ASIIN Seal & European Labels

Accreditation Report

Bachelor's and Master´s Degree Programmes
Material Science and Technologies of new Materials
Metallurgy

Provided by

Satpaev Kazak National Research Technical University, Almaty Republic of Kazakhstan

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A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
5B070900 Металлургия	Ba Metallurgy	ASIIN, EUR-ACE® Label	--	05
6M070900 Металлургия	Ma Metallurgy	ASIIN, EUR-ACE® Label	--	05
5B071000 Материаловедение и технология новых материалов	Ba Material Science and Technologies of new Materials	ASIIN, EUR-ACE® Label	ASIIN 2011-2016	05
6M071000 Материаловедение и технология новых материалов	Ma Material Science and Technologies of new Materials	ASIIN, EUR-ACE® Label	--	05
Date of the contract: 18.09.2015 **Submission of the final version of the self-assessment report:** 06.04.2016 **Date of the onsite visit:** 11.05/12.05.2016 **at:**				
Peer panel: Tilegen Kassymov, Student peer Eurasian National University Astana; Prof. Dr. Heinz Palkowski, Clausthal University of Technology; Prof. Dr. Hadi Mozaffari-Jovein, University of applied Science, Furtwangen;				

[1] ASIIN Seal for degree programmes; EUR-ACE® Label: European Label for Engineering Programmes
[2] TC: Technical Committee for the following subject areas: TC 05 – Physical Technologies

Prof. Dr. Daisy Nestler, Technical University Chemnitz; Winfried Messmann, WIMECO	
Representative of the ASIIN headquarter: Dr. Alexander Weber	
Responsible decision-making committee: Accreditation Commission for Degree Programmes	
Criteria used: European Standards and Guidelines as of 15.05.2015 ASIIN General Criteria, as of 04.12.2014 Subject-Specific Criteria of Technical Committee 05 – Physical Technologies, Materials and Processes as of 09. December 2011	

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
Metallugry/B.Eng.	Бакалавр/Bachelor of Science	--	6	Full time	--	8 Semester	129 KZ Credits/240 ECTS	Fall Semester/Fall 2001
Metallurgy/M.Sc.	Магистр /Master of Science/.	--	7	Full time	--	4 Semester	42 KZ Credits/120 ECTS	Fall Semester/Fall 2001
Material Science and Technologies of new Materials/	Бакалавр материаловедения и технологии новых материалов/Bachelor of Material Science and Technologies of new Materials	--	6	Full time	--	8 Semester	129 KZ Credits/240 ECTS	Fall Semester/Fall 2001
Material Science and Technologies of new Materials/M.tec. sc.	Магистр технических наук/Master of Technical Science	--	7	Full time	--	4 Semester	42 KZ Credits/120 ECTS	Fall Semester/Fall 2001

For the Bachelor's degree programme Metallurgy the institution has presented the following profile in the self-assessment report:

The aim of OP 5B071000 "Materials science and technology of new materials" is to ensure the preparation of educated and professionally competent Bachelor of Science in the field of new materials and advanced technologies for obtaining and processing materials.

The contents of OP "Materials science and technology of new materials" through the development of multi-level training system, basic and quality education, continuity of edu-

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

cation and science, the unity of teaching, education, research and innovation activities aimed at maximizing customer satisfaction should provide the following results:

- Receive full and high-quality vocational education in the field of materials science, confirmed the level of skills and knowledge, skills and competences on the basis established by the State general education standard criteria of their evaluation, both in content and volume;

- Providing bachelor for various industries, know the methods and principles of research, design, manufacture and operation of materials and engineering products;

- Professional training and competitive professionals in the field of materials science and development of new materials and technologies make the necessary properties to materials, equipment, and production management;

- Ability to apply knowledge of mathematics, basic sciences and engineering;

- Promote the use of methods of analysis and evaluation of experiments;

- Knowledge of modern manufacturing problems;

- Formulation of basic technical and economic requirements for equipment, methods and modes of preparation of the starting material, the heating mode, the shutter speed and cooling to obtain the desired properties and product quality;

- To promote the acquisition of skills to obtain new materials and their processing, mathematical processing of research results, preparation of technological roadmaps processes using modern information technologies;

- The ability to use the methods of analysis and evaluation of experiments;

- The ability to use the techniques, skills and modern engineering tools necessary in engineering practice;

- The ability to find and work with the necessary literature, computer information, databases and other sources of information for the task;

- Formation of students' skills in teamwork, productive and ethical responsibility, the ability to understand the problem and by working together with various specialists to find options for solutions, the need to improve their knowledge and skills;

- The ability to position themselves in the solution of technical problems and the formulation of a common information space in the machine-building enterprises;

- The ability to communicate effectively and work in a team;

- The ability to work in a team of multi-disciplinary subject, with the show individuality, and, if necessary, to solve problems on their own;

- The willingness of students to professional work through the disciplines that provide the fundamental knowledge and skills to work in the engineering industry, government organizations and educational institutions;

- Ability to apply knowledge of mathematics, basic sciences and engineering;

- The ability to position themselves in the solution of technical problems and the formulation of a common information space in the machine-building enterprises;

- The ability to use the techniques, skills and modern engineering tools necessary in engineering practice;

- Knowledge of contemporary social and political issues, know the state and foreign languages, the tools of the market economy, safety and environmental protection.

For the Master's degree programme Metallurgy the institution has presented the following profile in the self-assessment report:

The aim of OP 6M071000 "Materials science and technology of new materials" is to train specialists (Masters), capable of solving scientific problems of modern materials science, new materials and study their properties, the issues and the development of technology for designing materials with desired properties.

The contents of OP "Materials science and technology of new materials" through the development of multi-level training system, basic and quality education, continuity of education and science, the unity of teaching, education, research and innovation activities aimed at maximizing customer satisfaction should provide the following results:

- Training for research activities in the field of materials science and the development of new materials and technologies;

- Preparation of professional and competitive specialists in the field of materials science and development of new materials and technologies make the necessary properties to materials, equipment, and production management;

- Have an understanding of modern methods of teaching in universities and colleges, about modern methods of research work, the work of professionals in industry and research institutions;

- Practical skills for obtaining new materials and their processing, mathematical processing of research results, preparation of technological roadmaps processes using modern information technologies.

For the Bachelor's degree programme Material Science and Technologies of new Materials the institution has presented the following profile in the self-assessment report:

The aim of OP 5B071000 "Materials science and technology of new materials" is to ensure the preparation of educated and professionally competent Bachelor of Science in the field of new materials and advanced technologies for obtaining and processing materials.

The contents of OP "Materials science and technology of new materials" through the development of multi-level training system, basic and quality education, continuity of education and science, the unity of teaching, education, research and innovation activities aimed at maximizing customer satisfaction should provide the following results:

- Receive full and high-quality vocational education in the field of materials science, confirmed the level of skills and knowledge, skills and competences on the basis established by the State general education standard criteria of their evaluation, both in content and volume;

- Providing bachelor for various industries, know the methods and principles of research, design, manufacture and operation of materials and engineering products;

- Professional training and competitive professionals in the field of materials science and development of new materials and technologies make the necessary properties to materials, equipment, and production management;

- Ability to apply knowledge of mathematics, basic sciences and engineering;

- Promote the use of methods of analysis and evaluation of experiments;

- Knowledge of modern manufacturing problems;

- Formulation of basic technical and economic requirements for equipment, methods and modes of preparation of the starting material, the heating mode, the shutter speed and cooling to obtain the desired properties and product quality;

- To promote the acquisition of skills to obtain new materials and their processing, mathematical processing of research results, preparation of technological roadmaps processes using modern information technologies;

- The ability to use the methods of analysis and evaluation of experiments;

- The ability to use the techniques, skills and modern engineering tools necessary in engineering practice;

- The ability to find and work with the necessary literature, computer information, databases and other sources of information for the task;

- Formation of students' skills in teamwork, productive and ethical responsibility, the ability to understand the problem and by working together with various specialists to find options for solutions, the need to improve their knowledge and skills;

- The ability to position themselves in the solution of technical problems and the formulation of a common information space in the machine-building enterprises;

- The ability to communicate effectively and work in a team;

- The ability to work in a team of multi-disciplinary subject, with the show individuality, and, if necessary, to solve problems on their own;

- The willingness of students to professional work through the disciplines that provide the fundamental knowledge and skills to work in the engineering industry, government organizations and educational institutions;

- Ability to apply knowledge of mathematics, basic sciences and engineering;

- The ability to position themselves in the solution of technical problems and the formulation of a common information space in the machine-building enterprises;

- The ability to use the techniques, skills and modern engineering tools necessary in engineering practice;

- Knowledge of contemporary social and political issues, know the state and foreign languages, the tools of the market economy, safety and environmental protection.

For the Master´s degree programme Material Science and Technologies of new Materials the institution has presented the following profile in the self-assessment report:

The aim of OP 6M071000 "Materials science and technology of new materials" is to train specialists (Masters), capable of solving scientific problems of modern materials science, new materials and study their properties, the issues and the development of technology for designing materials with desired properties.

The contents of OP "Materials science and technology of new materials" through the development of multi-level training system, basic and quality education, continuity of edu-

cation and science, the unity of teaching, education, research and innovation activities aimed at maximizing customer satisfaction should provide the following results:

- Training for research activities in the field of materials science and the development of new materials and technologies;

- Preparation of professional and competitive specialists in the field of materials science and development of new materials and technologies make the necessary properties to materials, equipment, and production management;

- Have an understanding of modern methods of teaching in universities and colleges, about modern methods of research work, the work of professionals in industry and research institutions;

- Practical skills for obtaining new materials and their processing, mathematical processing of research results, preparation of technological roadmaps processes using modern information technologies.

C Peer 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:

- KazNRTU – Self Assessment Report 5B01700 and 6M071000 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M071000 Metallurgy
- KazNRTU – Matrix of objectives and modules for specialty 5B01700 Material Science and Technology of new Materials
- KazNRTU – Matrix of objectives and modules for specialty 6M01700 Material Science and Technology of new Materials
- KazNRTU – Matrix of objectives and modules for specialty 5B070900 Metallurgy
- KazNRTU – Matrix of objectives and modules for specialty 6M070900 Metallurgy
- KazNRTU – Engineers profile. Speciality Material Science and Technology of new Materials
- KazNRTU – Engineers profile. 5B70900 Metallurgy, 6M070900 Metallurgy
- Audit discussion May 11th-12th 2016

Preliminary assessment and analysis of the peers:

For all study programs under review detailed and more or less conclusive overall objectives and learning outcomes have been defined and, along with that, program-specific graduates profiles. As far as the peers can see these profiles are presented in the self assessment report (SAR) only. Following that, their public availability and liability remain to certain extend unclear. The respective information can´t be found on the departments´

[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.

websites, at least at first glance. In a more general manner the academic and professional profiles of the study programmes are summed up in the so called “Engineers profile. Speciality Material Science and Technology of new Materials” and “Engineers profile. 5B70900 Metallurgy, 6M070900 Metallurgy”. Although these documents seem to be officially adopted by the University and obviously the Ministry of Education as well, their legal status is not fully clear. However programme coordinators and students stress that legally binding information about objectives and structures of degree courses is provided via a so called “syllabus”.

As stated above the peers assess the objectives and learning outcomes laid down in the SAR to be principally plausible and meaningful. Nevertheless, the form of presentation gives a reason for criticism: The description is quite extensive, not well structured and, as a result, confusing and difficult to read: In case of 5B01700 and 6M071000 Material Science and Technology of new Materials the overall objectives are spread over 14, for the 5B070900 and 6M070900 Metallurgy over 15 text pages. Moreover Bachelors and Masters competences are not clearly separated, but intermixed to some extent. In this respect the module-objective matrices are easier to handle. Moreover, on the basis of these module-objective-matrices the Higher Education Institution (HEI) proves that the learning objectives for all degree programs are equivalent to the exemplary learning outcomes described in the ASIIN Subject Specific Criteria (SSC) of the Technical Committee 05 – Physical Technologies, Materials and Procedures. On programme level the different fields of subject related competences related to “Knowledge and Understanding”, “Engineering Analysis”, “Engineering Design”, “Research and Evaluation” and “Engineering Practice” are addressed by at least two learning objectives respectively. The so-called interdisciplinary competences are likewise considered adequate for all four study programmes under review.

In sum, the peers see the need to describe the objectives and learning outcomes of the degree programmes in a *brief* and *concise* way. Furthermore, they underline that based on the information at hand, an assessment whether the learning objectives are publicly available and fixed in a binding form isn´t possible. Therefore they ask the HEI for further information regarding this issue. In addition for all programs under review the so called “Syllabi” should be delivered.

Criterion 1.2 Name of the degree programme

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M071000 Material Science and Technology of new Materials

- KazNRTU – Self Assessment Report 5B070900 and 6M071000 Metallurgy
- KazNRTU – Engineers profile. Speciality Material Science and Technology of new Materials
- KazNRTU – Engineers profile. 5B70900 Metallurgy, 6M070900 Metallurgy
- Audit discussions May 11th-12th 2016

Preliminary assessment and analysis of the peers:
Educational level, profiles and names of the degree programs are set according to a digital and letter based classifier system prescribed by the Ministry of Education. As the teaching language is mainly Russian the degree programs are named in this language. The English translations 5B070900 and 6M070900 Metallurgy and 5B01700 and 6M01700 Material Science and Technologies of new Materials properly reflect the intended learning outcomes.

Criterion 1.3 Curriculum

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU – Module Handbook 5B01700 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 6M07100 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 5B070900 Metallurgy
- KazNRTU – Module Handbook 6M070900 Metallurgy
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 5B01700 Material Science and Technology of New Materials
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 6M01700 Material Science and Technology of New Materials
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 5B070900 Metallurgy

- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 6M070900 Metallurgy
- KazNRTU – Matrix of objectives and modules for specialty 5B01700 Material Science and Technology of new Materials
- KazNRTU – Matrix of objectives and modules for specialty 6M01700 Material Science and Technology of new Materials
- KazNRTU – Matrix of objectives and modules for specialty 5B070900 Metallurgy
- KazNRTU – Matrix of objectives and modules for specialty 6M070900 Metallurgy
- Audit discussions May 11th-12th 2016

Preliminary assessment and analysis of the peers:
The peers know that the content of educational programs in Kazakhstan is to some extend prescribed by so called “modular curricula” provided by the Ministry of Education. In this respect the remaining scope of action of the HEI can hardly be estimated much less quantified. On the one hand, the HEI states that the status of a “national research university” brings with certain autonomy in the composition of educational programmes. On the other hand the program coordinators claim that potential changes are strictly limited by the provisions of the ministry. This notwithstanding, the peers learn that the study programs are nevertheless further developed on a regular basis. They deem it laudable that thereby, as the industry representatives confirm, the needs of a regional labour market are taken into account.

As primary and secondary education at schools in Kazakhstan last 11 years only it is understandable that educational-programs contain general-education subjects like history, sociology or economics as compulsory components. Therefore the peers assess the consideration of general educational subjects in principal to be plausible. Regarding the Bachelor programs it is nevertheless remarkable that the value of these topics is disproportional high as compared to the subject-specific disciplines. As for example some important subject-related competences are not pronounced properly (see below), it is hardly understandable that non subject-specific modules make up roughly one quarter of the Bachelors´ curricula. The peers learn that students and program coordinators are aware of this problem principally. In this respect, the auditors acknowledge that there are discussions about whether some of these general educational subjects should be shifted to secondary education. Against this background the peers advise the HEI to consider whether the proportion of these general educational topics can be reduced in favour of the subject-related content.

The HEI provides module-objective-matrices for all study programs under review. From the peers point of view these matrices are proof that at least large parts of the overall objectives are properly implemented. Nevertheless there are some questions left:

In terms of the Bachelors curricula some of the natural-scientific and mathematical basic competencies are apparently imparted in a reversed order: In particular, it is striking that the teaching unit “Physics I” is provided for the first semester and, with that, prior to the module “Mathematics I” that is planned for the second semester. As the content of “Physics I” usually requires some basic mathematical knowledge, the peers wonder, whether this approach is indeed suitable for a structured acquisition of competencies. The program coordinators vindicate this structure first of all by means of strict provisions of the Ministry of Education. Moreover, they stress that basic mathematical competencies are subject to many other disciplines as well. Also the students do not assess this issue as problematical. They indicate that the module “Physics I” can be handled without any problems, just with mathematical school-knowledge. The peers take note that this approach apparently is well accepted amongst students´ and teaching staff. Notwithstanding the peer panel still has certain doubts regarding its expediency. Therefore the auditors recommend rethinking the structure of the curricula in terms of the sequence of the natural-scientific and mathematical basic modules.

The curriculum of the Bachelor 5B01700 Material Science and Technologies of new Materials is roughly structured along the topical sections (1) historical and social modules, (2) language modules, (3) health and safety modules, (4) mathematical and informatics related modules, (5) natural science modules, (6) general technical modules, (7) methodology for selecting materials and technologies for their treatment, (8) design, engineering and production economics and (9) structural and engineering material. In this framework, it is remarkable that in sections 6-9, which constitute the core curriculum of the specialty, hardly any compulsory components are included. As a rule, students may choose one out of two or three fixed modules instead. Taking a look at the options provided, the peers have serious doubts, that all basic topics are covered. To give only a few examples for this issue, the auditors refer to the module-numbers 2.2.7. (Either theoretical mechanics *or* applied mechanics), 2.2.8. (Either material science *or* structural materials and heat treatment) and 2.2.13. (Either strength of materials *or* technical mechanics). In turn, this may not only lead to an illogical sequence of the modules (highly specialized topics could be imparted *prior* the basic knowledge), but also harbors the risk that the intended overall objectives are not reached properly. The program coordinators claim that the already overloaded syllabus sets tight limits for a further extension of the teaching content. In so far the peers observe a direct link to the disproportional high value of the general educational subjects. Moreover, the HEI justifies this approach by means of strict provisions of

the Ministry of Education which is considered not at all convincing. In sum the peers see urgent need for action. They deem it necessary to ensure that the curriculum comprises a mandatory proportion of material science related basic knowledge.

Closely related to this point but also applicable for the Bachelor 5B070900 Metallurgy is a disproportion between practical and theoretical content. The peers do not see where the Bachelor students of both programs get into contact with e.g. mechanical properties of materials, not only on a theoretical but also on a practical level: (1) The University itself does not have the laboratory equipment to carry out fundamental experiments like the tension-, hardness- or compression-test. On request, the peers were told that the Bachelor students are made familiar with such experiments in a research institute that is apparently somehow related to the university. During the onsite inspection the auditors could see that in this institute at least the relevant devices are existent. Nevertheless it remains unclear in which way both institutions are connected. (2) Moreover the auditors do not see whether such practical competences are substantiated in the curricula at all. With respect to the Bachelor 5B01700 Material Science and Technologies of new Materials the program coordinators refer to the modules “applied mechanics” and “strength of materials”. As both modules could be replaced by other teaching units, the peers consider this reference to be not convincing. (3) The presumption of the peers that there are certain deficiencies in this respect is supported by the course of the audit discussions. The representatives of the local industry claim, that the practical knowledge of bachelor graduates is not sufficient. And also the students indicate that on the Bachelors level the experimental focus lies on the chemical properties of materials. In sum the peers think that the subject-related practical competences in both bachelor curricula need to be strengthened. In particular it must be ensured that all students know the fundamental testing methods for mechanical properties of materials. If the university collaborates with an external partner concerning this part of teaching, it has to ensure the quality and continuity of the respective study units at least throughout the accreditation period.

Criterion 1.4 Admission requirements

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M071000 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU – Bachelor degree/rules for admission (http://talapker.KazNRTU.kz/en/node/634 (20.05.2016))
- KazNRTU – Master degree/rules for admission (http://talapker.KazNRTU.kz/en/node/633 (20.05.2016))

- Audit discussions May 11th-May 12th 2016

Preliminary assessment and analysis of the peers:

The admission procedure for the Bachelor as well as for the Master programs is mostly governed by regulations issued by the Ministry of Education and conducted through a nationwide unified exam. Applicants for the Bachelor programs are required to provide evidence for their knowledge in Kazakh and Russian language, history of Kazakhstan and the chosen speciality. Applicants for the Masters programs have to pass an exam in the chosen speciality. The peers learn on request that the admission to the Masters programs in principal is not linked to a certain Bachelor degree. Graduates from other Bachelor programs as the chosen speciality may be admitted under certain conditions. As the Ministry of Education distributes grants according to the individual test results of the students, the admission procedure is highly competitive. Those applicants who pass the entry exams but stay below a predefined threshold score are entitled to start the respective bachelor or master program at their own expense. With regards to the ASIIN criteria the audit team considers the admission standards and procedures to be beneficial for the achievement of the intended learning outcomes. The peers get the impression that the students are informed about the terms and conditions upon which they can apply for a study program at KazNRTU. Moreover, the auditors see that the legal framework is well defined and easily accessible for all relevant stakeholders on the universities´ website.

The peers learn on request that the recognition of qualifications gained from other institutions of higher education in Kazakhstan and abroad is determined by regulations of the Ministry of Education. The auditors gain the impression that there are nationwide unified standards including the possibility to catch up on up to five disciplines per study year. Nevertheless the process of recognition at KazNRTU remains largely unclear. To estimate whether this process meets the standards of the Lisbon Convention, the peers ask to specify on this issue by means of legally binding documents.

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

1.1. Objectives and learning outcomes

The peers take positively note that the HEI has revised the overall qualification profile of each study program under review. As a result the profiles and, in addition, the module-objective-matrices depict the overall approach of the programs in a brief and concise and thereby understandable way. The peers moreover notice that conclusive descriptions of the programs are accessible to public on the department's websites (http://www.kazntu.kz/en/node/11465 (Bachelor/Master Metallurgy (19.07.2016),

http://kazntu.kz/en/about-university/institute/im/ksmitmp (Bachelor/Master Material Science and Technologies of new Materials (19.07.2016)). Despite this positive assessment the peers wonder that the files headed as "Syllabi" only contain extracts from the module handbooks and no information about the overall approach of the study programs under review. As the HEI has defined conclusive qualification profiles that are available to public the peers nevertheless see no need for further action.

1.3. Curriculum

~ General educational subjects in the Bachelor programs

Concerning the disproportional high share of general educational subjects in the Bachelor programs the peers understand that in Kazakhstan the structure of curricular is to some extend prescribed by rules of the Ministry of Education. Moreover, the peers agree with the HEI, that it is important to foster "universal competences" of the students as well. Nevertheless the auditors consider a share of 25% of these general educational subjects as much too high, precisely because some important subject specific content up to now isn´t pronounced properly. Therefore the peers repeat their sound advice to check whether the proportion of these general educational subjects can be reduced in favour of the subject-related content. The auditors think this issue should be discussed on occasion of the re-accreditation. Thus they keep up a respective recommendation.

~ Sequence of natural-scientific and mathematical basic modules in the Bachelor programs

The peers take positively note that the HEI is willing to sound out, whether there are possibilities to shift the sequence of the natural-scientific and mathematical basic modules within the Bachelor programs. The auditors deem it necessary to revive this aspect within the re-accreditation. Therefore they keep up a respective recommendation.

~ Consideration of material science related basic knowledge in the Bachelors Material Science and Technologies of new Materials curriculum

The peers do believe that the HEI spends serious efforts to support the students to create useful individual study plans. Nevertheless the present structure of the curriculum of the Bachelor Material Science and Technologies of new Material does not allow to cover all necessary basic disciplines in the field of material science likewise. Therefore the peers appreciate the intention of the HEI to revise the curricular structure in this manner. The auditors think the result of these efforts should be checked in a medium term. Therefore they recommend to uphold a respective requirement.

~ Subject related practical competences in both Bachelor programs and laboratory equipment for basic testing methods

In its comment on the report the HEI indicates that in both Bachelor programs 48,4% of the teaching content are attributed on practical training. The peers do not intend to question this calculation in general. However, the peers still do not see whether this practical training includes experiments on fundamental testing methods on mechanical properties of materials. Insofar the auditors deem it still necessary to revise the curricula of both Bachelor programs in this manner. As far as the laboratory equipment is concerned the peers repeat, that the respective devices seem to be suitable to conduct adequate research activities. Notwithstanding, during the site visit the auditors did not see that the HEI maintains sufficient laboratories for a basic education of the Bachelor students as well. In particular, that affects basic testing methods for mechanical properties of materials, that are as already discussed above are considered to be essential for an education on Bachelors level in the fields of Material Science and Metallurgy. However, along with the comment on the audit report the HEI presents contracts that should proof that these experiments can be conducted in the facilities of different cooperation-partners (cf., Appendix 15 and 16). Looking through these contracts the peers do not see whether the respective institutions maintain the relevant equipment. In Annex 4 the HEI reveals laboratory devices of chosen partner institutions; instruments that can be used for basic testing methods on mechanical properties of materials are missing here as well. Moreover, it remains unclear in how far the partner institutions are even involved in the regular teaching process. All in all the peers keep up their preliminary assessment and suggest to address this issue with a respective requirement.

1.4. Admission procedure

~ Rules for the recognition of competencies gained at another HEI, in particular abroad

Concerning the rules for the recognition of competencies gained at another HEI, in particular abroad, the HEI refers to the "DP 707 KazNRTU/Elimination of Debt" (Appendix 14). In this document the peers only find some very general conditions for the transfer of external students to a Kazakh National University. As Kazakhstan has ratified the Lisbon Convention the peers point out, that each university is obliged to recognize activities completed externally unless the HEI can prove that the competences gained at the other institution are completely different. Therefore the auditors deem it necessary, and appreciate a respective requirement, to adopt standards for the recognition of competences gained at another HEI that are in line with the Lisbon Convention.

Taking the statement of the HEI into account the peers assess criterion 1 for <u>all programs</u> under review to be partly fulfilled.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU – Module Handbook 5B01700 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 6M07100 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 5B070900 Metallurgy
- KazNRTU – Module Handbook 6M070900 Metallurgy
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 5B01700 Material Science and Technology of New Materials
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 6M01700 Material Science and Technology of New Materials
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 5B070900 Metallurgy
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 6M070900 Metallurgy
- KazNRTU – Matrix of objectives and modules for specialty 5B01700 Material Science and Technology of new Materials
- KazNRTU – Matrix of objectives and modules for specialty 6M01700 Material Science and Technology of new Materials
- KazNRTU – Matrix of objectives and modules for specialty 5B070900 Metallurgy
- KazNRTU – Matrix of objectives and modules for specialty 6M070900 Metallurgy
- Audit discussions May 11th – May 12th 2016

Preliminary assessment and analysis of the peers:
All degree programs are divided into modules that, in principle, comprise a comprehensible sum of teaching and learning.

As stated above the HEI at least to a certain degree provides evidence that the overall objectives of the degree programs are implemented on module level. All degree courses allow students to define an individual focus and course of studies. Especially in Bachelor 5B01700 Material Science and Technologies of new Material the professional training almost exclusively consists of elective modules. In doing so the curriculum on the one hand provides a big variety of topics. Otherwise, this approach entails the risk that some very basic disciplines are left out which has been already discussed in chapter 1.3.

In the course of the audit discussions the peers gain the impression that international mobility on an individual level is focused on conducting/producing the final theses. As far as the auditors understand, at least the masters' curricula include a mandatory internship abroad. This affects nevertheless always the entire cohort with no individual scope for action. In sum, the peers see that the curricula provide opportunities for a stay abroad. Even though the program coordinators maintain international cooperations, the possibilities to *study* at an international university nevertheless appear to be very little. This general expression is confirmed by the students that state vivid interest to participate in international exchange programs. As the HEI explicitly intends to strengthen its international alignment, the peers consider it to be necessary to promote the academic mobility, also on an individual level.

Criterion 2.2 Work load and credits

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU – Module Handbook 5B01700 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 6M07100 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 5B070900 Metallurgy
- KazNRTU – Module Handbook 6M070900 Metallurgy

- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 5B01700 Material Science and Technology of New Materials
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 6M01700 Material Science and Technology of New Materials
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 5B070900 Metallurgy
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 6M070900 Metallurgy
- KazNRTU – Matrix of objectives and modules for specialty 5B01700 Material Science and Technology of new Materials
- KazNRTU – Matrix of objectives and modules for specialty 6M01700 Material Science and Technology of new Materials
- Audit discussions May 11th-May 12th 2016

Preliminary assessment and analysis of the peers:

Students´ workload at KazNRTU is measured in terms of a national credit point system. Only for some parts the ECTS credit point system is used in parallel. The calculation basis of the ECTS credits remains to certain extend vague: Based on a sample inspection of module handbooks and curricula the application of the ECTS credit point system appears to be widely arbitrary. Just to name a few examples: On module level five ECTS points equal 135 working hours (e.g. “Fundamentals of life safety”) but also 120 working hours (e.g. “Corrosion and anticorrosion”). In turn, six credits are often estimated with 135 working hours (e.g. “Hydrometallurgy”). In other modules 180 working hours correspond to two ECTS credits (e.g. “Reactor and Material Science”) only. Taking into account the study plans, just another version for the calculation of ECTS credits is presented. According to the modular curriculum of 5B070900 Metallurgy for instance, 360 hours of students workload equal in the first semester 31 ECTS points, which corresponds to roughly 12 hours per ECTS points. In the second semester 375 hours of students´ workload equal 29 ECTS credits, corresponding to roughly 13 hours per credit point and so on. As Kazakhstan is part of the Bologna process the peers deem it necessary that the workload is calculated continuously according to the ECT System. In particular the HEI has to stipulate coherently for how many working hours one ECTS credit point is awarded. According to the ECTS Users guide the HEI thereby should use a range between 25 and 30 hours. Finally, it has to be ensured that this system is used consistently.

As a result of these shortcomings it is difficult to assess whether the estimated time budgets are realistic. Notwithstanding the peers do not gain the impression that the modules are overcharged. Also the students do not appear to be overloaded. In sum, the auditors see no evidence for serious structural problems.

Criterion 2.3 Teaching methodology

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU – Module Handbook 5B01700 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 6M07100 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 5B070900 Metallurgy
- KazNRTU – Module Handbook 6M070900 Metallurgy
- Audit discussions May 11th – May 12th 2016

Preliminary assessment and analysis of the peers:

Based on the module descriptions the auditors see that the HEI uses different teaching methods and instruments. As a rule, modules are subdivided in lectures and practical sessions. In addition, professional and research internships are included as well. The peers deem this distribution in general reasonable and supportive for the achievement of the intended learning outcomes. That in practise in the Bachelor programs some very basic practical parts aren´t pronounced properly has been already discussed in chapter 1.3.

All programs under review are characterized by a close and in-depth guidance of the students. This refers to all components of the learning process. Even large parts of the self study are conducted under the supervision of an advisor. Although this didactical approach may appear – at least from a European perspective – rigid, the auditors consider the teaching methods in general supportive for the implementation of the intended learning outcomes. Furthermore the auditors take positively note that the teaching methods are evaluated on a regular basis and, if necessary, adapted.

Major parts of the programs are offered in Russian. At least to a certain degree the HEI tries to promote foreign language skills as well. In the Bachelor programs a two-semester English course is included. The program coordinators state that on request subject related modules can be given in English as well. However taking into account the module descrip-

tions the peers do not see how often this happens in practice. The actual English skills of the students appear to be very limited. In this respect the students themselves admit certain deficiencies. Against the background of an intended internationalization of the institution as a whole the peers underline that it would be advisable to spend more efforts in promoting the students English language skills. Even in the subject related teaching units the oral and written language competences could be fostered for example by English presentations, English reports or the parallel usage of English teaching materials.

Criterion 2.4 Support and assistance

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU/Ministry of Education – Guidance on the preparation of individual curricula of students
- KazNRTU/Ministry of Education – Manual for students studying at KazNRTU
- Audit discussions May 11th – May 12th 2016

Preliminary assessment and analysis of the peers:

The peers learn that for each degree programme students are divided into groups of 4 to 20 students and that each group of students has its own advisor. Academic advisors are lecturers and professors of the university. The task of the academic advisor begins during the freshman year and continues throughout to the senior year. When starting the study programme, first-year students receive a Students' Guideline which contains all relevant information about the educational process, the national credit system, structural units of the university, general requirements to the students, their rights and obligations, main provisions of monitoring and evaluation of students' knowledge etc. The academic advisor provides academic advice in terms of courses to be selected; additionally, the academic advisor also supports students regarding personal matters. The students confirmed that the academic advisors were very supportive and tried to assist the students in all matters. Additionally, the university collects information about the students' academic progress at each stage, their current level of knowledge, the rating score of students' performance, and the tendency of their academic progress. This system allows the university to identify students falling behind immediately and take necessary action where this deems necessary. The website also provides a number of additional counselling and advisory services that can be used by the students. The auditors gain the impression that suf-

ficient resources were available for individual support, supervision and advice for students.

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

2.1. Structure and modules / 2.3. Teaching methodology

~ International orientation

Already during the site visit the peers took positively note that an international internship is a mandatory part of both master programs under review. The auditors moreover understood that the entire cohort passes this internship at the same time at the same institution. As a result, the individual scope of action for each student is very little. As this internship is obviously passed in an industrial company, the peers stress that academic mobility should cover the possibility for Bachelor and Master students to spent parts of the academic studies at a foreign higher education institution as well. Therefore the auditors still think Satpaev University should try to promote the academic mobility on an individual level. Moreover, to support this objective efforts should be made to improve the written an oral English skills of the students. In sum, the peers deem it necessary to revive this aspect on the occasion of the re-accreditation. Thus they keep up a respective recommendation.

2.2. Workload and credits

~ Consistent use of the ECT System

Taking a look at the revised module handbooks the peers still do not see that the credits are calculated continuously and consistently according to the ECT System. Referring to their preliminary assessment (see above) the peers still think this issue should be fixed in a medium term and recommend a respective requirement.

Taking the comment of the HEI into account the peers deem criterion 2 for all study programs under review to be partly fulfilled.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 5B01700 Material Science and Technology of New Materials
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 6M01700 Material Science and Technology of New Materials
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 5B070900 Metallurgy
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 6M070900 Metallurgy
- KazNRTU – Module Handbook 5B01700 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 6M07100 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 5B070900 Metallurgy
- KazNRTU – Module Handbook 6M070900 Metallurgy
- KazNRTU/Ministry of Education – Assessment of Knowledge
- KazNRTU/Ministry of Education – Elimination of Debt
- KazNRTU/Ministry of Education – Position on the procedure for conducting oral examinations
- KazNRTU/Ministry of Education – Position on the procedure for conducting written examinations
- KazNRTU/Ministry of Education – Guidance on the preparation of individual curricula of students
- KazNRTU/Ministry of Education – Manual for students studying at KazNRTU
- Inspection of module examinations and final projects May 11th 2016
- Audit discussions May 11th – May 12th 2016

Preliminary assessment and analysis of the peers:

The total number of examinations appears to be rather high: In addition to a midterm and a final exam there are current controls within the lectures on a weekly basis (essays, laboratory reports etc.). On module level, the final grade is formed by 60% of the midterm and final exams and 40% of current controls. The conduct of the examination as well as the assessment criteria are ruled very precisely. In turn, this provides a high transparency for all relevant stakeholders. As compared to European standards, the examination system appears to be highly regulated. Nevertheless, the peers acknowledge that this system is well accepted and after all, aligned to a close monitoring of the development of competences. The students consider the examination load acceptable. Problems in terms of a graduation in the standard period of time have not become visible.

The peers learn that the HEI uses different forms of examination in all study programs under review. Even in the bachelor programs the oral form is usually used along woth written examinations.

With two Kazakh credits in the Bachelor and three in the Master programs the scope of the final theses appears to be disproportionately low. On request, the auditors learn that the theses are closely linked to the pre-diploma in case of the Bachelor and the research practice in the Master programs. While in the practices the experimental work is done, the actual Bachelor/Masters-thesis module is only dedicated to the execution and defence of the final paper. Taking this into account, the final theses comprise between 7 and 10 Kazakh credits. The auditors assess this scope to be sufficient for a preparation of a scientific work on the intended qualification level. Moreover the peers acknowledge that final theses are also prepared in the industry or external research labs. The peers learn that in this case the HEI vouches for its quality in terms of relevance and content too.

On occasion of the site visit the peers had the opportunity to inspect a selection of module examinations and final projects. They judge that the scientific problems dealt with meet the bachelor respectively the masters level and are well harmonized with the expected learning outcomes. Depending on the lecturer the quality of the individual performance nevertheless is considerably different: Some works neither discuss nor interpret their findings at all. A classification in terms of the present state of research is mostly missing as well. Against this background the peers think the HEI should try to unify the scientific standards for the final theses. In particular the students should be required to present and critically discuss their findings.

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

~ Scientific standards for the final theses

The HEI did not make any comment on this issue. Therefore the auditors adhere to their preliminary assessment and a respective recommendation.

The peers assess criterion 3 for all study programs under review to be predominantly fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU/Chair Metallurgy of nonferrous materials – CVs
- KazNRTU/Chair Metallurgical processes, heat engineering and technology of special materials – CVs
- KazNRTU/Material Science and Technologies of new Materials – CVs
- KazNRTU/Chair Metallurgy of nonferrous materials – List of scientific research projects 2011-2015
- KazNRTU/ Chair Machine-tool, materials and technology of machine-building production – Research topics
- Audit discussions May 11th – May 12th

Preliminary assessment and analysis of the peers:
Staff involved in the respective study programs is quantified within the SER. In terms of quantity the staffing level seems at present to be sufficient to sustain the degree programs properly. Looking at the CVs (as far as available) the age distribution of full professors appears to be rather high. Nevertheless the university management substantiates that throughout the accreditation period no staff reduction will take place.

Concerning the quality of the teaching staff in general, the auditors learn that in case of a professorship the applicant has to demonstrate an adequate academic qualification as

well as certain research activities. For the most chairs the HEI lists former and current research projects. Apparently even the masters students are involved in those research projects. With regard the professional and academic background of the teaching staff in particular, the peers regret that only for a few lecturers CVs are available. In order to allow a valid assessment the missing CVs should be delivered in addition. Taking into account the available information, it is nevertheless striking that the programs are run by a considerable number of persons with just a bachelors or masters degree. The auditors principally appreciate the involvement of young academics in teaching activities as an opportunity to promote their scientific career. In terms of the quality of the teaching and learning process, it nevertheless should be ensured that lecturers with PhD build the majority of the teaching body. In its present state the peers see the staff structure as a resource for the future. In the long run, this structure could be used to ensure the sustainability of a well qualified teaching staff. Therefore, the auditors give the advice to spend further efforts in the academic development of the staff. In particular, the number of teaching staff with a PhD grade should be gradually increased.

Criterion 4.2 Staff development

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU/Chair metallurgical processes, heat engineering and technology of special materials – Results of professional development of academic staff from 2010 till 2015
- KazNRTU/Department Material Science – Staff certificates
- Audit discussions May 11th-12th

Preliminary assessment and analysis of the peers:

The HEI proofs that there are offers and support mechanisms available for the teaching staff who wish to further develop their professional and teaching skills. The peers do see that these offers are used on a regular basis.

Criterion 4.3 Funds and equipment

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU – List on agreements on pre-diploma and research practice
- Kaz NTU - List of equipment available for Metallurgy of nonferrous metals and Metallurgical processes, heat engineering and technology of special materials chairs
- Inspection of Laboratories May 11th-12th
- Audit discussions May 11th-12th

Preliminary assessment and analysis of the peers:

Obviously, teaching activities at KazNRTU are financed to a large extend through tuition fees. In addition, the HEI obtains public subsidies depending on the total number of students enrolled in a program. In turn research activities as well as the laboratory infrastructure is funded and maintained partly project-based and to a smaller amount from the overall university budget. It is remarkable that the local industry and non-university research institutions are highly involved in the programs, mostly on an individual level though. Regarded as future employees, qualified students gain an active promotion by non-university institutions. Besides an individual contract based financing of studies, companies and other third party institutes create possibilities for internships and an in-depth practical training.

The laboratories and large devices are quite old. Also the quantity of laboratory places seems to be limited. The inspected items nevertheless appear to be sufficient to ensure at least research activities and an adequate education of students on Masters level. Against this background, it is quite understandable that a considerable number of bachelor and master theses are conducted at different research institutions in Kazakhstan and abroad. In this respect students obviously benefit from individual and/or institutionalized international networks of the staff. The peers deem it laudable that these networks are not limited on Kazakhstan and the close neighbour countries, but also encompass institutions in Western Europe and the United States. In sum, the peers see that the university is able to deal with certain deficiencies in their own laboratory equipment by means of those cooperations. As roughly 75% of the Master theses are conducted that way the University nevertheless has to ensure, that these forms of collaboration are sustainable. The program-coordinators state, that most of these cooperations are contract based. These contracts should be delivered in addition.

As a more important problem, the HEI apparently lacks an own experimental basis for the basic education e.g. in the fields of mechanical properties of materials. Program-coordinators claim that the respective content is imparted in the facilities of cooperation partners. However the peers do not see whether the respective tests and experiments are mandatory subjects of the Bachelors programs. It has been already pointed out in chapter 1.3. that the curricula should be revised in this regard and that the university should ensure a reliable und sustainable experimental basis at least through cooperation partners.

As a general advice the auditors finally stress that in the laboratories the labour safety equipment like for instance safety glasses or eye showers appears to be limited and below the necessary standards.

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

4.1. Staff

~ Academic development

According to the HEIs comment on the audit report at the chair of Material Science 80,7 % (in the Bachelors education) respectively 100% (in the Masters education) of the teaching staff has a PhD-grade. In the Metallurgy programs the share of lecturers with a PhD is even estimated with 100%. Looking at the CVs presented with the self assessment report and the comment on the audit report these figures are not comprehensible. The auditors stress that it isn´t their attention to criticize the involvement of young scientist in the teaching process. Nevertheless they still deem it necessary to gradually increase the number of teaching staff with a PhD grade. Therefore they think this issue should be discussed on occasion of the reaccreditation. All in all they keep up their primary assessment and vote for a respective recommendation.

4.3. Funds and equipment

~ Laboratory equipment

Cf. Chapter 1

~ Cooperation contracts for master theses

With its comment on the audit report, the HEI presents a list of partly international cooperations that can be obviously used for students' research works as well (Annex 2). Even if the HEI missed to document the respective contracts, the auditors consider it credible

that there are sufficient resources to carry out master theses on an adequate level. Insofar the peers see no need for further action.

Taking the statement of the HEI into account the peers assess criterion 4 for the bachelor programs to be partly and for the master programs to be predominantly fulfilled.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU – Module Handbook 5B01700 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 6M07100 Material Science and Technologies of new Materials
- KazNRTU – Module Handbook 5B070900 Metallurgy
- KazNRTU – Module Handbook 6M070900 Metallurgy
- Audit discussions May 11th-May 12th 2016

Preliminary assessment and analysis of the peers:

Together with the SAR the HEI provides module descriptions for all study programs. A cross-comparison with the Curricula reveals that the module descriptions of all programs are incomplete. Furthermore in some cases the module-titles slightly differ between the module descriptions and the curricula. The peers suppose that the latter could be attributed to translation errors. At first glance the module descriptions, as far they are available, contain the most necessary information. However, as stated above, it is remarkable that ECTS credits aren´t shown continuously and consistently. Furthermore, a part of the bibliographical references appear to be rather old (mainly Russian literature of the 80s) and should be updated. In terms of quality the auditors notice that most descriptions only register the content, but not the intended competences of the respective teaching unit. Finally it remains unclear, whether the module descriptions are available for students and teaching staff. In sum, the peers deem it necessary to revise the module descriptions in terms of an orientation at the intended competences. Furthermore, it has to be ensured that all module descriptions indicate ECTS credits. The HEI should ensure that the module

descriptions are available for all relevant stakeholders. Additionally, missing descriptions have to be delivered.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU – Diploma Supplement and Transcript 5B070900 Metallurgy
- KazNRTU – Diploma Supplement and Transcript 6M070900 Metallurgy

Preliminary assessment and analysis of the peers:

Subject specific diploma supplements in Russian are only provided for 5B070900 Metallurgy and 6M070900 Metallurgy. In addition an English transcript with information about the individual results is existent for these programs. The diploma supplement that should be issued in English anyway does not meet the European standards. As a result, the document does not provide a comparable description of academic profiles and therefore does not serve the real purpose of a diploma supplement either. In particular, information about the educational objectives and intended learning outcomes, the structure and the academic level are missing. Statistical data according to ECTS Users´ guide are not revealed either. In sum, the peers consider it necessary to revise the Diploma Supplements of all study programs in this manner.

Criterion 5.3 Relevant rules

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 5B01700 Material Science and Technology of New Materials
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 6M01700 Material Science and Technology of New Materials

- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 5B070900 Metallurgy
- KazNRTU/Ministry of Education and Science of the Republic of Kazakhstan – The curriculum for the modular training system of speciality 6M070900 Metallurgy
- KazNRTU/Ministry of Education – Assessment of Knowledge
- KazNRTU/Ministry of Education – Elimination of Debt
- KazNRTU/Ministry of Education – Position on the procedure for conducting oral examinations
- KazNRTU/Ministry of Education – Position on the procedure for conducting written examinations
- KazNRTU/Ministry of Education – Guidance on the preparation of individual curricula of students
- KazNRTU/Ministry of Education – Manual for students studying at KazNRTU
- Audit discussions May 11th – May 12th 2016

Preliminary assessment and analysis of the peers:
The determination of overall study conditions as well as structure and content of the educational programs takes place in a generally binding framework provided to a large extend by the Ministry of Education. Within this scope the HEI documents provisions that govern the modular-construction of the study programs at hand, the curricula, the teaching process, examination regulations and assessment criteria. The program coordinators state that the rules for the recognition of qualifications gained at another University are fixed in a legally binding form as well. As stated above the latter should be proved in the further course of the accreditation procedure. For the students the relevant information is apparently worked up in a transparent way ("Guidance"). The students confirm that all relevant documents are easily accessible via internet. All in all, it appears that they are well aware about the relevant rules and provisions that govern their course of studies.

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

5.1 Module descriptions

The peers take positively note, that the module descriptions of all programs under review have been revised and meanwhile register the teaching contented and the intended competences likewise. However, other shortcomings as the inconsistent use of the ECT System (cf. Chapter 2) are still existent. As the link cited in the HEIs comments leads to module-objective-matrices of the Metallurgy program it remains moreover unclear,

whether the module handbooks are available to public (cf. http://www.kazntu.kz/ru/node/15270 (02.09.2016)). In sum the peers deem it necessary to fix the remaining shortcomings in a medium term. Insofar they consider a respective requirement to be necessary.

5.2. Diploma Supplements

The peers take positively note that diploma supplements that match with European standards should be issued from the academic year 2016/17 on. The peers think the implementation of this intention should be examined in a medium term. Referring to their primary assessment the auditors consider a respective requirement to be necessary.

Taking the HEI statement into account the peers consider criterion 5 for all programs under review to be partly fulfilled.

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:

- KazNRTU – Self Assessment Report 5B01700 and 6M07100 Material Science and Technology of new Materials
- KazNRTU – Self Assessment Report 5B070900 and 6M070900 Metallurgy
- KazNRTU – Quality management system (http://www.KazNRTU.kz/en/about-university/smk (23.05.2016))
- Audit discussions May 11th- 12th

Preliminary assessment and analysis of the peers:

The peers learn that the University maintains a structured quality management system that is certified according to the standard ISO 9001-2008. The auditors appreciate that the quality management policy is published on the university´s website even in an English version. On the website of the quality management department most relevant documents that govern the educational process at KazNRTU are also publicly available.

The auditors gain the impression that the HEI strives to involve students in the further development of the educational programs. Even if neither the respective processes nor the results are documented within the SAR, the peers understand that there are instruments in place to evaluate teaching activities and overall study conditions. Specific mod-

ules and courses are evaluated on a regular basis. After completion of a module the students are asked to provide an anonymous feedback via an internal online platform. The peers learn on request that the questionnaires are analyzed at central level. Direct feedback-loops with the students are apparently not institutionalized. The auditors find out that the results of the different surveys are not only discussed in committees and councils, but also published on the universities website. Moreover, students' representatives are involved in different quality related panels. On occasion of the site-visit, the students confirm that their feedback on the educational process is seriously taken into account and leads to remarkable changes. The peers finally learn that informal feedback processes are as important as institutionalized measures: The students stress that the teaching staff is principally open for criticism, even in the day-by-day-contact.

In how far data in terms of study progress/success are collected and taken into account as well remains largely unclear. The HEI presents employment rates for the Bachelor Metallurgy 5B070900 Metallurgy. As the numbers are not contextualized the significance of the findings remains vague. Data in terms of study progress (grade distribution, failure rates and average duration of studies) are not presented either. Finally, it remains unclear whether the quality management system pays attention on the Alumni too.

In sum, the peers assess the quality management system ambivalent. With the course evaluation the HEI obviously maintains an instrument to collect data that are principally useful for a continuous improvement of the educational process. Also, the students appear to be well integrated in this process. As hardly any evidences are documented, this assessment nevertheless remains vague. To substantiate their findings the peers ask the HEI to submit exemplary questionnaires for the course evaluation, the findings for the last two semesters and examples for derived measures. The HEI should also explain whether data on study progress and Alumni matters are collected and interpreted.

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

Together with its comment to the audit report the HEI delivers general provisions on the quality management system, exemplary questionnaires and examples for derived measures. All in all the HEI makes plausible that the quality management system is adequately regulated and covers all relevant topics for a continuous improvement of teaching and learning. In sum the peers see no need for further action.

Taking the statement of the HEI into account the peers assess criterion 6 to be completely fulfilled.

D Additional Documents

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

1. [ASIIN 1.1.] Information about liability and public availability of learning outcomes
2. [ASIIN 1.1.] Syllabi for all study programs
3. [ASIIN 1.4.] Legally binding documents that govern the recognition of qualifications gained at other higher education institutions
4. [ASIIN 4.1.] Missing CVs
5. [ASIIN 4.3.] Contracts with partner institutions for Master thesis
6. [ASIIN 5.1.] Missing module descriptions
7. [ASIIN 6] Material from the Quality management system
    a. Evaluation of teaching: exemplary Questionnaires, findings for the last two semesters, examples for derived measures
    b. Data and findings on study progress and Alumni matters (if existent)

E Comment of the Higher Education Institution (23.07.2016)

The institution provided an extensive statement as well as the following additional documents on various topics.

F Summary: Peer recommendations (02.09.2016)

Taking into account the additional information and the comments given by Satpaev Kazakh National Technical Research University the peers summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	**ASIIN-seal**	**Subject-specific label**	**Maximum duration of accreditaiton**
Ba Material Science and technology of new materials	With requirements	EUR-ACE	30.09.2023
Ma Material Science and technology of new materials	With requirements	EUR-ACE	30.09.2022
Ba Metallurgy	With requirements	EUR-ACE	30.09.2022
Ma Metallurgy	With requirements	EUR-ACE	30.09.2022

Requirements

All study programs

A 1. (ASIIN 2.2.) Calculate the workload according to the ECT System continuously. Stipulate coherently for how many student working hours one ECTS credit is awarded (in a range of 25-30 hours). Make sure that not more than 60 credits are awarded per academic year on average. Ensure that this system is used consistently.

A 2. (ASIIN 5.1.) Rewrite the module descriptions so as to include reliable information on ECTS credits. Make the module descriptions available for all relevant stakeholders.

A 3. (ASIIN 5.2.) Ensure that the Diploma Supplement contains detailed information about the educational objectives, intended learning outcomes, the structure and the academic level of the degree programme as well as about the individual performance. Furthermore, provide statistical data according to the ECTS-Users‘ guide in addition to the final grade.

Bachelor Programmes

A 4. (ASIIN 1.3.) Strengthen the subject-related practical competences in the curriculum. In particular, make sure that all students get to know the fundamental testing methods for mechanical properties of materials. If it is necessary to engage an external partner with this part of teaching, ensure the quality and continuity throughout the accreditation period.

Bachelor Material Science

A 5. (ASIIN 1.3.) Ensure that the curriculum comprises a mandatory proportion of material science related basic knowledge.

Recommendations

All study programs

E 1. (ASIIN 4.1.) It is recommended to spend more efforts on the academic development of the staff. In particular, the number of teaching staff with a Phd-grade should be gradually increased.

E 2. (ASIIN 2.1., 2.3.) It is recommended to strengthen the international orientation of the degree programmes. Particularly, efforts should be made to improve the students' written and oral English skills. Moreover the HEI should promote the academic mobility on an individual level.

E 3. (ASIIN 3) It is strongly recommended to adopt scientific standards for the final thesis. In particular, students should be required to present and critically discuss their findings.

For the Bachelor programs

E 4. (ASIIN 1.3.) To strengthen the subject related content, it is recommended to check/consider whether the proportion of general educational subjects can be reduced.

E 5. (ASIIN 1.3.) It is recommended to rethink the structure of the curriculum in terms of the in terms of the sequence of the natural-scientific and mathematical basic modules.

G Comment of the Technical Committee 05- Physical Technologies, Materials, Processes (20.09.2016)

Assessment:

The technical committee discusses the procedure. The technical committee takes note that the HEI obviously does not maintain laboratory equipment for a basic education in the field of mechanical properties of materials. As the peers the technical committee deems it essential that Bachelor students get in touch with such very fundamental experiments. In this context the technical committee takes further note, that relevant devices may be existent in the facilities of different cooperation-partners located in Kazakhstan and abroad. Even if those devices could be used for the regular teaching process (which obviously remains still unclear), the technical committee thinks that a long-lasting solution urgently requires an own experimental basis in the respective fields. Insofar the technical suggests requiring the university to develop and execute a schedule for the acquisition of relevant basic equipment.

The technical committee takes finally note, that the quality of the final theses is rather inconsistent. The technical committee sees it as a serious problem, that not all, but a considerable number of graduation projects obviously don´t match with scientific standards. To ensure a consistent high quality of the degree theses, the technical committee deems it necessary to adopt uniform scientific standards in a medium term. Insofar the technical committee suggests changing the respective recommendation 3 into a synchronous requirement.

In all other aspects the technical committee judges the assessment of the peers as well as the proposed requirements and recommendations to be adequate.

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 not comply with the engineering specific parts of Subject-Specific Criteria of the Technical Committee 05.

The Technical Commitee 05 – Physical Technologies, Materials and Processes recommends the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Material Science and technology of new materials	With requirements	EUR-ACE	30.09.2023
Ma Material Science and technology of new materials	With requirements	EUR-ACE	30.09.2022
Ba Metallurgy	With requirements	EUR-ACE	30.09.2022
Ma Metallurgy	With requirements	EUR-ACE	30.09.2022

A 4. (ASIIN 3) Adopt scientific standards for the final thesis. In particular, students should be required to present and critically discuss their findings.

A 5. (ASIIN 1.3.) Strengthen the subject-related practical competences in the curriculum. In particular, make sure that all students get to know the fundamental testing methods for mechanical properties of materials.

A 6. (ASIIN 4.3.) Develop and execute a schedule/time table for the acquisition of relevant basic equipment for mechanical properties of materials.

H Decision of the Accreditation Commission (30.09.2016)

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

In consideration of the contend-related modifications suggested by the technical committee 05 and minor editorial adjustments the accreditation commission follows the proposal for a decision of the peer group.

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

The Accreditation Commission deems that the intended learning outcomes of the degree programme do comply with the engineering specific parts of Subject-Specific Criteria of the Technical Committee 05 – Physical Technologies, Materials, Processes.

The Accreditation Commission for Degree Programmes decides to award the following seals:

Degree Programme	**ASIIN-seal**	**Subject-specific label**	**Maximum duration of accreditation**
Ba Material Science and technology of new materials	With requirements	EUR-ACE	30.09.2023
Ma Material Science and technology of new materials	With requirements	EUR-ACE	30.09.2022
Ba Metallurgy	With requirements	EUR-ACE	30.09.2022
Ma Metallurgy	With requirements	EUR-ACE	30.09.2022

Requirements

All study programs

A 1. (ASIIN 2.2.) Calculate the workload according to the ECT System continuously. Stipulate coherently for how many student working hours one ECTS credit is awarded (in a range of 25-30 hours). Make sure that not more than 60 credits are awarded per academic year on average. Ensure that this system is used consistently.

A 2. (ASIIN 5.1.) Rewrite the module descriptions so as to include reliable information on ECTS credits. Make the module descriptions available for all relevant stakeholders.

A 3. (ASIIN 5.2.) Ensure that the Diploma Supplement contains detailed information about the educational objectives, intended learning outcomes, the structure and the academic level of the degree programme as well as about the individual performance. Furthermore, provide statistical data according to the ECTS-Users' guide in addition to the final grade.

A 4. (ASIIN 3) Develop guidelines and adopt scientific standards for the final thesis. In particular, students should be required to present and critically discuss their findings.

Bachelor Programmes

A 5. (ASIIN 1.3.) Strengthen the subject-related practical competences in the curriculum. In particular, make sure that all students get to know the fundamental testing methods for mechanical properties of materials.

A 6. (ASIIN 4.3.) Develop and execute a schedule/time table for the acquisition of relevant basic equipment for mechanical properties of materials.

Bachelor Material Science

A 7. (ASIIN 1.3.) Ensure that the curriculum comprises a mandatory proportion of material science related basic knowledge.

Recommendations

All study programs

E 1. (ASIIN 4.1.) It is recommended to spend more efforts on the academic development of the staff. In particular, the number of teaching staff with a Phd-grade should be gradually increased.

E 2. (ASIIN 2.1., 2.3.) It is recommended to strengthen the international orientation of the degree programmes. Particularly, efforts should be made to improve the students' written and oral English skills. Moreover the HEI should promote the academic mobility on an individual level.

For the Bachelor programs

E 3. (ASIIN 1.3.) To strengthen the subject related content, it is recommended to check/consider whether the proportion of general educational subjects can be reduced.

E 4. (ASIIN 1.3.) It is recommended to rethink the structure of the curriculum in terms of the sequence of the natural-scientific and mathematical basic modules.

Appendix: Programme Learning Outcomes and Curricula

According to self assessment report the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Metallurgy:

Cf. p. XX

The following **curriculum** is presented:

Disp. cycle	Disp. code	Disciplines	Semester	Credits		Lecture.	Laboratory work.	Practical work.	Ind. work		Type of control	Competences	Department
				KZ Credits	ECTS				Office hours	Ind. work			
Historical and social module													
Core component													
GD 1.1.1	IK 1101	History of Kazakh-stan	1	3	5	2		1	3	3	W	CC1	HK and SHD
Language Module													
Core component													
GD 1.1.2	K(R)Ya 1106	Kazakh (Russian) language	1	3	5			3	3	3	O	CC4	Kaz. lang
GD 1.1.3	IYa 1108	Foreign Language	1	3	5			3	3	3	O	CC4	Eng. lang
Physics and Mathematics Module													
Core component													
BD 1.2.1	Fiz 1203	Physics I	1	2	3	1	1		2	2	T	CC7	GTP
Elective Module													

General Technical Module													
Elective Module													
BD 1.2.2	NGKG 1202	Descriptive geometry and Computer Graphics	1	3	5	1	2		3	3	W	CC7	DGG
Labor safety and Environmental Protection Module													
Core component													
GD 1.1.5	OBZH 1103	Fundamentals of Health and Safety	1	2	3	1		1	2	2	T	CC 12, PC2	HS& EP
Elective Module													
Elective Module													
BD 1.2.5	VvS 1205	Introduction to Specialty	1	3	5	2		1	3	3	W	CC11	MNM
BD 1.2.5.1	OS 1205.1	Fundamentals of specialty	1	3	5	2		1	3	3	W	CC11	MNM

1 semester

The cycle of additional types of training													
ATT 1	FK	Physical Training	1	2				2				CC12	PT

Total - 19 KZ credits - Total workload / semester, (hours) – 360 – ECTS 31

2 semester

Disp. cycle	Disp. code	Disciplines	Semester	Credits	Lecture.	Laborato-.	Practical	Ind. work		Type of control	Compe-tences	Depart-ment
								Of-fice	Ind.			

				KZ credits	ECTS								
Historical and social module													
Core component													
GD 1.1.6	Pol 1110	Politology	2	2	3	1		1	2	2	T	CC9	НКи SHD
Language Module													
Core component													
GD 1.1.7	K(R)Ya 1106	Kazakh (russian) language	2	3	5			3	3	3	O	CC4	Kaz. lang
GD 1.1.8	IYa 1108	Foreign Language	2	3	5			3	3	3	O	CC4	Eng. lang
Physics and Mathematics Module													
Core component													
GD 1.1.4	Inf 1102	Informatics	2	3	5	2	1		3	3	T	CC2, CC3	KTP UP
BD 1.2.3	Fiz 1203	Physics II	2	2	3	1	1		2	2	T	CC7	GTP
Chemical Module													
Core Module													
BD 1.2.4	Him 1201	Chemistry	2	3	5	2	1		3	3	T	CC7	Chem.
Labor safety and Environmental Protection Module													
Core component													
GD 1.1.9	EUR 1105	Ecology and Sustainable Development	2	2	3	1		1	2	2	T	CC5	AE
Elective Module													

The cycle of additional types of training													
ATT 2	FK	Physical Training	2	2				2				CC12	PT
Practice-oriented Module													
CP	SP	Practical training	2	4								CC11	MNM
Module of final certification													
Core component													
SAC		State exam on the history of Kazakh-stan	2										HK and SHD

Total - 18 KZ credits - Total workload / semester, (hours) – 375 – ECTS 29

3 semester

Disp. cycle	Disp. code	Disciplines	Semester	Credits		Lecture.	Laboratory work.	Practical work.	Ind. work		Type of control	Competences	Department
				KZ Credits	ECTS				Office hours	Ind. work			
Historical and social module													
Core component													
GD 2.1.1	OP 2109	Fundamentals of Law	3	2	3	1		1	2	2	T	CC6	HKи SHD
GD 2.1.2	Fil 2111	Philosophy	3	3	5	2		1	3	3	T	CC 10	HKи SHD
Professionally-oriented language Module													
Core component													
BD	PK(R)	Professional ka-	3	2	3			2	2	2	O	PC1	MPH

2.2.6	Ya 2204	zakh (russian) language											& TSM
BD 2.2.7	P-oIYa 2205	Professionally-oriented foreign language	3	2	3			2	2	2	O	PC1	MPH & TSM
Physics and Mathematics Module													
Core component													
BD 2.2.8	Mat 2202	Mathematic I	3	3	5	2		1	3	3	T	CC7	Math
Chemical Module													
Elective Module													
BD 2.2.9	FCh 2209	Physical Chemistry	3	4	5	1	1	1	3	3	T	CC7	Chem.
General technical Module													
Elective Module													
BD 2.2.10	Elt 2210	Electrical engineering	3	3	5	2	1		3	3	W	CC8	EE
BD 2.2.10.1	TOE 2210.1	Theoretical bases of Electrical Engineering	3	3	5	2	1		3	3	W	CC8	EE

The cycle of additional types of training													
ATT 3	FK	Physical Training	3	2				2				CC12	PT
ATT 4	VP	Military education	3	2								OK18	MD

Total - 19 KZ credits - Total workload / semester, (hours) – 390 – ECTS 30

4 semester

Disp. cycle	Disp. code	Disciplines	Semester	Credits		Lecture.	Laboratory work.	Practical work.	Ind. work		Type of control	Competences	Department
				KZ Credits	ECTS				Office hours	Ind. work			
Historical and social module													
Core component													
GD 2.1.4	Soc 2104	Sociology	4	2	3	1		1	2	2	T	CC9	НКи SHD
Physics and Mathematics Module													
Core component													
BD 2.2.10	Mat 2202	Mathematic II	4	3	5	2		1	3	3	T	CC7	Math
Elective Module													
BD 2.2.9	Fiz 1203	Physics III	4	4	6	2	2		4	4	T	CC7	GTP
General technical Module													
Elective Module													
BD 2.2.11	PM 2211	Applied mechanics	4	3	5	2		1	3	3	T	CC8	AM &BMD
BD 2.2.11.1	OKDM 2211.1	Fundamentals of design and machine parts	4	3	5	2		1	3	3	T	CC8	AM &BMD
Economic Module													
Core component													
GD 2.1.3	OET 2107	Basics of economic theory	4	2	3	1		1	2	2	T	CC14,CC	IE

												16	
Module of theoretical basis of the specialty													
Core Module													
BD 2.2.12	TMP 2206	Theory of metallurgical processes	4	3	5	2	1		3	3	T	PC8	MPH & TSM
Elective Module													
BD 2.2.13	MiS 2213	Metals and their compounds	4	3	5	2		1	3	3	T	PC 7	MNM
BD 2.2.13.1	SCChM 2213.1	The alloys of ferrous and nonferrous metals	4	3	5	2	1		3	3	W	PC 7, PC 6	MNM
BD 2.2.13.2	ORMK 2213.2	Development features of metallurgy in Kazakhstan	4	3	5	2		1	3	3	T	PC 7	MPH & TSM
BD 2.2.13.3	OPSM 2213.3	Fundamentals of special materials	4	3	5	2		1	3	3	T	PC 11, PC 16	MPH & TSM

The cycle of additional types of training													
ATT 5	FK	Physical Training	4	2				2				CC12	PT
ATT 6	VP	Military education	4	2								CC18	MD
Practice-oriented Module													
CP	SP	Work experience internship	4	3								CC15	MNM

Total - 20 KZ credits - Total workload / semester, (hours) – 405 – ECTS 32

5 semester

Disp. cycle	Disp. code	Disciplines	Semester	Credits		Lecture.	Laboratory work.	Practical work.	Ind. work		Type of control	Competences	Department
				KZ Credits	ECTS				Office hours	Ind. work			
Metallurgical production technology Module													
Core Module													
PD 3.3.1	TehMP 3301	The technology of metallurgical processes	5	2	3	1	1		2	2	T	PC 7, PC 8	MNM
PD 3.3.2	TepMP 3302	Heat engineering of metallurgical processes	5	3	5	2	1		3	3	T	PC 7, PC 17	MPH & TSM
Elective Module													
PD 3.2.14	OM 3214	General metallurgy	5	3	5	2		1	3	3	T	PC 7, PC 16	MNM
BD 3.2.1	OKPPS 3214.1	Fundamentals of complex pro-	5	3	5	2	1		3	3	W	PC 7,	MNM

4.1		cessing of polymetallic raw materials										PC 16	
BD 3.2.14.2	GTM 3214.2	Geotechnology in metallurgy	5	3	5	2		1	3	3	W	PC 16	MPH & TSM
BD 3.2.14.3	ESTMP 3214.3	Environmentally compatible technologies in metallurgical production	5	3	5	2		1	3	3	W	PC 9	MPH & TSM
BD 3.2.15	PSMP 3215	Preparation of raw materials for metallurgical processing	5	3	6	2		2	4	4	W	PC 13	MNM
BD 3.2.15.1	SSPRM 3215.1	Current state and prospects of development of metallurgy	5	3	5	2		1	3	3	W	PC 7, PC 13	MNM
BD 3.2.15.2	GidM 3215.2	Hydrometallurgy	5	3	6	2		2	4	4	W	PC 19	MPH & TSM
BD 3.2.15.3	TPM 3215.3	Technologies of coatings on metals	5	3	6	2	1	1	4	4	W	PC 13, PC 11	MPH & TSM
BD 3.2.16	PMChM 3216	Processes of metallurgy of ferrous metals	5	3	5	1	1	1	3	3	W	PC 6, PC 15	MNM
BD 3.2.16.1	OFP 3216.1	Fundamentals of ferroalloy production	5	3	5	2		1	3	3	W	PC 6, PC 15	MNM
Module of certification, management and operation of devices													

Elective Module													
BD 3.2.17	ISM 3217	Measurement and certification in metallurgy	5	3	5	2		1	3	3	W	PC 10	MPH & TSM
BD 3.2.17.1	KRUMP 3217.1	Control, regulation and management of metallurgical processes	5	3	5	2		1	3	3	W	PC 10, PC 11	MPH & TSM
Module of special materials and scientific research													
Elective Module													
BD 3.2.18	OPE 3218	Organization and planning of the experiment	5	3	6	2		2	4	4	W	PC 16	MPH & TSM
BD 3.2.18.1	TWER 3218.1	Technique of per-formance experi-mental work	5	3	6	2	1	1	4	4	W	PC 16	MPH & TSM
BD 3.2.18.2	ONIM 3218.2	Fundamentals of scientific research in metallurgy	5	3	6	2		2	4	4	W	PC 14	MNM
BD 3.2.18.3	VTM 3218.3	Nanotechnologies in metallurgy	5	3	6	2		2	4	4	W	PC 16, PC 14	MNM

The cycle of additional types of training													
ATT 8	VP	Military education	5	2								CC18	MD

Total - 20 KZ credits - Total workload / semester, (hours) – 435 – ECTS 33

6 semester

Disp. cycle	Disp. code	Disciplines	Semester	Credits		Lecture.	Laboratory work.	Practical work.	Ind. work		Type of control	Competences	Department
				KZ Credits	ECTS				Office hours	Ind. work			
Metallurgical production technology Module													
Elective Module													
PD 3.3.3	MLM 3303	Metallurgy of light metals	6	3	5	2	1		3	3	W	PC 7, PC 8	MNM
PD 3.3.3.1	MTCM 3303.1	Metallurgy of heavy non-ferrous metals	6	3	5	2	1		3	3	W	PC 7, PC 8	MNM
PD 3.3.3.2	PyrM 3303.2	Pyrometallurgy	6	3	5	2		1	3	3	W	PC 19	MPH & TSM
PD 3.3.3.3	TKM 3303.3	Technology of composite materi-als	6	3	5	2		1	3	3	W	PC 13, PC 11	MPH & TSM
PD 3.3.4	MLM 3304	Metallurgy of rare metals	6	3	5	2		1	3	3	W	PC 6, PC 8	MNM
PD 3.3.4.1	MRSM 3304.1	Metallurgy of ra-dioactive and asso-ciated metals	6	3	5	2		1	3	3	W	PC 6, PC 8	MNM
PD 3.3.4.2	EMCM 3304.2	Electrometallurgy of non-ferrous metals	6	3	5	2	1		3	3	W	PC 6, PC 8	MNM
Module of certification, management and operation of devices													
Elective Module													

PD 3.3.5	PAMChM 3305	Processes and apparatuses in ferrous metallurgy	6	3	5	2		1	3	3	C/W	PC 12, PC 15	MNM
PD 3.3.5.1	PAMCM 3305.1	Processes and apparatuses in non-ferrous metallurgy	6	3	5	2		1	3	3	C/W	PC 12, PC 15	MNM
PD 3.3.5.2	AOGP 3305.2	Apparatus equipping of hydrometallurgical processes	6	3	5	2		1	3	3	C/W	PC 12	MPH & TSM
PD 3.3.5.3	MP 3305.3	Metallurgical furnaces	6	3	5	2		1	3	3	C/W	PC 15	MPH & TSM
Module of special materials and scientific research													
Elective Module													
PD 3.3.6	PM 3306	Powder metallurgy	6	3	5	2		1	3	3	W	PC 13	MPH & TSM
PD 3.3.6.1	PAPM 3306.1	Processes and apparatuses of powder metallurgy	6	3	5	2		1	3	3	W	PC 11, PC 15	MPH & TSM
PD 3.3.6.2	PPKM 3306.2	Production of powder and composite materials	6	3	5	2		1	3	3	W	PC 13, PC 11	MPH & TSM
Module of scientific research- R&D, designing and modeling													
Elective Module													
PD 3.3.7	FCIMP 3307	Physico-chemical studies of metallurgical processes	6	3	5	2	1		3	3	W	PC 17, PC 13	MPH & TSM

PD 3.3.7. 1	KZM 3307.1	Corrosion and protection of metals	6	3	5	2	1		3	3	W	PC 7, PC 13	MPH & TSM

The cycle of additional types of training													
ATT 10	VP	Military education	6	2								CC1 8	MD
Practice-oriented Module													
CP	IP	Work experience internship	6	3								CC1 5	MN M

The cycle of additional types of training													
ATT 10	VP	Military education	6	2								CC1 8	MD
Practice-oriented Module													
CP	IP	Work experience internship	6	3								CC1 5	MN M

Total - 18 KZ credits - Total workload / semester, (hours) – 360 – ECTS 30

7 semester

Disp. cycle	Disp. code	Disciplines	Semester	Credits		Lecture.	Laboratory work.	Practical work.	Ind. work		Type of control	Competences	Department
				KZ Credits	ECTS				Office hours	Ind. work			
Economic Module													

Elective Module													
BD 4.2.20	EUP 4220	Economics and Production Management	7	3	5	2		1	3	3	T	PC20	IE
Metallurgical production technology Module													
Elective Module													
PD 4.3.8	PPTVS 4308	Technogenic and secondary raw materials recycling Processes	7	3	5	2		1	3	3	W	PC 13	MNM
PD 4.3.8.1	PT 4308.1	Metallurgy of thiosalts	7	3	5	2		1	3	3	W	PC 11, PC 8	MNM
PD 4.3.8.2	PUMS 4308.2	Processing of refractory metallurgical raw materials	7	3	5	2		1	3	3	W	PC 13	MPH & TSM
PD 4.3.8.3	PTPM 4308.3	Processes and technologies of reduction (pig) metallurgy	7	3	5	2		1	3	3	W	PC 13, PC 6	MPH & TSM
PD 4.3.9	TPRRM 4309	Theory and practice of metals separation and refining	7	3	5	2		1	3	3	W	PC 12	MPH & TSM
PD 4.3.9.1	SGMP 4309.1	Special chapters of metallurgical production	7	3	5	2		1	3	3	W	PC 12	MPH & TSM
PD 4.3.9.2	APM 4309.2	Autogenous processes in metallurgy	7	3	6	2		2	4	4	W	PC 6, PC 7	MNM
PD 4.3.9.3	PKM 4309.3	Dedusting and condensation in metallurgy	7	3	5	2		1	3	3	W	PC 9, PC 15	MNM

Module of special materials and scientific research													
Elective Module													
PD 4.3.10	PSSN 4310	Production of alloys of special purpose	7	3	5	2		1	3	3	C/W	PC 13	MPH & TSM
PD 4.3.10.1	NIIM 4310.1	Research and innovation in the metallurgy	7	3	5	2		1	3	3	C/W	PC 14	MPH & TSM
PD 4.3.10.2	KNIR LRM 4310.2	The research coursework on light and rare metals	7	3	5	2		1	3	3	C/W	PC 14	MNM
PD 4.3.10.3	KNIR TCM 4310.3	The research coursework on heavy non-ferrous metals	7	3	5	2		1	3	3	C/W	PC 14	MNM
Module of scientific research- R&D, designing and modeling													
Elective Module													
PD 4.3.11	OPMP 4311	Basics of designing metallurgical plants	7	3	5	2		1	3	3	W	PC 19	MNM
PD 4.3.11.1	MMP 4311.1	Modelling of metallurgical processes	7	3	5	2		1	3	3	W	PC 18	MNM
PD 4.3.11.2	KMA 4311.2	Construction of metallurgical units	7	3	5	2		1	3	3	W	PC 19	MPH & TSM
PD 4.3.11.3	MOTP 4311.3	Modeling and optimization of technological processes	7	3	5	2		1	3	3	W	PC 18	MPH & TSM

The cycle of additional types of training

ATT 11	VP	Military education	7	2								CC18	MD

Total - 15 KZ credits - Total workload / semester, (hours) – 300 – ECTS 25

8 semester

Practice-oriented Module													
CP		Prediploma practice	8	5								PC 19, PC 20	MNM
Module of final certification													
Core component													
SAC		State exam on specialty		1									Dept. Prof.
DWp		Writing and defense of a thesis (project)		2								PC 5	Dept. Prof.

Conclusion

Total amount for BA – 129 RK credits - total workload / semester, (hours) – 2625 – ECTS 210

According to self assessment report the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Metallurgy:

Cf. p. XX

The following **curriculum** is presented:

Disp. cycle	Disp. code	Disciplines	Semester	Credits	Lecture.	Laboratory	Practical work	Ind. work		Type of control	Competences	Department
								Of-	Ind.			

				KZ credits	ECTS								
Socio-linguistic Module													
Core Module													
BD 1.1.1	IFN 5201	The history of philosophy and science	1	2		1		1	2	6	O	CC1	HK and SHD
BD 1.1.2	IYa 5202	Foreign language (professional)	1	2				2	2	6	O	CC2	Frgn. lang
BD 1.1.3	Ped 5203	Pedagogy	1	2		1		1	2	6	O	CC3	HK and SHD
BD 1.1.4	Psi 5204	Psychology	1	2		1		1	2	6	O	CC3	HK and SHD
Technology of metallurgical processes Module													
Elective Module													
BD 1.2.1.1	TPRKM 5302.1	Technologies and processes of distillation and condensation in metallurgy	1	3	5	2	1		3	9	W	PC 6, PC 7	MNM
BD 1.2.1.2	TIBMUPS 5302.2	Technology of extraction precious metals from refractory polymetallic raw materials	1	3	5	2	1		3	9	W	PC 6, PC 7	MNM
BD 1.2.1.3	GTPPS 5302.3	Hydroalkaline technologies for processing polymetallic raw materials	1	3	5	2		1	3	9	W	PC 6, PC 7	MPH & TSM
BD 1.2.1.	EMPPRUP	Extractive methods of processing of produc-	1	3	5	2		1	3	9	W	PC 6,	MPH &

4	5302.4	tive solutions of uranium production										PC 7	TSM
Module of technology, calculations and design													
Elective Module													
BD 1.2.2.1	IRM 5303.1	Engineering calculations in metallurgy	1	3	5	2		1	3	9	W	PC 2	MNM
BD 1.2.2.2	PRTPM 5303.2	Design of reactors and transport processes in metallurgy	1	3	5	2		1	3	9	W	PC 5	MNM
BD 1.2.2.3	BTMP 5303.3	Non-waste technologies of metallurgical production	1	3	5	2	1		3	9	W	PC 9	MPH & TSM
BD 1.2.2.4	UIMRM 5303.4	Innovations management in metallurgy of radioactive metals	1	3	5	2		1	3	9	W	PC 14	MPH & TSM
The cycle of additional types of training													
Scientific Research Module													
Core component													
ATT 1	NIRM	Scientific research work of a graduate student, including the performance of the master's thesis	1	1								PC 11	MNM

1 semester

Total - 14 KZ credits - Total workload / semester, (hours) – 300 – ECTS 22

2 semester

Disp. cycle	Disp. code	Disciplines	Semes-	Credits	Lecture.	Labora-	Practical work	Ind. work	Type of	Compe- tences	De- partmen

									Office hours	Ind. work			
				KZ cred-.	ECTS								
Technology of metallurgical processes Module													
Core Module													
PD 2.1.1	SPTPSR ChCM 5301	Modern and prospective technologies for processing raw materials of ferrous and nonferrous metallurgy	2	2	3	1		1	2	6	W	PC12	MNM
Elective Module													
BD 1.2.3	SGTMP 5306	Special chapters in the theory of metallurgical processes	2	3	5	2		1	3	9	W	PC 6	MPH & TSM
BD 1.2.4.1	ESMTCM 5304.1	Extraction and sorption in metallurgy of heavy non-ferrous metals	2	3	5	2	1		3	9	W	PC 6	MNM
BD 1.2.4.2	ESMRM 5304.2	Extraction and sorption in metallurgy of rare metals	2	3	5	2	1		3	9	W	PC 6	MNM
BD 1.2.4.3	OSVMP 5304.3	Treatment of wastewater of metallurgical enterprises	2	3	5	2	1		3	9	W	PC 10	MPH & TSM
BD 1.2.4.4	OPR NIR 5304.4	Processing and presentation of R&D results	2	3	5	2		1	3	9	W	PC 11	MPH & TSM
Module of technology, calculations and design													
Elective Module													
PD 2.2.1.1	AOPPRM 5305.1	Process equipment production of radioactive metals	2	3	5	2		1	3	9	W	PC 1, 3, 4	MPH & TSM

PD 2.2.1.2	SGMK 5305.2	Special chapters of metallurgical kinetics	2	3	5	2	1		3	9	W	PC 6	MPH & TSM
PD 2.2.1.3	TPIMSS 5305.3	Technology of direct extraction of metals from sulfide raw material	2	3	5	2		1	3	9	W	PC 9	MNM
PD 2.2.1.4	TPILRRM 5305.4	Technologies of associated extraction of light, rare and rare earth metals	2	3	5	2		1	3	9	W	PC 9	MNM
Module of metallurgical products producing													
Elective Module													
PD 2.2.2.1	PPLS 5306	Processes of direct alloying of steel	2	3	5	2		1	3	9	W	PC 6, PC 9	MNM
PD 2.2.2.2	TPOM 5206.1	The production technology of refractory materials	2	3	5	2		1	3	9	W	PC 6, PC 9	MNM
PD 2.2.2.3	TOPSTM 5206.2	Theoretical basis of the sintering process of hard materials	2	3	5	2		1	3	9	W	PC 6, PC 7	MPH & TSM
PD 2.2.2.4	TTPNM 5206.3	Theory and technology of production of nanostructured materials	2	3	5	2		1	3	9	W	PC 6, PC 9	MPH & TSM
The cycle of additional types of training													
Scientific Research Module													
Core component													
ATT 2	NIRM	Scientific research work of a graduate student, including the	2	1								PC 11, PC	MNM

		performance of the master's thesis										15	
Practice-oriented Module													
Core component													
ATT 3	IP	Research practice	2	3								PC 16	MNM

Total - 14 KZ credits - Total workload / semester, (hours) – 285 – ECTS 23

3 semester

Disp. cycle	Disp. code	Disciplines	Semester	Credits		Lecture.	Laboratory work.	Practical work.	Ind. work		Type of control	Competences	Department
				KZ cred-	**ECTS**				Office hours	Ind. work			
Technology of metallurgical processes Module													
Elective Module													
PD 2.2.3. 1	PM 5307. 1	Plasma metallurgy	3	3	5	2		1	3	9	W	PC 6	MPH & TSM
ПД 2.2.3. 2	RMA 5307. 2	Resonance methods of analysis	3	3	5	2		1	3	9	W	PC 6	MPH & TSM
PD 2.2.4. 1	TIMSh 5308. 1	Technologies of metals extraction from slag	3	3	5	2	1		3	9	W	PC 12	MNM
PD 2.2.4. 2	TVUT EMS 5308. 2	Technology of separation and disposal of toxic elements from metallurgical raw materials	3	3	5	2		1	3	9	W	PC 10	MNM
PD 2.2.4.	SPVM S	Collection and processing of secondary	3	3	5	2		1	3	9	W	PC 6,	MPH

3	5208.3	metal containing raw materials										PC 9	& TSM
PD 2.2.4.4	TPUS 5308.4	Technologies of processing of uranium-containing raw materials	3	3	5	2		1	3	9	W	PC 12	MPH & TSM
PD 2.2.5.1	TPVOSS 5309.1	The technology of direct reduction of oxide and sulfide raw materials	3	4	6	3		1	4	12	W	PC 6, PC 7	MNM
PD 2.2.5.2	TFRMPS 5309.2	Technology of fractional separation of metals from the gas mixture	3	4	6	3		1	4	12	W	PC 6, PC 7	MNM
PD 2.2.5.3	TOKMP 5309.3	Thermophysical design principles of metallurgical furnaces	3	4	6	3		1	4	12	W	PC 6, PC 7	MPH & TSM
PD 2.2.5.4	AMRBM 5309.4	Refining in metallurgy of radioactive and noble metals	3	4	6	3		1	4	12	W	PC 6, PC 7	MPH & TSM
Module of metallurgical products producing													
Elective Module													
PD 2.2.6.1	NiN 5310.1	Nanoalloys and nanomaterials	3	4	6	3	1		4	12	W	PC 12	MNM
PD 2.2.6.2	PPOChM 5310.2	Processes and production of high pure metals	3	4	6	3		1	4	12	W	PC 6,7,4	MNM
The cycle of additional types of training													
Scientific Research Module													

Core component													
ATT 4	NIRM	Scientific research work of a graduate student, including the performance of the master's thesis	3	1								PC 13	MNM
Practice-oriented Module													
Core component													
ATT 5	PedP	Teaching practicum	3	3								CC3	MNM

Total - 14 KZ credits - Total workload / semester, (hours) – 270 – ECTS 22

4 semester

Disp. cycle	Disp. code	Disciplines	Semester	Credits	Lecture.	Laboratory work.	Practical work.	Ind. work	Type of control	Competences	Department

The cycle of additional types of training														
Scientific Research Module														
Core component														
ATT 6	NIRM	Scientific research work of a graduate student, including the performance of the master's thesis	4	4								PC 13		MNM
Module of final certification														
Core module														
SAC	KE	Complex exam	4	1										MNM
DWdp5	OZMD	Execution and defense of the master's thesis	4	3										MNM

Conclusion

Total amount for MA – 42 KZ credits - total workload / semester, (hours) – 855 – ECTS 67

According to self assessment report the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Material Science and Technologies of new Materials

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The following **curriculum** is presented:

cycle of discipline	discipline code.	name of disciplines	Semester	the number of credits	lectures	laboratory	practical	Independent work of students		Type of control		COMPETENCE	Department
								CP	C	exa	co		

				РК	ECTS				СП	РС	m	urse project / work		
Historical and social unit														
Required component														
ООД .1.1. 1	Soc 210 4	Sociology	1	2	3	1	0	1	2	2	Т		ОК3	ИКиСТД
ООД 1.1.2	ОР 210 2	Law basics	1	2	3	1	0	1	2	2	Т		ОК8	ИКиСТД
ООД 1.1.7	IK 110	History Of Kazakhstan	2	3	5	2	0	1	3	3	П		ОК1	ИКиСТД
	1													
ООД 2.1. 12	Fil 211 3	Philosophy	4	3	5	2	0	1	3	3	Т		ОК2	ИКиСТД
ООД 2.1.1 3	Pjl 411 5	Political science	4	2	3	1	0	1	2	2	Т		ОК3	ИКиСТД
		National Certification Commission for the History of Kazakhstan	2											ИКиСТД
Polylingual training module														

Required component														
ООД 1.1.3	K(P)Ya 1102	Kazakh (Russian) language	1	3	5	0	0	3	3	3	У		ОК5	Каз. яз
ООД 1.1.4	IYa 1103	Foreign language	1	3	5	0	0	3	3	3	У		ОК5	Иностр.яз.
ООД 1.1.8	K(P)Ya 1102	Kazakh (Russian) language	2	3	5	0	0	3	3	3	У		ОК5	Каз. яз
ООД 1.1.9	IYa 1103	Foreign language	2	3	5	0	0	3	3	3	У		ОК5	Иностр.яз.
БД	PR	Professional Kazakh (Russian)	3	2	3	0	0	2	2	2	У		ОК6	СМиТМП

2.2.5	(R) 2201	language											
БД 3.2.16	P-olYa 3202	Professionally oriented foreign language	5	2	3	0	0	2	2	2 У		ОК6	Ин.яз
Module health and safety													
Required component													
ООД 1.1.5	EUR 1105	Ecology and Sustainable Development	1	2	3	1	0	1	2	2 Т		ОК4	Экология
ООД 1.1.6	OBJ 1103	Basics of Life Safety	1	2	3	1	0	1	2	2 Т		ОК4	ОБЖиОТ
БД 2.2.12	OT 2210	Occupational Safety and Health	4	2	3	1	1	0	2	2 Т		ОК4	ОБЖиОТ
Additional kinds of training													
ДВО	FK	Physical Culture	1-4	8								ОК4	ФВ
Module Mathematical and Information Training													
Required component													
ООД	Inf	Informatics	2	3	5	2	1	0	3	3 Т		ОК10	ИКиСТД

1.1.10	1104												
БД 1.2.4	Mat1201	Mathematics I	2	3	5	2	0 1	3	3	T		ПК1	Мате мат.
БД 1.2.6	Mat 1203	Mathematics II	3	3	5	2	0 1	3	3	T		ПК1	Математ.
Electives													
БД 2.2.11	Mat 2211	Mathematics III	4	3	5	2	0 1	3	3	T		ПК1	Математ.
БД 2.2.11.1	Mat 2211.1	Mathematics in problems	4	3	5	2	0 1	3	3	T		ПК1	Математ.
БД 3.2.17	Mat 3218	Mathematics IV	5	3	5	2	0 1	3	3	T		ПК1	Математика
БД 3.2.17.1	Mat 3218.1	Probability theory and mathematical statistics	5	3	5	2	0 1	3	3	T		ПК1	Математика
Module physics													
Required component													
БД 1.2.3	Fiz 1202	Physics I	2	4	6	2	2 0	4	4	T		ПК2	ОиТФ

Electives														
БД 3..2. 19	IGF 3221	Selected chapters of physics	5	3	5	1	2	0	3	3	-		ПК2	ОиТФ
БД 3.2. 19.1	PF 3221/1	Applied physics	5	3	5	1	2	0	3	3	-		ПК2	ОиТФ
Chemical module														
Required component														
БД 1.2.2	Him 1203	Chemistry	1	3	5	2	1	0	3	3	Т		ПК3	ПХ
Electives														
БД 3.2.18	FM 3219	Physical chemistry	5	2	3	1	1	0	3	3	Т		ПК3	ПХ
БД 3.2. 18.1	Him 3219.1	Chemistry I	5	2	3	1	1	0	3	3	Т		ПК3	ПХ
Module descriptive geometry and computer graphics														
Required component														
БД 1.2.1	NGI 1204	Descriptive geometry	1	3	5	1	0	2	3	3	П		ПК6	НГиИГ
Electives														
БД	RG 220	Computer graphics	3	2	3	1	1	0	3	3	Т		ПК6	НГиИГ

2.2.10	9													
БД 2.2.10.1	IG 2209.1	Engineering graphics	3	2	3	1	1	0	3	3	Т		ПК6	НГиИГ
General Technical module 1														
Electives														
БД 2.2.7	TM 2207	Theoretical mechanics	3	3	5	2	1	0	0	3	П		ПК2	ПМиОКМ
БД 2.2.7.1	PM 2207.1	Applied mechanics	3	3	5	2	1	0	0	3	П		ПК2	ПМиОКМ
БД 2.2.8	Mat 2208	Materials science	3	3	5	2	1	0	0	3	Т		ПК4	СМиТМП
БД 2.2.8.1	KMT 2208.1	Structural materi-als and heat treatment	3	3	5	2	1	0	0	3	Т		ПК4	СМиТМП
БД 2.2.9	MSP22116	Mechanical and physical properties of materials	3	2	3	2	0	1	0	3	П		ПК5	СМиТМП
БД .2.29.1	DKS22116.1	Defects in the crystal structure	3	2	3	2	0	1	0	3	П		ПК5	СМиТМП
БД	SM	Strength of	4	3	5	2	1	0	0	3	П		ПК2	ПМи

2.2.13	2212	materials												ОКМ
БД 2.2.13.1	ТМ 2212.1	Technical mechanics	4	3	5	2	1	0	0	3	П		ПК2	ПМи ОКМ
General Technical module 2														
Electives														
БД2.2.14	Elek 2213	Electrical engineering	4	3	5	2	1	0	3	3	Т		ПК2	Элекротехники
БД 2.2.14.1	TOE 2213.1	Theoretical foundations of electrical engineering	4	3	5	2	1	0	3	3	Т		ПК2	Элекротехники
БД 3.2.20	TCM 2214	Technology of construction materials	5	3	5	2	1	0	0	3	Т		ПК7	СМиТМП
БД 3.2.20.1	TPMP 2214.1	The technological processes of machine-building production	5	3	5	2	1	0	0	3	Т		ПК7	СМиТМП
Module methodology for selecting materials and technologies of their treatme														
Electives														
БД 2.2.15	TSM 2215	The theory of the structure of materials	4	3	5	2	1	0	3	3	П		ПК5	СМиТМП

БД .2. 15.1	FM 2215.1	Physical material science	4	3	5	2	1	0	3	3	П		ПК5	СМиТМП
Required component														
ПД 3.3.1	TOM 3301	Heat processing of materials	5	3	6	2	1	0	3	3	П	КП	ПК7	СМиТМП
ПД 3.3.2	MVM 3302	Methodology of materials selection	6	2	5	1	0	1	2	2	П	КР	ПК7	СМиТМП
Electives														

БД 3.2.22	MLM 3222	Modification and alloying materials	6	2	3	2	0	1	3	3	П		ПК5	СМи ТМП
БД 3.2. 22.1	TM 3222.1	Refractorymaterials	6	2	3	2	0	1	3	3	П		ПК5	СМи ТМП
ПД 3.3.3	КАР 3305	Corrosion and anti-corrosion coatings	6	3	6	2	1	0	3	3	П		ПК5	СМи ТМП
ПД 3.3.3 .1	CAC 3303.1	Corrosion processes and protection against corrosion	6	3	6	2	1	0	3	3	П		ПК5	СМи ТМП
Module design, engineering and production economics														

Required component													
ООД 2.1. 11	OET 2107	Fundamentals of economic theory	3	2	3	1	0	1	2	2	Т		ПК17	ЭП
Electives													
БД 3.2.21	OKDM 3220	Fundamentals of design and machine parts	5	3	5	2	1	0	3	3		КП	ПК6	ПМиОКМ
БД 3.2. 21.1	DM 3220.1	Machine parts	5	3	5	2	1	0	3	3		КП	ПК6	ПМиОКМ
ПД 3.3.7	ETMS 3307	Equipment and accessories in materials science	3	3	6	2	0	1	3	3	П		ПК8	СМи ТМП
ПД 3.3.7.1	TEM-bP 3307.1	Technological equipment for engineering production	3	3	6	2	0	1	3	3	П		ПК8	СМи ТМП
ПД 4.3.8	OPP 4308	Organization and planning of production	7	2	3	1	0	1	2	2	П		ПК17	ЭП
ПД 4.3.8.1	MMP 4308.1	Management and marketing of production	7	2	3	1	0	1	2	2	П		ПК17	ЭП
ПД	PP	Production Design	7	3	6	2	0	1	3	3	П	КП	ПК1	СМиТ

4..3.11	43011											4	МП
ПД 4.3.11.1	PP 4311.1	Design and manufacture of blanks 7	3	6	2	0	1	3	3	П	КП	ПК14	СМиТМП
Module structural engineering material													
Electives													
ПД 3.3.4	MNG 3304	Materials in the oil and gas industry 6	3	6	2	0	1	3	3	П		ПК7	С
ПД 3.4.1	MNG 3304.1	Porous materials 6	3	6	2	0	1	3	3	П		ПК7	СМиТМП
ПД 3.3.5	NM 3305	Non-metallic materials 6	3	6	2	0	1	3	3	П	КР	ПК5	СМиТМП
ПД 3.3.5.1	PCM 3305.1	Powder and composite materials 6	3	6	2	0	1	3	3	П	КР	ПК5	СМиТМП
ПД 3.3.6	EM 3306	Engineering materials 6	3	6	2	0	1	3	3	П		ПК12	СМиТМП
ПД 3.3.6.1	FWM 33061	The friction and wear of the materials 6	3	6	2	0	1	3	3	П		ПК12	СМиТМП

ПД 4.3.9	ASM 4309.1	Nuclear and Space Materials	7	2	5	2	0	1	3	3	П		ПК7	СМиТМП
ПД 4.3.9.1	ASM 4309.1.1	Diffusion in metals	7	2	5	2	0	1	3	3	П		ПК7	СМиТМП
ПД 4.3.10	H-sTM 4310	High-strength engineering materials	7	3	6	2	1	0	3	3	П		ПК12	СМиТМП
ПД 4.3.10.1	PCM 4310.1	Protective coating materials	7	3	6	2	1	0	3	3	П		ПК12	СМиТМП
Research module														
Electives														
ПД 4.3.12	MSP 4312	Materials with special properties	7	3	6	2	1	0	3	3	П		ПК16	СМиТМП
ПД 4.3.12.1	SCM 43012.1	Special methods of casting	7	3	6	2	1	0	3	3	П		ПК16	СМиТМП
ПД 4.3.13	P-sPCM 431	Physics of strength and ductility of structural materia	7	3	6	2	0	1	3	3	П		ПК17	СМиТМП

	3													
ПД .3. 13.1	CSM 4313.1	Superplasticity materials	7	3	6	2	0	1	3	3	П		ПК17	СМиТМП
Practice-oriented module														
ДВО	UP 1	Teaching practice	2	4	6									СМиТМП
ДВО	PP2	Production practice 1	4	3	5									СМиТМП
ДВО	PP3	Production practice 2	6	3	5									СМиТМП
ДВО	PdP	Undergraduate practice	13	5										СМиТМП
The module final certification														
ДРдп	NZDR	Writing and defense of thesis	7	2	3									СМиТМП
ГАК	GE	The module final certification	4	1	2									СМиТМП

According to self assessment report the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Material Science and Technologies of new Materials

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The following **curriculum** is presented:

Cycledis	Discitis	Name of disciplines		the number of credits	lectur	labo	practic	Independent work of	Type of		Department

citis	code.		Semester	рк	ECTS	es	rat or y	al	students		con trol	COMPETENCE	
									РСП	РС			
					Course 1 Semester Autumn								
Module historical and social and training polylingual													
Compulsory module													
БД 1	IFN 5201	History and philosophy of science	1	2	3	1		1	2	2	У	ОК 1 ОК 3	ИКиСГД
БД2	IYa 5202	Foreign language (professional)	1	2	3			2	2	2	У	ОК 6 ОК 9	ИЯ
БД3	Ped 5203	Pedagogy	1	2	3	1		1	2	2	У	ОК 2 ОК 5 ОК 8	ИКиСГД
БД4	Psi 5204	Psychology	1	2	3	1		1	2	2	У	ОК 2 ОК 3	ИКиСГД
												ОК 4	
Module fundamentals of materials science													
Compulsory module													
ПД 1	FPM	Fundamental Problems of Materials Science	1	1	2	1			1	1	У	ОК 10 ОК 15 ОК	СМиТМП
Module optionally													
БД 5.1	MAS	Materials alu-minum alloys	1	3	5	2		1	3	3	П	ОК 12 ОК 16	СМиТМП

БД 5.2	DM	Damping materials	1	3	5	2		1	3	3	П	ОК 13 ОК 15	СМиТМП
БД 6.1	ESRM	Extreme condition and destruction of materials	1	2	3	1		1	2	2	У	ОК 14 ОК 15 ОК 16	СМиТМП
БД 6.2	MMPE	Methods of mathematical experiment planning	1	2	3	1		1	2	2	У	ОК 10 ОК 11 ОК 14	СМиТМП
Course 1 Spring Semester													
Module methods of research and testing of materials													
Module optionally													
БД 7.1	GZMSP	The life cycle of materials and their means of support	2	3	5	2		1	3	3	У	ОК 17 ПК 6	СМиТМП
БД 7.2	MIKIMM	Methods of testing, monitoring and investigation of engineering materials	2	3	5	2		1	3	3	У	ОК 15 ОК 17 ПК 6	СМиТМП
Materials electrical module													
Module optionally													
БД 8.1	MRPNP	Materials with controlled density of nanostructured coatings	2	4	6	2		2	4	4	П	ОК 13 ПК 1 ПК 4	СМиТМП

БД 8.2	EM	Electrical Materials	2	4	6	2		2	4	4	П	ОК 16 ОК 17 ПК 3	СМиТМП
Module technology innovation in materials science													
Compulsory module													
ПД 2	MRFP	Methods for calculating the phase trans-formations	2	1	2	1			1	1	У	ПК 7 ПК 12	СМиТМП
Module optionally													
ПД 3.1	MNM	Massive nanostructured materials	2	3	5	2		1	3	3	У	ПК 1 ПК 5 ПК 11	СМиТМП
ПД 3.2	PZK	Passive protec-tion against cor-rosion	2	3	5	2		1	3	3	У	ПК 16 ПК 17	СМиТМП
ПД 4.1	EBTPM	Eco-friendly Materials Technology	2	3	5	2		1	3	3	У	ПК 8 ПК 10 ПК 22	СМиТМП
ПД 4.2	OPNS	Common problems nanosystems	2	3	5	2		1	3		У	ПК 2 ПК 4	СМиТМП

Research Module 1													
ДВ О1	NIR M	The research work of a student, including the implementation of the master's thesis (research)	2	3	28							ПК 20 ПК 30 ПК 32 ПК 33	СМиТМ П
Practice-oriented module 1													
ДВ О2	IP	Research practice	2	3	12							ПК 29 ПК 30	СМиТМ П
Course 2 Semester Autumn													
Module Materials of Advanced Materials													
Module optionally													
ПД 4.1	RM	Reactor Materials	3	3	5	2		1	3	3	П	ПК 13 ПК 24	СМиТМ П
ПД 4.2	MSS S	Metallurgical special steels and alloys	3	3	5	2		1	3	3	П	ПК 21 ПК 22 ПК 23	СМиТМ П
ПД 5.1	BOS	Metals with special properties	3	3	5	2		1	3	3	У	ПК 24 ПК 25	СМиТМ П
ПД 5.2	PMT P	Perspective materials and technologies for their production	3	3	5	2		1	3	3	У	ПК 6 ПК 10 ПК 17	СМиТМ П
Module Surface Engineering													
Module optionally													
ПД 2.1	MCh MP	Mechanochemistry and coatings	3	3	5	2		1	3	3	П	ПК 3 ПК 5	СМиТМ П

											ПК 14	
ПД 2.2	NPOPM	New approaches to assessing the strength	3	3	5	2		1	3	3	П	ПК 15 ПК 19	СМиТМП
ПД 2.3	KMM	Computer simulations in materials science	3	2	3	1		1	2	2	У	ОК 10 ПК 10	СМиТМП
ПД 2.4	PI	Surface Engineering Materials	3	2	3	1		1	2	2	У	ПК 5 ПК 11 ПК 14	СМиТМП
ПД 2.7	UPOM	Control parameters material handling	3	3	5	2		1	3	3	У	ПК 22 ПК 23	СМиТМП
ПД 2.8	MIAPSSM	Methods of research, analysis and forecasting of the structure and properties of materials	3	3	5	2		1	3	3	У	ПК 9 ПК 14 ПК 18	СМи ТМП
Research Module 2													
ДВО1	NIRM	The research work of a student, including the implementation of the master's thesis (researc)	3	4	16							ПК 31 ПК 32 ПК 33	СМиТМП
Practice-oriented module 2													
ДВО 3	PP	Teaching practice	3	3	12							ПК 27 ПК 28 ПК 29	СМиТМП

Course 2 Semester Spring													
The module final certification													
Compulsory module													
ИА	CE	State examination in the specialty	4	1	4								СМиТМП
ИА	DP	Registration and protection of the master's thesis	4	3	11								СМиТМП