3602 Engineering Psychology / GTN3602 General Pedagogy 2 lec., 2 prac. 4 ECTS	RH4810 Relay Protection 2 lec.. 1 prac., 1 lab. 5 ECTS	RH4810 Relay Protection 2 lec., 1 prac., 1 lab. 1 course work 5 ECTS
FIZ1208 Physics 2 lec., 1 prac, 1 lab. 4 ECTS	FIZ1208 Physics 2 lec., 1 prac., 1 lab. 4 ECTS	NET2408 Theoretical Electrotechnics 3 lec., 1 prac., 1 lab. 4 ECTS	NET2408 Theoretical Electrotechnics 2 lec., 1 prac., 1 lab. 4 ECTS	EL3504 Electronics 2 lec., 1 prac., 1 lab. 4 ECTS	MA1819 Qualification practice 7 ECTS	SKET4808 The Power Supply of Industrial Enterprises 2 lec., 1 prac., 1 lab. 4 ECTS	SKET4808 The Power Supply of Industrial Enterprises 2 lec., 1 prac., 1 lab. 1 course project 4 ECTS
OM1314 Higher Mathematics 3 lec., 3 prac. 6 ECTS	OM1314 Higher Mathematics 2 lec, 2 prac. 4 ECTS	OM1314 Higher Mathematics 2 lec, 2 prac. 4 ECTS	MA1819 Qualification practice 6 ECTS	ETT3608 Electrical Networks and Systems 2 lec., 1 prac., 1 lab. 4 ECTS	ETT3608 Electrical Networks and Systems 2 lec., 1 prac., 1 lab., 1 course project 4 ECTS	SHET4808 City Power Supply 2 lec., 1 prac., 1 lab. 4 ECTS	SHET4808 City Power Supply 2 lec., 1 prac., 1 lab. 1 course work 4 ECTS
O'EYT1104 Contemporary History of Uzbekistan 2 lec., 2 sem. 4 ECTS	JTS1202 Physical Education and Sports 2 prac. 2 ECTS	EM2408 Energy Management 1 lec., 1 prac., 1 lab. 3 ECTS	EM2408 Energy Management 2 lec., 2 prac., 1 lab. 5 ECTS	ELXI3610 Electrical Safety and Reliability 2 lec., 1 prac., 1 lab. 4 ECTS	ELXI3610 Electrical Safety and Reliability 2 lec., 1 prac., 1 lab. 6 ECTS	ETTMI4809 Installation and Operation of Electrical Power Systems / EQS4809 Electrical Machine Design 2 lec., 1 prac., 1 lab. 5 ECTS	ETTMI4809 Installation and Operation of Electrical Power Systems / EQS4809 Electrical Machine Design 2 lec., 1 prac., 1 lab. 4 ECTS

TTAT1104 Information Technology in Technical Systems 2 lec., 1 prac., 1 lab. 4 ECTS	KIM1204 Chemistry 2 lec., 1 prac., 1 lab. 4 ECTS	ETQ2408 Electrotechnological Installations 1 lec., 1 prac., 1 lab. 3 ECTS	ETQ2408 Electrotechnological Installations 2 lec., 2 prac., 1 lab. 5 ECTS	SPEQ3506 The Electric Part of the Station and Substation 4 lec., 4 prac. 10 ECTS	IEQ3605 Thermal Energy Devices 3 lec., 3 prac. 5 ECTS	EYO4704 Electric Lighting / YOT4704 Lighting Technique 2 lec., 2 prac. 4 ECTS	RE4806 Digital Power Systems / ENHAT4806 Automated Systems for Electrical Energy Consumption Accounting and Monitoring 2 lec., 2 prac., 2 lab. 6 ECTS
YK1104 Introduction to the Discipline 2 lec, 2 prac. 4 ECTS	EQ1206 Energy Equipment (alternative) / MEM1206 Alternative energy sources 2 lec., 2 prac., 2 lab. 6 ECTS	Mex2404 Mechanics (theoretical and applied) 1 lec., 0,5 prac., 0,5 lab. 2 ECTS	Mex2404 Mechanics (theoretical and applied) 1 lec., 0,5 prac., 0,5 lab. 2 ECTS			O'KI4704 Overvoltage and Insulation / O'J Transient processes 2 lec., 2 prac. 4 ECTS	MA1819 Qualification practice 2 ECTS
	MA1819 Qualification practice 4 ECTS						BMI4805 State attestation 5 ECTS
13 lec. + 13 prac. + 2 lab + 2 sem. = 30 h./week	**8 lec. + 14 prac. + 4 lab. = 26 h./week**	**13 lec. + 8.5 prac. + 6.5 lab. = 28 h./week**	**9 lec. + 10,5 prac. + 4,5 lab. = 24 h./week**	**14 lec. + 8 prac. + 4 lab. + 2 sem = 28 h./week**	**11 lec. + 7 prac. + 2 lab. +2 sem. = 22 h./week**	**14 lec. + 10 prac. + 4 lab. = 28 h./week**	**10 lec. + 6 prac. + 6 lab. = 22 h./week**
7 exam	**7 exam 1 practic report**	**7 exam**	**6 exam 1 practic report**	**6 exam**	**5 exam 1 course work 1 practic report**	**7 exam**	**5 exam 3 course work 1 practic report State exam**
30 ECTS	**30 ECTS**	**30 ECTS**	**30 ECTS**	**30 ECTS**	**30 ECTS**	**30 ECTS**	**30 ECTS**
Total						**240 ECTS**	
Component by selection 4 ECTS (13,33%)	**Component by selection 5 ECTS (16.7%)**	**Component by selection 6 ECTS (20%)**	**Component by selection 0 ECTS (0 %)**	**Component by selection 9 ECTS (30 %)**	**Component by selection 4 ECTS (13.33%)**	**Component by selection 8 ECTS (26.7%)**	**Component by selection 7 ECTS (23.33%)**

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

“LO 1 Able to competently express your speeches in Russian and foreign languages

LO 2 A way of using information and pedagogical technologies in pedagogical activity and effectively using engineering and technical knowledge in conducting scientific research and developing energy solutions

LO 3 Capable of participating in scientific seminars, conferences, and symposiums, developing research projects; acquiring skills in conducting scientific and applied research, processing experimental results, and making scientifically justified conclusions ba sed on them, as well as preparing and editing scientific articles

LO 4 Able to calculate and select types of protection and automation of power supply systems based on complex relay protection devices and automation of microprocessor complexes using the theory of control and regulation of processes in power plants and techni ques, as well as intelligent methods for solving energy problems that ensure the reliability of power supply and nominal quality indicators electricity

LO 5 Capable of diagnosing and monitoring work relay protection devices and electrical automation of power supply systems using modern microprocessor devices, as well as design relay protection and automation of power supply systems, having the skills to work with digital technology and microprocessor systems

LO 6 Able to conduct energy surveys during the operation of electrical equipment of power supply systems, carrying out metrological verification of the primary means of measuring parameters and monitoring the quality of functioning and management of electrical facilities, observing energy efficiency and reliability of power supply systems

LO 7 Able to develop and implement measures for the rational use of energy resources in the system power supply of industrial enterprises and cities using methods of optimization, regulation, management, and ensuring the reliability of the power supply

LO 8 Ability to use modern methods of designing power supply systems for industrial enterprises and cities and their feasibility study, using modern methods of reactive power compensation and calculation of electrical loads, as well as the ability to control compliance with regulatory standards in the energy sector during design.”

The following **curriculum** is presented:

Curriculum for master's EP MA 70710601- Power Supply (Industrial Enterprises and Cities)

1 semester	2 semester	3 semester	4 semester
Scientific activity 50%			
ITIMDT1430 Preparation and Defence of Scientific Research Work and Master's Thesis 4 ECTS	ITIMDT1430 Preparation and Defence of Scientific Research Work and Master's Thesis 4 ECTS	ITIMDT1430 Preparation and Defence of Scientific Research Work and Master's Thesis 4 ECTS	ITIMDT1430 Preparation and Defence of Scientific Research Work and Master's Thesis 18 ECTS
IPI1414 Scientific and Pedagogical Work 2 ECTS	IPI1414 Scientific and Pedagogical Work 2 ECTS	IPI1414 Scientific and Pedagogical Work 4 ECTS	IPI1414 Scientific and Pedagogical Work 6 ECTS
		IA2416 Scientific Practice (Experience Enhancement) 10 ECTS	IA2416 Scientific Practice (Experience Enhancement) 6 ECTS
Required subjects 30%			
AXT1104 Applied Foreign Language 4 prac. 4 ECTS	ITM1204 Scientific Research Methodology 2 lec, 2 prac. 4 ECTS	ABRN2306 Theory of Automatic Control and Regulation 3 lec, 3 prac. 6 ECTS	
ETTRHA1210 Relay Protection and Automation of the Power Supply System 2 lec., 2 prac., 2 lab. 6 ECTS	ETTRHA1210 Relay Protection and Automation of the Power Supply System 2 lec., 2 prac. 1 course project 4 ECTS		
EESK1208 Quality Indicators of Electrical Energy 2 lec., 2 prac. 4 ECTS	EESK1208 Quality Indicators of Electrical Energy 2 lec., 2 prac. 4 ECTS		
	EAUJ1204 Energy Audit Methods and Equipment 2 lec, 2 prac. 4 ECTS		
	RQK1204 Reactive Power Compensation 2 lec, 2 prac. 4 ECTS		
Optionally 20%			
ERFEESM106 Measuring the Rational Use of Energy and Electricity Consumption / **ETTE1106** Energy Efficiency in the Electric Power Supply System 3 lec, 3 prac. 6 ECTS		**SSHEYHU2306** Methods of Calculating Electrical Loads for Industrial Enterprises and Urban Consumers / **SKSHETL2306** Design the Electrical Supply for Industrial Enterprises and Cities 3 lec, 3 prac.	

1 semester	2 semester	3 semester	4 semester
ETTOB1208 Optimisation and Management in the Electric Power Supply System / **ETTI1208** Reliability of Power Supply Systems 2 lec, 2 prac. 4 ECTS	**ETTOB1208** Optimisation and Management in the Electric Power Supply System / **ETTI1208** Reliability of Power Supply Systems 2 lec, 2 prac. 4 ECTS	6 ECTS	
9 lec. + 13 prac. + 2 lab. = 24 h./week	**12 lec. + 12 prac. + 0 lab. = 24 h./week**	**6 lec. + 6 prac. + 0 lab. = 12 h./week**	**0 lec. + 0 prac. + 0 lab. = 0 h./week**
5 exam	**6 exam 2 course work**	**2 exam 1 practic report**	**1 practic report**
30 ECTS	**30 ECTS**	**30 ECTS**	**30 ECTS**
Total	**120 ECTS**		
Component by selection 10 ECTS (33.3 %)	**Component by selection 4 ECTS (13.33%)**	**Component by selection 6 ECTS (20%)**	**Component by selection 0 ECTS (0%)**

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

“LO 1 Able to competently express his speeches in Uzbek, Russian and foreign languages

LO 2 Able to make decisions based on information of philosophical and historical content, methods of discussion and polemics, engineering psychology and pedagogy

LO 3 Able to make decisions based on information about health, safety, and work in the workplace, applying methods to ensure the safety of social systems for the preservation, development and effective functioning of the individual, society

LO 4 Able to apply basic and exceptional knowledge in th e field of mathematical, natural, and technical sciences in complex engineering activities using the results of the latest scientific achievements in the field of physics, mechanics and the laws of higher mathematics to solve computational problems and simulate processes in power plants and systems

LO 5 Able to develop solutions using the laws of electronics and electrical engineering, intelligent systems for solving energy problems, as well as economic laws and the theo ry of process control in power plant s and systems

LO 6 Able to carry out maintenance of electric power installations and systems, carrying out metrological verification of the primary means of measuring parameters and control over the quality of functioning and management of electrical objects

LO 7 Able to understand and analyse the complex phenomena associated with grinding, crushing, sorting and beneficiation of ores in order to prepare them for processing in metallurgical plants using an extensive and thorough basic knowledge of chemistry, science and engineering

LO 8 Able to make decisions based on information about health, safety and work in the workplace, applying methods to ensure the safety of social systems for the preservation, development and effective functioning of the individual and society

LO 9 Able to calculate the parameters of metallurgical processes, analyse processes in metallurgical systems, using the results of the latest scientific achievements in the field of metallurgy and inorganic chemistry to solve computational problems and simulate processes in reaction systems

LO 10 Able to understand and analyse complex phenomena in electrical and electronic engineering using a broad and solid background in mathematics, science and engineering

LO 11 Able to understand and analyse complex phenomena occurring in the equipment of pyrometallurgical and hydrometallurgical plants, in the machines of concentrating plants, using a broad and solid knowledge of metallurgical sciences

LO 12 Able to calculate the parameters, characteristics, selection, automated systems of equipment of metallurgical plants and processing plants, as well as installations for the transportation of metallurgical raw materials

LO 13 Able to determine the chemical and material composition of metallurgical raw materials, technological and mechanical properties of products, as well as the corresponding parameters of composite materials of a new design, using analytical methods in accordance with the standards of the metallurgical industry

LO 14 Able to calculate and select quantitative and sludge schemes for the extraction of gold, silver and similar precious metals based on the complex processing of quartz and sulfide ores containing precious metals

LO 15 Able to diagnose and control the process and technology of extracting precious metals from ores and concentrates, developing methods for intensifying the process, reducing the loss of precious metals with waste, as well as developing technologies for extracting metals from raw materials containing precious metals, having the skills to work with waste free technology and environmental protection systems environment

LO 16 Able to independently study the processes of steelmaking and ferroalloy production, obtaining ferroalloys of a new composition and testing them, electrothermal treatment of

solid scrap metal or secondary alloys, diagnostics of systems for improving the quality of steel and ferroalloys of a new design

LO 17 Able to develop and introduce into the main producti on technologies for the processing o f industrial waste from metallurgical production, corresponding to the additional extraction of non ferrous metals in the main volume of production indicators, using metallurgical slag, dust, and waste from enrichment processes

LO 18 Able to use metallurgical technologies in practice and effectively use engineering and technical knowledge when conducting qualifying training and processing the results of experiments and drawing reasonable conclusions based on them."

The following **curriculum** is presented:

Curriculum for Bachelor's EP BA 60712100-Metallurgy

1 Semester	2 Semester	3 Semester	4 Semester	5 Semester	6 Semester	7 Semester	8 Semester
O'EYT1104 The newest history of Uzbekistan 2 lec., 2 sem. 4 ECTS	MA1206 Fundamentals of metallurgy 3 lec., 2 prac., 1 lab. 6 ECTS	MT2304 Metal science 2 lec, 1 prac., 1 lab. 4 ECTS	MS2404 Metrology and standardisation 2 lec., 1 prac., 1 lab. 4 ECTS	FAL3504 Philosophy 2 lec, 2 sem. 4 ECTS	SIM3604 Industrial Economics and Management 2 lec., 2 prac., 4 ECTS	XFX4704 Life Safety 2 lec., 2 prac., 4 ECTS	MZMD4809 Mechanical equipment of the metallurgical factory 2 lec., 2 prac., 1 lab. 5 ECTS
TTAT1104 Information technologies in technical systems 2 lec., 1 prac., 1 lab 4 ECTS	KIM1204 General and inorganic chemistry 2 lec., 1 prac., 1 lab. 4 ECTS	KIM1204 General and inorganic chemistry 2 lec., 1 prac., 1 lab. 4 ECTS	ELTEX2404 Electrical and electronics 2 lec., 1 prac., 1 lab. 4 ECTS	EKA3504 Ecology 2 lec., 1 prac., 1 lab. 4 ECTS	MP3604 Engineering psychology / UP3604 General pedagogy 2 lec., 2 sem. 4 ECTS	MZMD4809 Mechanical equipment of the metallurgical factory 2 lec., 1 prac, 1 lab. 4 ECTS	PICHT4810 Steel production technology 2 lec., 2 prac. 4 ECTS
MKG1104 Engineering and computer graphics 2 lec., 2 prac. 4 ECTS	XT1408 Foreign language 4 prac. 4 ECTS	RQIT2308 Preparation of ores for processing 4 lec., 2 prac., 2 lab. 8 ECTS	XT1408 Foreign language 4 prac. 4 ECTS	PMJM3608 Theory of pyrometallurgical processes 3 lec., 1 prac., 4 ECTS	PMJM3608 Theory of pyrometallurgical processes 2 lec, 1 prac., 1 lab., 4 ECTS	PICHT4810 Steel production technology 2 lec, 2 prac, 2 course project 6 ECTS	ORMM4808 Metallurgy of heavy non-ferrous metals 2 lec, 1 prac., 1 lab. 4 ECTS course project
O'RT1206 Uzbek (Russian) language 4 prac. 4 ECTS	O'RT1206 Uzbek (Russian) language 2 prac. 2 ECTS	MJIM2412 Heat and mass transfer in metallurgical processes 3 lec., 2 prac., 1 lab. 2- course project 8 ECTS	MJIM2412 Heat and mass transfer in metallurgical processes 2 lec., 1 prac., 1 lab. 4 ECTS	GMJN3610 Theory of hydrometallurgical processes 3 lec., 1 prac., 4 ECTS	GMJN3610 Theory of hydrometallurgical processes 2 lec., 2 prac., 2 lab., 6 ECTS	ORMM4808 Metallurgy of heavy non-ferrous metals 2 lec., 1 prac., 1 lab. 4 ECTS	MXKF4807 Complex use of raw materials in metallurgy 1 lec, 1 prac., 1 lab 3 ECTS
FIZ1208 Physics 2 lec., 1 prac., 1 lab.	FIZ1208 Physics 2 lec., 1 prac., 1 lab.	TFKU2306 Physico-chemical methods of analysis / MRT2306 Resource-saving technologies in metallurgy	MR2408 Metals recycling 4 lec, 3 prac., 1 lab.	MBJ3504 Biotechnological processes in metallurgy/ MZL3504 Design of metallurgical plants 2 lec., 2 prac,	NMM3605 Metallurgy of rare metals 3 lec, 2 prac.,	MXKF4807 Complex use of raw materials in metallurgy 2 lec, 1 prac., 1 lab.,	PFEM4808 Steel and ferroalloys electrometallurgy / TXQI4808 Processing of technogenic raw materials 2 lec, 2 prac.

1 Semester	2 Semester	3 Semester	4 Semester	5 Semester	6 Semester	7 Semester	8 Semester
4 ECTS	4 ECTS	3 lec., 1.5 prac., 1,5 lab. 6 ECTS	8 ECTS	4 ECTS	5 ECTS	4 ECTS	4 ECTS
OM1313 Higher mathematics 3 lec., 3 prac. 6 ECTS	OM1313 Higher mathematics 2 lec, 2 prac. 4 ECTS		MA1829 Qualification practice 6 ECTS	FM3505 Civil defence/ TBA3505 Basics of medical knowledge 3 lec, 2 sem 5 ECTS	MA1829 Qualification practice 7 ECTS	PFEM4808 Steel and ferroalloys electrometallurgy / TXQI4808 Processing of technogenic raw materials 2 lec, 2 prac. 4 ECTS	NMM4807 Precious metal metallurgy / EMM4807 Metallurgy of lightweight metals 2 lec, 1 prac., 3 ECTS
YK1104 Introduction to speciality/ UM1104 General metallurgy 2 lec., 1 prac., 1 lab. 4 ECTS	JTS1202 Physical education and sports 2 prac. 2 ECTS			TRBO3505 Direct extraction of iron from ore 3 lec, 2 prac, 5 ECTS		NMM4807 Precious metal metallurgy / EMM4807 Metallurgy of lightweight metals 2 lec, 1 prac, 1 lab. 4 ECTS	MA1829 Qualification practice 2 ECTS
	MA1829 Qualification practice 4 ECTS						State certification 5 ECTS
13 lec. + 12 prac. + 3 lab + 2 sem. = 30 h./week **7 exam**	**9 lec. + 14 prac. + 3 lab. = 26 h./week** **7 exam 1 practice report**	**14 lec. + 7.5 prac. + 6.5 lab. = 28 h./week** **5 exam 1 course project**	**10 lec. + 10 prac. + 4 lab. = 24 h./week** **5 exam 1 practice report**	**18 lec. + 7 prac. + 1 lab. + 4 sem = 30 h./week** **7 exam**	**11 lec. + 7 prac. + 3 lab. +2 sem. = 23 h./week** **5 exam 1 practice report**	**14 lec. + 10 prac. + 4 lab. = 28 h./week** **7 exam 1 course project**	**11 lec. + 9 prac. + 3 lab. = 23 h./week** **6 exam 1 course project 1 practice report State exam**
30 ECTS	**30 ECTS**	**30 ECTS**	**30 ECTS**	**30 ECTS**	**30 ECTS**	**30 ECTS**	**30 ECTS**
Total						**240 ECTS**	
Component by selection 4 ECTS (13,33%)	**Component by selection 0ECTS (0%)**	**Component by selection 6 ECTS (20%)**	**Component by selection 0 ECTS (0 %)**	**Component by selection 9 ECTS (30 %)**	**Component by selection 4 ECTS (13.33%)**	**Component by selection 8 ECTS (26.7%)**	**Component by selection 7 ECTS (23.33%)**

According to the Diploma Supplement, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Metallurgy (non-ferrous metals):

“LO 1 Able to competently express his speeches in Russian and foreign languages

LO 2 Able to use the information and pedagogical technologies in teaching activities and effectively use engineering and technical knowledge in conducting scientific research and developing energy solutions

LO 3 Able to participate in scientific seminars, conferences and symposiums, development of scientific projects; to acquire the skills of conducting scientific, applied research, processing the results of experiments and drawing scientifically based conclusions on their basis, preparing and editing scientific articles

LO 4 Able to know and be able to analyse the state and use of resources containing non ferrous metals; be able to introduce the technology of integrated use of raw materials containing non ferrous metals in production; develop technologies for processing waste from non ferrous metal production; forecast opportunities to increase the extraction of additional types of non ferrous metals; to create new technologies for the extraction of non ferrous metals from challenging to enrich ones

LO 5 Able to conduct metallurgical research to determine the components of non ferrous metal ores, with the correct selection of appropriate e quipment and develop technologies for the effective extraction of non ferrous metals from polymetallic, infusible, and refractory ores, as well as the choice of effective enrichment methods that reduce the transfer of metals to waste.

LO 6 Able to develop and introduce into the main production technologies for the processing of industrial waste from metallurgical production, corresponding to the additional extraction of non ferrous metals in the main volume of production indicators, using metallurgical slag , dust, and waste from enrichment

LO 7 Able to use modern methods of analysis with the use of promising, modern equipment that gives accurate research results, organize new research methods to determine new ways to develop technologies for the processing of metal containing raw mate ials, as well as the ability to control the progress of research work in laboratory and industrial conditions, processing the results research, compliance with research standards that exist in metallurgical enterprises.”

The following **curriculum** is presented:

Curriculum for master's EP MA 70712101-Metallurgy (non-ferrous metals)

1 Semester	2 Semester	3 Semester	4 Semester
Scientific activity 50%			
ITIMDT1430 Preparation and defence of research work and master's dissertation 4 ECTS	ITIMDT1430 Preparation and defence of research work and master's dissertation 4 ECTS	ITIMDT1430 Preparation and defence of research work and master's dissertation 4 ECTS	ITIMDT1430 Preparation and defence of research work and master's dissertation 18 ECTS
IPI1414 Scientific and pedagogical work 2 ECTS	IPI1414 Scientific and pedagogical work 2 ECTS	IPI1414 Scientific and pedagogical work 4 ECTS	IPI1414 Scientific and pedagogical work 6 ECTS
		IA2416 Scientific practice 10 ECTS	IA2416 Scientific practice 6 ECTS
Mandatory subjects 30%			
AXT1104 Practical foreign language 4 prac. 4 ECTS	MFO'M1204 Methodology of teaching special subjects 2 lec, 2 prac. 4 ECTS	TCHQIT2306 Technologies for the processing of industrial waste 3 lec, 3 prac. 6 ECTS	
RMYT1208 New technologies in non-ferrous metallurgy 2 lec., 2 prac. 4 ECTS	RMYT1208 New technologies in non-ferrous metallurgy 2 lec., 2 prac. 4 ECTS course project		
MJTK1210 Thermodynamics and kinetics of metallurgical processes 4 lec., 2 prac 6 ECTS	MJTK1210 Thermodynamics and kinetics of metallurgical processes 2 lec, 2 prac. 4 ECTS		
	ITM1204 Methodology of scientific research 2 lec, 2 prac. 4 ECTS		
	RMRQITJ1204 Technological processes of recycling non-ferrous metal ores 2 lec, 2 prac. 4 ECTS		
By selection, 20%			
RMTJ1106 Reduction processes in non-ferrous metallurgy/ **RMKL1106**		**RMAJ2306** Autogenous processes in non-ferrous metallurgy / **ENIBUSH2306**	

1 Semester	2 Semester	3 Semester	4 Semester
Design of non-ferrous metallurgical enterprises 3 lec, 3 prac. 6 ECTS		Processing of experimental results and their formulation 3 lec, 3 prac. 6 ECTS	
MICHEM1208 Environmental problems of the metallurgical industry / **RMCHT1208** Waste-free technologies in non-ferrous metallurgy 2 lec, 2 prac. 4 ECTS	**MICHEM1208** Environmental problems of the metallurgical industry / **RMCHT1208** Waste-free technologies in non-ferrous metallurgy 2 lec , 2 prac. 4 ECTS		
11 lec. + 13 prac. + 0 lab. = 24 h./week	**12 lec. + 12 prac. + 0 lab. = 24 h./week**	**6 lec. + 6 prac. + 0 lab. = 12 h./week**	**0 lec. + 0 prac. + 0 lab. = 0 h./week**
5 exam	**6 exam** **1 course work**	**2 exam** **1 practic report**	**1 practic report**
30 ECTS	**30 ECTS**	**30 ECTS**	**30 ECTS**
Total	**120 ECTS**		
Component by selection 10 ECTS (33.3 %)	**Component by selection 4 ECTS (13.33%)**	**Component by selection 6 ECTS (20%)**	**Component by selection 0 ECTS (0%)**