ASIIN Seal & EUR-ACE® Labels

Accreditation Report

Master's Degree Programmes
Small Enterprises Metallurgy
Systems Engineering

Provided by
Ural Federal University

Version: 17 September 2020

Table of Content

A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Процессы малой металлургии	Small Enterprises Metallurgy	ASIIN, EUR-ACE® Label	-	01, 06
Системная инженерия	Systems Engineering	ASIIN, EUR-ACE® Label	-	01, 06

Date of the contract: 09.11.2017

Submission of the final version of the self-assessment report: 23.05.2019

Date of the onsite visit: 28.-29.05.2019

at: Ural Federal University Campus, Yekaterinburg

Peer panel:

Prof. Dr.-Ing. Axel Schumacher, Universität Wuppertal

Prof. i.R. Dr. Horst Brezinski, Technische Universität Bergakademie Freiberg

Dr. Matthias Wunderlich, Renault Group

Irina Karabutova, Ural State University of Railway Transport (Student)

Representative of the ASIIN headquarter: Arne Thielenhaus

Responsible decision-making committee: Accreditation Commission for Degree Programmes

Criteria used:

European Standards and Guidelines as of 10.05.2015

ASIIN General Criteria, as of 04.12.2014

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

[2] TC: Technical Committee for the following subject areas: TC 01 - Mechanical Engineering/Process Engineering; TC 06 - Industrial Engineering.

Subject-Specific Criteria of Technical Committee 01 – Mechanical Engineering / Process Engineering as of 09.12.2011 and Technical Committee 06 – Industrial Engineering as of 06.12.2013

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
Процессы малой металлургии	M.Sc. in Small Enterprises Metallurgy	-	7	Full time	-	4 Semester	120 ECTS points	2 years. First time offer 2011.
Системная инженерия	M.Sc. in Systems Engineering	-	7	Full time	-	4 Semester	120 ECTS points	2 years. First time offer 2015.

For the **Master's degree programme Systems Engineering**, the institution has presented the following profile on its website:

"The educational program "System Engineering" was developed in accordance with the federal state educational standard of higher education in the field of training 04/27/03 "System Analysis and Management" (master's level), approved by order of the Ministry of Education and Science of the Russian Federation dated October 30, 2014 No. 1413.

Systems, as well as the processes and practices necessary to develop them, are critical to adequately respond to the challenges of the modern world. The International Council of System Engineers (INCOSE) defines system engineering (SI) as an interdisciplinary approach and means to ensure the implementation of successful systems. The principles and practices of SI play a key role in the development of large, complex and / or reliable systems, including products, services and enterprises. SI forms the modern lifestyle, which is based on the daily interaction of people with high-performance systems in various fields. Systems thinking is today the necessary ability for a successful career of engineers of any specialties to ensure the deep integration of technical systems and organizations to support those multiple services which employees of the enterprises and consumers need. Systems engineering helps to ensure that the developed system is really an effective solution to existing problems or provides the necessary features.

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

The special training required to perform the role of a system engineer differs significantly from training in other engineering specialties. Since SI continues to actively develop in the world and in Russia, the implementation of the System Engineering education program developed at the Graduate School of Engineering on the basis of the international recommendations of GRCSE becomes critical.

The purpose of the Master's program "Systems Engineering" is to train technical leaders who are able to increase the competitiveness of industrial enterprises through the introduction of advanced technologies in their products, as well as in the processes of their development, production, maintenance, modernization and replacement (decommissioning)."

(Translated using Google Translate)

For the **Master's degree programme Small Enterprises Metallurgy** the institution has presented the following profile on the programme website:

"Engineering training under the master's program "Small Enterprises Metallurgy" is conducted as project training, as a didactic system. The method of implementation of consistent and interrelated projects underlies the technology of training, which provides for the integration of knowledge, the application of updated knowledge and the acquisition of new ones.

The basic principle of undergraduate project training is based on the results of mastering undergraduate programs and their logical development, establishing a direct link between educational material and students' life experience in their active cognitive and creative joint activities. This strategy reflects the ideas of learning on an active basis, through the student's expedient activity, in line with his personal interest in concrete knowledge. The result of educational technology on the project method is a joint analysis, formulation and solution of problems using the necessary knowledge from different areas to obtain a real and tangible result.

The constructed design methodology allows to solve a number of target tasks of technological magistracy:

Ø classes go out to the practical actions of students, affecting their emotional sphere, thereby increasing motivation;

Ø students carry out educational, creative work within the framework of the project (projects) that was independently developed, exploring and obtaining the necessary information;

Ø Various forms of organization of educational activities are successfully implemented to enable students to interact with each other and with the teacher, whose role changes: instead of the

controller, he becomes an equal partner, a participant in project activities, an adviser and a consultant.

The idea, design and implementation of projects assumes not so much special areas of knowledge as metaknowledge (knowledge of how to acquire knowledge) and cognitive skills that can be successfully transferred to other areas of activity, which is reflected in the successive results of training undergraduate (Master) 2).

(Translated using Google Translate)

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:

- Learning-Outcome-Module Matrices
- Self-Assessment Report
- Module descriptions (submitted after audit)
- SE programme brochure
- Basic Professional Educational Programme "System Engineering" (2015)
- SE programme website: https://programs.edu.urfu.ru/ru/8693/
- SEM programme website: https://programs.edu.urfu.ru/ru/9934/
- Audit discussions
- Skype call with programme coordinators (22.10.2019)

Preliminary assessment and analysis of the peers:
The peers refer to the Subject-Specific Criteria (SSC) of the ASIIN Technical Committees Mechanical Engineering / Process Engineering (TC 01) and Industrial Engineering (TC 06) as basis for judging whether the intended learning outcomes of the Systems Engineering (SE) and Small Enterprises Metallurgy (SME) Master degree programmes correspond with the competencies as outlined by the respective SSC. The SSC are the result of an assessment, regularly performed by ASIIN Technical Committees, which summarise what is considered as good practice by a professional community formed equally by academics and professional practitioners in higher education and is required as future-oriented quality of training in the labour market.

[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.

As described in the SAR and mentioned by the programme coordinators during the audit, the objectives and learning outcomes of the Small Enterprises Metallurgy (SEM) Master programme are anchored in the Federal State Education Standards (FSES) of the Russian Federation 22.04.02 "Technologies of materials". The FSES standard describes a number of general cultural, general professional and profession-specific competencies, which students must obtain during the degree program. The degree qualifies graduates to occupy positions in accordance with the professional standards of the Russian Federation, including the professional standard “foundry engineer in the automotive industry” (approved by order of the Ministry of Labor and Social Protection of the Russian Federation from 13.10.14 No. 711н, reg. number 214). During the audit, the peers learn that the SEM programme is designed to be a work-study programme.

Following the audit, the University submits revised learning-outcome-module (LOM) matrices, which list the desired learning outcomes in the categories knowledge, skills and competencies, for each module. The peers can see that the desired competencies include the ability to use modern communication technologies and foreign languages, and the ability to take into account the diversity of cultures. Graduates shall possess leadership skills including the ability to organize and manage teamwork and to develop team strategies, as well as the ability to identify and implement priorities of their own activities. They shall be able to manage projects at all stages of the project life cycle, to carry out critical analysis of problem situations using a systematic approach, and to subsequently develop an action plan. They should be able to plan, develop, organize and modernize technical facilities, systems and processes in foundry and additive manufacturing activities, taking into account economic, environmental and social constraints. They shall be able to analyse environmental and safety risks and to develop measures to mitigate them. They shall be able to develop complex technical regulations, apply quality control systems, evaluate and develop scientific, technical and proprietary information, and issue scientific and technical reports, with regards to both the foundry industry as well as additive technologies. A complete overview of acquired skills, knowledge and competencies is provided in the annex.

The peers are pleased to see that the revised LOM contains desired learning outcomes specifically related to foundry and additive manufacturing, as this was not the case in the initially submitted LOM. However, they note that the revised LOM contains a much greater number of desired learning outcomes and objectives, and that there is no brief and concise list of overall programme objectives in any of the provided documents. The peers are of the opinion that the University must include a brief and concise definition of the SEM programme’s objectives and learning outcomes on the programme website or otherwise ensure that the relevant stakeholders have easy access to them.

While examining the university's online presence, the peers note that there are two websites for the SEM programme, with a differing amount of information. In the Skype call following the audit, the programme coordinators explain that one of the websites is formal, the other informal. The peers believe that having two websites may be confusing for students and therefore recommend that only one programme website be used. Alternatively, the websites should be clearly distinguished from each other, so that it is apparent to students where they must look for information.

Concerning the Systems Engineering (SE) work-study Master programme, the qualifications achieved by graduates are set by the FSES RF, 27.04.03 "System analysis and management". Graduates should be able to occupy positions in accordance with the professional standards of the Russian Federation: "Specialist in Automated Production Management Systems". A digital copy of the standard is made available on the programme website. During the Skype call following the audit, the programme coordinators explain that this standard is relatively new and that a Russian national accreditation agency will examine adherence to the standard in the future. The programme coordinators note that adherence to the standard does not require any curriculum content specific to the automotive sector.

The University provides a brochure for the SE programme, which contains a list of objectives and desired learning outcomes. It states that programme graduates should be able to develop formalized tasks on the basis of system research, manage team projects and use informal information as initial data. They shall be able to assess and control the complexity of systems in the process of resolving problem situations, to describe complex non-formalized systems with the help of known physical, chemical, biological, economic and other formalized models, and to apply mathematics for the purposes of problem solving. They shall be able to make decisions in conditions of uncertainty with the help of situational modelling, utilizing computer technology, system life-cycle management, evidence-based problem-solving, creative thinking, design thinking, system integration and super system approaches.

The peers note that there is variation with regards to the learning outcomes presented in the programme brochure, the LOM matrices, and the description on the programme's website. In particular, they note that the website suggests that graduates will achieve desired learning outcomes "3-5 years after the end of the programme". The peers are of the opinion that the learning outcomes described on the website must be tied to the study programme and not to the students' career choices following the programme. The University is asked to revise the online description. Furthermore, the desired learning outcomes must be communicated consistently in all documents (website, module handbook, official course description).

The programme coordinators explain to the peers that learning outcomes are evaluated on the course level, module level and study programme level. The peers find that the initially submitted module descriptions group various courses (sub-modules) together, resulting in very broad descriptions with insufficient details about the contents and objectives of each course. Following the audit, the University responds to the peers' request and submits revised module descriptions, including descriptions of the sub-modules. The peers find that the descriptions list the desired learning outcomes in an appropriate format. In addition, the University submits revised LOMs, which also detail the achieved learning outcomes.

According to the SAR, the learning outcomes and competence profiles for both programmes were shaped with the input from a variety of stakeholders. For the programme launch, they were based on the students' and employers' feedback. Following the launch, the competence profile is annually reviewed and (if necessary) adjusted, also leading to adjustment of the competency matrix, modules, disciplines and documents. At the third cycle of the programmes implementation, the University has changed 50% of the program content. For the SEM programme, for instance, the content now includes additional competencies in production modelling. The University has also expanded the list of industry partners.

The curriculum contents are periodically validated in professional communities. For the SEM programme, they are submitted for expert discussion in the commissions of the Council of Chief Engineering Designers of the Sverdlovsk region, where one of the programme coordinators is active as Vice-head of Commission.

In the Skype conference following the audit, the SE programme coordinators indicate that the programme content and learning outcomes are based on recommendations of the International Council on Systems Engineering (INCOSE) and the MITRE Corporation. The learning outcomes are also discussed at local INCOSE branch meetings. Subsequently, it seems to the peers that the learning outcomes are analysed and adjusted on a regular basis.

In conclusion, the peers find that the objectives and learning outcomes of the SEM and SE programmes are in agreement with the SSC of the TC01 and TC06 and thus the EUR-ACE® requirements. However, for both programmes, the objectives and learning outcomes must be presented consistently across all communication platforms (including the websites) to avoid confusion for students, applicants and other interested parties. There should only be one website for the SEM programme, or else it should be made clear which is the "formal" website and which is the "informal" website so students can immediately find information. The University has provided official Russian-language documents for the SE programme

(22.04.02/28.01 Curriculum №6076 (Version 3)), which contains the official general description of the educational programme. The peers ask the University to provide a complete translation of this official document, as well as of the corresponding official document for the SEM programme.

Criterion 1.2 Name of the degree programme

Evidence:

- Self-Assessment Report
- Audit discussions

Preliminary assessment and analysis of the peers:

During the audit, the programme coordinators explain that the Small Enterprises Metallurgy programme was developed due to the strong local need for people with skills in both business and foundry engineering. Many of the graduates subsequently work in foundries and some even have opened their own foundries.

The peers are surprised by the fact that the graduates are awarded the qualification "Specialist foundry in the automotive industry", noting that the curriculum contents do not contain a focus on the automotive industry. However, as this qualification is awarded by the Russian Ministry of Labor, it is not subject of the ASIIN accreditation.

The peers find that there are some inconsistencies with respect to the translation of the name: for instance, the programme is referred to as "Processes of Small-scale metallurgy" on the website. The University should use a consistent translation in all documents to avoid confusion. During the audit discussions, the peers note that the programme focuses on Entrepreneurship and suggest that it could therefore also be named "Entrepreneurship and Innovation in Metallurgy", which may increase its appeal to potential applicants. The programme coordinators agree to consider this.

According to the SAR, the name "System Engineering" reflects the programme's goal to train students to adopt a holistic systems approach towards the increasingly complex and constantly changing world of machinery and technology. The programme was developed as a training programme for local industry partners who saw a strong need for interdisciplinary engineering personnel able to adopt a comprehensive approach towards solving problems. These engineers provide a counterweight to narrowly specialized personnel and are also able to overcome interdepartmental disunity, characteristic for post-Soviet era companies.

Overall, the peers concur that the Russian names of the degree programmes reflect the aims and learning outcomes as well as the main course language.

Criterion 1.3 Curriculum

Evidence:

- Curricula
- Academic Calendar
- Basic Professional Educational Programme „Systems Engineering" (submitted after audit)
- Module Descriptions (submitted after audit)
- Learning-Outcome-Module Matrices (submitted after audit)
- Skype call with Programme Coordinators (22.10.2019)

Preliminary assessment and analysis of the peers:
As indicated under criterion 1.1, following the audit the University submits revised module handbooks and LOMs. These detail the knowledge, skills and competencies acquired by the students in each module and sub-module.

The University also provides curricula overviews for the two programmes, which in the absence of English-language curricula are translated using online translation tools. The peers find the provided curricula overviews difficult to understand, as all primary module names are listed a second time as sub-modules, but are in fact not sub-modules and are not provided a module description. The peers are of the opinion that the curricula should be revised to be easily understandable; in particular, the individual "modules" and "sub-modules" as well as the respective credit points should be clearly distinguishable as credited reference units. Furthermore, the peers see that a "Minor" with 3 ECTS points is included in the curricula. During the Skype call following the audit, the programme coordinators explain that this Minor represents elective courses which the students can choose from a list provided at the beginning of each academic year.

While this is not made clear in the initially submitted documentation, the peers discover that both programmes are designed to accommodate working students in particular. Almost all students work in local companies parallel to their studies. As explained by the programme coordinators during the audit, students are not required to have a job when they apply to the programme – the University can help arrange an internship or traineeship with partner-companies. Furthermore, students can work with the University.

The programme coordinators explain that the programmes were changed following the switch from the previous Russian degree system to the current Bachelor/Master system. They found that most students prefer to begin working and earning an income as soon as they receive their Bachelor's degree. For this reason, all courses are held in the evenings or

on Saturdays. According to the programme coordinators, the programmes' large elective components also intends to accommodate the students, allowing them to take courses in accordance with their interests and profession. The students present during the audit confirm that, while they have less free time, combining work with studies gives them the opportunity to apply the acquired knowledge and skills in real-world settings. The peers recognize that the programmes allow students to define an individual focus and course of study.

The initial documentation provides very limited information about the practices, so that the peers ask for additional information. During the Skype call, the programme coordinators explain that students participate in three practices, of which the first two generally take place at the University's School of Engineering facilities. In the "modelling" practice, students may for instance be required to simulate foundry processes. In the "research" practice, students focus on a research project - one group of students won a regional prize for developing a new method to treat used batteries. A third, "technological" practice takes place at a partner company. In the SEM programme, the technological practice focuses either on "design" or "production" aspects. For instance, students may be involved in the design of casting tools. In the SE programme, the technological practice may involve modelling company production systems, simulating business processes, designing digital twins, or optimizing a complex assembly process (for example for a locomotive). While the practices are supervised by instructors and employers, the contact time is very limited, so that in the curriculum all the practice hours are listed under "self-study". In conclusion, the peers see that the students are given opportunities to apply the acquired skills in practical, real-world settings.

Concerning the use of English, the peers note that the SE programme offers a small number of English-language seminars, also taught by guest lecturers. While the SEM programme includes the ability to use foreign languages as a learning objective, the peers learn during the audit discussions that, aside from the foreign language course, it does not include courses with English-language contents. The peers therefore recommend integrating more English-language contents in the curriculum. They furthermore recommend increasing the internationalization of the programme by inviting more lecturers from universities abroad and publishing programme-related information in English.

Both Master programmes also include desired learning outcomes regarding soft skills. During the audit discussions, the peers learn from the students that the students receive training in soft skills as part of the curriculum. The students report that these courses are valuable and effective.

The peers inquire to what extent intellectual property rights are featured in the curriculum: the programme coordinators explain that they are featured in the core curriculum of the SE programme and as an elective in the SEM programme. According to them, the students also learn about intellectual property rights during their Bachelor degree programmes. The peers conclude that the subject receives appropriate attention.

With regards to the Additive Manufacturing elective in the SEM programme, the peers learn that the course contents include modelling and researching the composition of additive manufacturing powders. After touring the facilities, the peers believe that the related learning outcomes can be safely achieved.

In general, the peers are of the opinion that the presented learning outcomes are in line with the courses offered. Industry placements form part of the degree programmes. The peers see that the contents of the SEM and SE programmes are generally in line with the SSC of the TC01 and TC06 and are therefore also in agreement with the EUR-ACE® requirements. The curricula of the programmes reflect the competencies of the University in the areas of Metallurgy and Systems Engineering.

Criterion 1.4 Admission requirements

Evidence:

- Self-Assessment Report
- "Statistics regarding Study Programmes"
- "Master's program entrance examination" (submitted after audit)
- "Admission Rules Governing Master's Degree Programs in 2019" (submitted after audit)
- "Basic Professional Educational Programme Systems Engineering" (submitted after audit)
- "Explanation of the division of the workload between workplace, university and self-study" (submitted after audit)
- Audit discussions

Preliminary assessment and analysis of the peers:
Although the admission requirements are described identically in the respective SAR reports, the peers learn during audit discussions that the admission process for the two programmes is different and ask the University to submit a detailed written explanation of the process as well as the official admission regulations.

Following the audit, the University provides official documentation and the English-language translation of the University's admission rules for Master's degree programmes, as well as a written explanation of the previous and future admission processes for the two programs. According to the admission rules, students can pay for the Master's education programmes or compete for "budgeted" spots, paid for by the Russian federal government. Students who wish to study for free must have completed a Bachelor's or Specialist degree and cannot already be in possession of a Master's degree, whereas persons with any level of higher education are eligible to compete for the paid spots. According to the websites, there are 15 budgeted spots for the SE programme and 5 extra-budgetary spots. For the SEM programme, there are 20 budgeted spots and 2 extra-budgetary spots.

While previous applicants were required to take written entrance exams, as of the winter semester 2019 both the SE and SEM programmes will begin using online testing to determine applicants' eligibility. In addition to business Russian and foreign language skills (A2 level in English, German or French), the online tests cover math and physics. The entrance exam for the SE programme also covers economics, project management and basic systems engineering knowledge, while the SEM entrance exam additionally covers chemistry and knowledge of metal casting and foundry technology.

Furthermore, the peers do not see that the programme-specific admission criteria and work-study arrangements mentioned above are anchored in any binding documentation. The peers require that the University provides evidence of this. Finally, the peers ask the University to provide evidence that the admission procedures have been made publicly available, for example via the website.

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

In its response, the University states that the admission rules follow the official admission rules of the University. The peers therefore assume that the programme-specific admission rules are not anchored in any binding documentation and are not publicly available. The University must therefore ensure that the programme-specific admission requirements and procedures are binding, transparent and the same for all applicants.

Criteria partially fulfilled.

2. The Degree Programme: Structures, methods & implementation

Criterion 2.1 Structure and modules

Evidence:

- Self-Assessment Report
- Curricula
- Audit discussions
- Module descriptions (submitted after the audit)
- "Explanation of the division of the workload between workplace, university and self-study" (submitted after the audit)

Preliminary assessment and analysis of the peers:
In accordance with the FSES of the Russian Federation, both the SME and SE programmes require two years and include a workload of 120 ECTS points. Also in accordance with the Russian federal standards, both curricula are divided into three blocks. Each block consists of one or several modules, some of which are also composed of sub-modules. The peers see that the modules and sub-modules are a sum of teaching and learning whose contents are concerted.

Block 1 of the curriculum covers the theoretical parts of the programme and can be further broken down into the "basic" component, which is required by Russian federal education standards, as well as the "variable" component. The "variable" component, freely determined by the University, is composed of both required courses as well as electives which the students can choose.

The initially submitted documents provide limited information about the structure of the curricula, so that they only become clearer to the peers after the audit discussions and after reviewing the additional documents submitted by the University. In the SE programme, the basic and variable components consist of 33 ECTS points each. The core programme features 6 modules, some of which are composed of multiple (maximum 3) sub-modules. The modules include "Philosophy of Science and Technology", "Self-management and effective Communication", "Foreign language", "Theoretical foundations of Systems Engineering", "Decision support", and "Designing complex systems". For the variable part, the students can choose from a number of different electives, which, as mentioned, amount to 33 ECTS points. The peers can thus see that the programme allow students to define an individual focus and course of study.

Block 2 of the SE curriculum consists of three practices with a total volume of 48 ECTS points. As indicated by the SAR, these working practices aim to build up the students' engineering competencies. According to the module handbook, the SE practices are distributed across all semesters, beginning with "Research Work" (21 ECTS points) in the first three semesters, a technological traineeship in the third semester (6 ECTS points) and a "pre-diploma" or "professional" internship in the fourth semester (21 ECTS points). The peers learn from the module handbook that a key aspect of the practice modules is the presentation of the final research and project results at an annual international System Engineering conference.

The peers are surprised about some of the contents of the practice module description, which suggest that, "as part of the module, individual training is implemented and the program's teachers become experts in solving project problems of undergraduates." The peers are of the opinion that only information relevant to students should be presented in the module descriptions. The positive impact on the teachers' experience may be considered an added benefit, but should not be listed in the module descriptions. Furthermore, the module description provides insufficient detail (see criterion 5.1.). The peers also note that the detailed curriculum provided by the University breaks down the last practice into two components consisting of 18 and 3 ECTS points, and urge the University to describe its modules consistently across all documents to avoid confusion.

According to the curriculum and module handbook, the SE Students must also pass Block 3, the state final certification, consisting of 6 ECTS points. This includes the preparation for the defense and the defense procedure for the final qualifying work. The SE programme coordinators explain that students do not participate in the state exams (see criterion 3).

In the SEM programme, the core modules include "Foreign language", "Effective Communication", Organization of Engineering Research and Projects", "Practices of Systems Engineering", "Economics and Organization of Production", "Entrepreneurship in Small Metallurgy", "Technical rationing" and "Investment Management". According to the curriculum, students additionally choose from 6 elective modules. While the core component has a volume of 24 ECTS points, the elective component has a workload of 33 ECTS points. The peers therefore recognize that this programme, too, permits individual courses of study.

Block 2 of the SEM curriculum consists of six practices with a total volume of 54 ECTS points, distributed across all four semesters. These include the "Educational practice on professional graphics and drawing", the "Educational practice on modelling professional field process", the "Training practice in designing professional field furniture", the "Technological practice in obtaining professional skills and professional experience", the "R&D project" and the "Pre-diploma practice". From documents submitted after the audit, the peers learn

that the R&D practice can take place either in the company where the student is working or at the University. The peers see that the practices are consecutive and that, in general, each practice builds on the experiences and projects developed in the previous practice. They note that some of the practice descriptions, in particular the description of the "R&D Project", are brief and provide limited detail (see criterion 5.1). The peers ask the University to provide separate module descriptions for each practice and to check if the translated name of the "Training practice in designing professional field furniture" is correct.

According to the revised module handbooks and the curricula, the SEM students must also pass Block 3, the final state certification, consisting of 9 ECTS points.

Since some of the projects are executed at the facilities of the students' employers, the peers ask how the University ensures that the learning outcomes are equal for all students. The programme coordinators respond that, in their experience, students themselves quickly decide to leave companies if they feel that the quality level is insufficient. When it comes to determining the students' projects within the company, the students, company management and professors meet for discussion purposes. A final decision on whether a student's project is carried out always involves multiple people. The peers are thus satisfied with the project selection process.

With regards to the business contents of the curricula, the peers are of the opinion that the the desired learning outcomes of the modules "Economics and Organization of Production" in the SEM programme and "Financial and Economic Activity" in the SE programme are too broad and must be made more concise.

Mobility

With regards to the recognition of external achievements, the peers learn during the audit that many of the students who apply to the Masters programmes have completed their Bachelor degrees at other universities. Entrance examinations and interviews permit the programme coordinators to determine whether the applicants' skills are sufficient. While in general, a four-year Bachelor degree (240 ECTS points) is required to participate in the course, the programme coordinators state that students who have completed shorter Bachelor degree programmes may also be accepted, provided that there is sufficient over-lap in the learning outcomes. During the Skype call, however, the programme coordinators note that this has never been the case so far, and that the university's current regulations do not allow for this. The programme coordinators also explain during the audit discussions that they wish to facilitate mobility between study programmes within the University, as this is currently still problematic.

Since 240 ECTS is the Russian standard for Bachelor's degrees, and since the study programmes target Russian students, the peers consider these regulations adequate. The peers however encourage the programme coordinators to consider other regulations to facilitate recognition of Bachelor degrees with less than 240 ECTS points. The peers note that the University has not provided evidence of the regulations for recognising achievements and competencies acquired outside the higher education institution. The peers therefore ask the University to provide a translation of the official regulations.

Criterion 2.2 Work load and credits

Evidence:

- Self-Assessment Report
- Curricula for both programmes
- Audit discussions
- Skype call with programme coordinators (22.10.2019)

Preliminary assessment and analysis of the peers:
From the SARs, curricula and Diploma Supplement, the peers learn that the workload for both programmes corresponds to 120 ECTS points and that each credit point corresponds to 36 academic hours (1 academic hour = 45 minutes). Each course presented in the curricula is awarded a number of ECTS points corresponding to the workload. In the SE programme, each semester carries a workload of 30 ECTS points. In the SEM programme, the workload is distributed as 27, 33, 33, and 27 ECTS points across the four semesters.

As can be seen in the curricula, the workload is comprised of both attendance-based learning and self-study. During the audit, the students report that, while their Bachelor programmes required more home tasks, the Master programmes require a significant amount of self-study. They consider the Master programmes to be more difficult but also more interesting, due to the fact that they have their own projects.

In the SAR, the University reports that the workload is determined empirically and is based on the success of achieving learning outcomes in the previous cycles of the program. However, the student evaluation forms viewed by the peers as well as the "Expert Opinion" forms do not request any information with regards to workload or the achievement of learning outcomes. During the Skype call following the audit, the University explains that workload is determined based on discussions with students, teachers and previous experience.

During the audit, the peers ask the programme coordinators about the students' workload. The programme coordinators explain that the students do not work full-time; rather, they receive time off from their companies to dedicate to their studies. The companies allow this because the students apply their newly acquired skills to solve company problems, thereby also providing them with additional motivation.

When asked by the peers, all students present during the audit discussions confirm that they are working and that they do not have much free time: in some cases, they also work Saturdays. Many of the students report working 40 hours a week: individual students describe the overall workload as 40 hours of work, 12 hours of study. However, the students do not report any misgivings with regards to the workload.

During the audit discussions, the programme coordinators suggest that e-courses (online courses) integrated in the curriculum reduce attendance requirements and make it easier for students to keep up with the work. In the Skype call following the audit, the programme coordinators clarify that there are no pure e-courses, rather there are a number of courses using e-course elements. The peers positively view the integration of these elements.

In conclusion, the peers are under the impression that the students' workload is very high, particularly considering that most of the students work full-time. While the peers see that qualitative data is gathered on the student workload through discussions with students and teachers, the peers do not see evidence that the workload is empirically determined, as no surveys are presented through which this could be achieved. The peers therefore recommend that the University systematically surveys students in order to empirically determine workload (see criterion 3).

Criterion 2.3 Teaching methodology

Evidence:

- Self-Assessment Report
- Brochure Systems Engineering Programme
- Audit discussions
- Module descriptions (submitted after the audit)
- "Information about teaching methods" (submitted after the audit)
- Skype call with programme coordinators (22.10.2019)

Preliminary assessment and analysis of the peers:
Following the audit, the University provides revised module descriptions with information concerning the teaching methods used in each module, as well as a document with general information about teaching methods. These reveal that the number of students in each course is essentially the same as the number of students in the study programmes and generally ranges between 10-15 students. Lectures and practical lessons are conducted for all students at the same time. For project work during courses, students are divided into teams containing 2-3 people.

The brochure for the SE programme suggests that a variety of teaching methods is utilized, including discussions (both on- and offline), case studies, Socratic conversations, laboratory experiments, student-centered and peer learning and joint research and project activities. While classroom attendance is required for many courses, individual learning paths and the availability of online courses also permit students to set their own learning pace. E-learning courses include courses created by UrFU as well as courses from other universities.

The students confirm that all of them have at least some E-learning courses; some report that they present and defend their studies-related work in webinar formats. Other courses in the SE programme also employ gamification formats: for instance, students play an election campaign game as part of their communication courses. The SE programme also employs business case studies and both study programmes also employ business games.

The programme coordinators explain that practical skills are taught through demonstrations: for instance, teachers may demonstrate how to prepare simulations and conduct modelling using Archimed software in front of the class and give the students the chance to follow along on separate computers. Students also go into the laboratories: in the SEM programme, the students may produce “green” sand and resin sand.

The peers see that the practices play an important role in the curricula. For the SE programme, the three practices account for 48 credit points, while the six practices in the SEM programme account for 54 credit points.

When only examining the non-practice modules, the curricula suggest that self-study accounts for approximately 75% of the work load. In some SE courses, such as “Needs analysis” and “Innovation Infrastructure”, the self-study portion is 72 hours versus 18 hours of contact (80%). In the module “Fundamentals of System Sciences” (SE programme), the self-study portion is even larger: 108 hours of self-study versus 18 hours of contact (approx. 85%).

While most of the modules in the SEM programme involve more contact hours, some courses such as “Technical Rationing” and “Investment Management” also have a high self-

study / contact hours ratio (86 hours to 18 hours). With regards to "Investment Management", the peers are of the opinion that the contact hours are too low – they should be increased to between 30-36 hours.

According to the SARs, both study programmes introduced the module "Methods of Engineering and Design" in 2017. In this, students conduct a research project and subsequently publish the results. While the peers assume that this module familiarises the students with independent academic research and writing, they are unable to find the module description in the module handbooks and ask the University to provide it.

Criterion 2.4 Support and Assistance

Evidence:

- Audit discussions

Preliminary assessment and analysis of the peers:

During the audit, the peers learn from the students and programme coordinators that there is close interaction between students and teachers. The students in the SE programme use a conference app for smart phones with which they can ask peers and teachers questions in a forum. The SEM students report that they occasionally visit their teachers' homes. While there are consultation hours, the students can also communicate with teachers informally outside of these hours via for example WhatsApp. With regards to E-learning, the students also benefit from online tutors. The programme coordinators explain that they also assist students in finding faculty advisors relevant to their professional interests and specializations.

The programme coordinators explain that more than 20 different types of scholarships are available to students who perform well. These generally consist of monthly payments of around 40-80 Euros. Scholarships can be related to research activities, academic marks or athletic achievements. Of the students present during the audit discussions, several report that they have scholarships.

Following the audit discussions, the peers are impressed by the good relationship between students and faculty and conclude that the support provided to the students (both technical and general) is sufficient.

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

In its response to the report, the University submits revised module descriptions. The University suggests that the recommendations of the peers have been followed and that the

content of the modules “Economics and Organization of Production” in the SEM programme and “Financial and Economic Activity” in the SE programme have been concretized and additional topics introduced, to make the learning outcomes more specific. After reviewing the newly submitted descriptions for the two modules, however, the peers note that only the contents and not the desired learning outcomes have been modified. The peers therefore require that the University resubmits these module descriptions, with revised desired learning outcomes which are more closely related to the module’s contents. While the University states that the module descriptions for “Methods of Engineering and Design” have been added to the handbooks, these descriptions are not in the module handbooks submitted to the peers. The peers therefore require that the university submits these.

Regarding the measurement of student workload, the University states that annual surveys are used in order to empirically determine the workload. However, as mentioned, the provided surveys do not mention workload, nor does the University provide any other surveys as proof. The peers therefore recommend that the University systematically implements module-specific surveys to determine workload.

The University does not provide evidence of rules for recognising externally acquired achievements and competences. The peers require that the University provide this.

Criteria not fulfilled.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Curricula
- Audit discussions
- Module handbooks (submitted after audit)
- “Basic Professional Educational Programme Systems Engineering” (submitted after audit)
- “Grading regulations” (submitted after audit)
- “Requirements for Final Qualification Works and Practices of Students in the Engineering School” (submitted after audit)
- Skype call with programme coordinators (22.10.2019)

Preliminary assessment and analysis of the peers:
The assessment methods are indicated in the module handbooks and curricula. The peers see that an assessment exists for each module.

For the SEM programme, the examination formats include tests, written reports, project presentations as well as business games. During the discussions, the peers learn that one type of exam is used per course and that the e-learning courses also use online tests. Examination methods may also include open exam questions. For instance, the examiner may place a casting on the table and require the student to explain how it was created.

During the audit discussions, the peers discover that the SEM programme utilizes the state final exam. During the exam, students receive a drawing on which basis they must develop models and simulations. Subsequently, they must identify possible errors and address them.

For the SE programme, the module handbook suggests that the only assessment forms utilized are written essays and tests. However, the programme description indicates a greater variety of examination methods, such as course work, development of technical project documentation, etc. During the audit discussions and the subsequent Skype call, the peers also learn that SE students are required to give oral presentations. The peers therefore see that the module descriptions provide an incomplete picture of the utilized assessment methods and must be revised by the university accordingly.

The peers learn that the SE programme coordinators chose not to participate in the state exams. In their opinion, the individual student projects and the achievement of the desired learning outcomes take priority over participation in the state exams, particularly since the exams are not required by the government. The peers accept this view.

As previously indicated, both programmes require a Master's thesis. The Master's thesis must be defended in front of an expert committee consisting of UrFU staff and staff from the partner company where the student has completed his technological practice.

Following the audit, the University submits a document with grading regulations, which indicate that learning outcomes are examined in the categories knowledge, skills and personal qualities (motivation). The University also provides examination schedules. While these are in Russian, and therefore not legible to most of the peers, the students do not voice any critique regarding the number and distribution of exams, so that the peers conclude that the exam load and preparation times are adequate.

During the audit, the peers are provided with a number of sample assessments. Proper evaluation is not possible, however, as the assessments are all in Russian. The peers note that some of the reports utilize Wikipedia as a reference, and are subsequently concerned

that the reports utilize untrustworthy sources. The teachers should ensure students utilize scientific reporting standards.

The peers note that the University has not provided English-language evidence of binding examination regulations. To ensure that binding regulations exist with regards to resits, disability compensation measures, illness and other mitigating circumstances, etc., the peers require that the University provides an English-language translation of the official examination regulations and of the other regulations where these matters are covered. The University must also provide evidence that these regulations are published and available to stakeholders in the course language.

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

In its response to the accreditation report, the University notes that all binding examination regulations with regards to resits, disability compensation measures, illness etc. can be found in the Russian language documents on the website, which is confirmed by the Russian-speaking member of the peers team. The peers therefore consider this criteria fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:

- Staff handbooks (submitted after the audit)

Preliminary assessment and analysis of the peers:
Upon request of the peers, the University provides staff handbooks for both of the study programmes after the audit.

The official General description of the educational programme contains the requirements for personnel conditions for the implementation of the master's programme (item 5.1, 5.2). In accordance with Russian Federal Standards, the share of scientific and pedagogical workers with education corresponding to the profile of the discipline is no less than 90% and the share of scientific and pedagogical workers among managers and employees of organizations is not less than 15%.

The peers learn from the teachers of the SEM programme that most of the business knowledge (80%) transmitted to students does not come from the economics department,

rather from the foundry department. The department's close cooperation with the local industry includes a joint-venture, which, according to the teachers, is successful on a national level. As a result, the foundry department staff are able to transmit significant business experience to their students. The teachers inform the peers that around 40 of the programme graduates are successfully running their own foundry-related businesses.

The peers subsequently conclude that the SEM staff is well-equipped to provide the students with industry-specific knowledge. However, the peers note that there are no staff members from the Economics department present during the audit discussions. Following the audit, the University provides documentation of the cooperation between the Engineering and Economics departments for the purposes of executing the SE study programme. However, as this is in Russian, the peers ask the University to provide a translation.

Following the discussions with the teachers and students, the peers are of the opinion that the staff resources are sufficient to provide assistance and advice to students. As described under criterion 2.4, the peers are impressed by the teachers' good relationship with the students and their commitment to helping them. The peers furthermore consider the composition, scientific orientation and qualification of the teaching staff to be suitable for sustaining the degree. The research and development activities carried out by the teaching staff are in line with and support the level of desired academic qualification.

Criterion 4.2 Staff development

Evidence:

- Self-Assessment Report

Preliminary assessment and analysis of the peers:
According to the SAR, development of the teaching staff's professional competence is recorded in the educational policy of the University. Special funds are dedicated to advanced training. Teachers are required to go through training in, for instance, education technologies as well as teaching methods, in order to maintain their positions. Teaching staff are also encouraged to take initiative themselves and make proposals for additional training. These proposals are considered and approved if they are found to correspond to the needs of the programme.

Following the audit discussions, the peers see that the University provides the staff with sufficient training offers.

Criterion 4.3 Funds and equipment

Evidence:

- Audit discussions
- Tour of facilities
- "List of Laboratories SEM" (submitted after audit)
- Photos of facilities (submitted after audit)
- Email "Answer on SEM Prog. Quest."

Preliminary assessment and analysis of the peers:
During the audit discussions, the students report that they are satisfied with the available resources and equipment. According to the SAR, the programme administrators plan and carry out work to eliminate bottlenecks in the facilities and equipment. As previously mentioned, the students work parallel to their studies and complete practical modules at partner companies. As a result, the resources of these partners are also used.

During the tour of the facilities, the peers visit a variety of advanced technical laboratories, workshops with machine-tools, as well as the workshop for additive manufacturing. The peers learn that the additive manufacturing equipment allows the changing of alloys, and that the department has built its own 3D printing equipment and works together with industry partners to conduct research. The peers consider the additive manufacturing equipment to be appropriate for the purposes of achieving the learning outcomes. They also see that there are appropriate lecture rooms available with standard presentation equipment.

However, the peers do not have a chance to visit any facilities related to casting or foundry activities. Furthermore, they find out that the students in the programmes only have limited access to some of the viewed facilities.

Following the audit, the University responds to the peers' requests for more information and provides lists and photos of the facilities and equipment available to the students in the programmes. The peers conclude that the facilities for the SE programme are sufficient. With regards to casting, the programme coordinators note that the university's foundry department operates its own small foundry plant. However, this is generally not used by the students, as it is utilized for commercial production. The students generally acquire practical experience with casting technology at a partner company during the technological practice. During the Skype call following the audit, the University is asked to submit additional photos of laboratories with microscopes that can be used by the students.

Due to the fact that the SE programme was specifically implemented to meet the needs of local businesses, the programme is designed as a training programme for company staff. The programme costs are minimum 100,000 Rubles per student per year, which can be paid either by the employer or by the student. The SEM programme is a federal programme designed to develop metallurgical specialists and is thus sponsored through steady state subsidies. The peers therefore conclude that the funding for the programmes is adequate.

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

As requested, the University submits the translation of the cooperation agreement between the Economics and Engineering Departments, as well as photos of the microscopes following the audit.

Criteria fulfilled.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Module descriptions (submitted after the audit)
- "Basic Professional Educational Programme Systems Engineering" (submitted after audit)

Preliminary assessment and analysis of the peers:
As previously discussed, the module descriptions initially submitted by the University encompass several courses and do not cover the information required by the ASIIN criteria. Following the audit, the University submits revised module descriptions for both programmes. The peers can see that these provide details regarding course contents, assessment forms, applicability, credit points, and in general meet the content requirements.

However, the peers notice a number of inconsistencies in the SE module descriptions. For instance, the module codes in many cases do not match the codes provided in the curriculum – many modules in the handbook have the same module code (ex: "Requirements Engineering" and "System Architecture"). For the course "Technical English", the number of hours does not correspond to the number of credit points. As mentioned under criterion 3, the descriptions of the assessment types are identical for all modules and differ from those mentioned in the SE programme description. The SE module handbook also list all modules

as compulsory, even though a number of them are listed as electives in the curriculum. Furthermore, the peers note that descriptions are missing for a number of the modules listed in the curriculum (ex: “Conflictology”, “Systems analysis and decision theory” etc.). Also, while three different types of practices are listed in the curriculum, there is only one module description covering all of the practices (with a volume of 48 ECTS points), providing very limited information with regards to the contents, workload, etc. of each practice. There should be a separate module description for each practice.

In the SEM module handbook, all six “practical” modules are similarly grouped into a single module description. While a good description of each module’s contents is provided, the peers are unable to identify the length of each module, when it takes place, and the desired learning outcomes for each. Here too, the peers require individual module descriptions. The peers also note some other inconsistencies: for instance, the module “Technical Rationing” is listed under the code 1.5.1 in the handbook but appears to be listed under 1.5.3 in the curriculum. Furthermore, the peers are unable to find the module descriptions for a number of modules listed in the curriculum, including modules 1.8, 1.11, and 1.13.

The peers conclude that for all modules in both programmes, the corrected and completed English-language module descriptions must be submitted in the course of the procedure. Furthermore, module descriptions meeting the ASIIN criteria must be made available to all stakeholders (for example via the website) in the programme language (Russian).

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Sample Diploma Supplements

Preliminary assessment and analysis of the peers:
According to the SAR, the University issues diplomas to all graduates. The peers learn that the University issues diploma supplements upon request and note that this is inconsistent with the ASIIN criteria: the University must issue diploma students to all graduates, regardless of whether these are specifically requested or not.

The University has provided sample diploma supplement for the SE programme. It provides information on the student’s qualification profile and individual performance as well as the classification of the degree programme with regard to its applicable education system. The individual modules and the grading procedure on which the final mark is based are explained in a way, which is clear for third parties. In addition to the final mark, statistical data as set forth in the ECTS points User's Guide is included to allow readers to categorise the individual result/degree.

The peers note that the second Diploma Supplement submitted by the University is for a "Theory and Technology of Foundry Production" Programme. The peers require the University to clarify if the Diploma Supplement is for the SEM programme and whether the programme name used on the Diploma Supplement is different. In case the name is different, it must be used consistently in all course documents.

Criterion 5.3 Relevant rules

Evidence:

- Audit discussions
- Website of the SE Programme: https://programs.edu.urfu.ru/ru/8693/documents/
- Website of the SEM Programme: https://programs.edu.urfu.ru/ru/9934/documents/

Preliminary assessment and analysis of the peers:
The University has indicated that the rights and duties of the University and of students are clearly defined and binding. The peers see that the programme websites provide information such as related professional standards, entrance exam information, curriculum, module descriptions and an official programme description. The peers note that the Russian-language module annotations on the course websites do not contain the same information as the ones provided in English and do not adhere to the ASIIN format requirements. The University may keep these module annotations, but must also make available the revised module handbooks - which meet the ASIIN criteria – in the course language (Russian).

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

Along with its response to the accreditation report, the University submits revised module descriptions with the corrected module codes and adjusted assessment forms. The University also submits separate module descriptions for each of the practices. The peers note that the inconsistency regarding the credit points and number of hours in the module "Technical English" in the SE programme has not been corrected.

The peers note that the newly submitted curriculum still contains modules, such as "Conflictology", "Systems analysis and decision theory", etc. for which no module descriptions have been provided. As a result, the peers require the University to submit the missing module descriptions and to eliminate inconsistencies regarding credit points and work

load. Furthermore, the complete module descriptions must be made available to students in Russian via the University's website.

The peers also suggest that the University revises the curriculum overview and make it easier to distinguish credited modules – currently, many items in the curriculum overview are accorded "0" hours, which makes the role of these items unclear for external viewers.

The University does not provide a response regarding the diploma supplement for the SEM programme. The peers therefore require that the University provides a diploma supplement in which the official English-language programme name is used.

Criteria not fulfilled.

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:

- Self-Assessment Report
- Quality policy: https://urfu.ru/ru/about/today/development-program/menedzhment-kachestva/
- Quality Management Department: https://urfu.ru/ru/about/units/ppe-i-sr/ouk/
- Audit discussions
- "Questionnaire for Employers"
- "Explanation of the UrFU Quality Assurance System" (submitted after audit)
- "Response to ASIIN Request for Additional Information regarding Quality Assurance" (submitted after audit)
- "Requirements for Final Qualification Works and Practices of Students in the Engineering School" (submitted after audit)
- Skype call with programme coordinators (22.10.2019)

Preliminary assessment and analysis of the peers:

As indicated by the University in an explanation submitted after the audit, the university's quality policy, presented on the university website, serves as a guideline for all of the university's quality management activities. The policy covers many different areas, such as

continuous study, monitoring and forecasting of requirements and satisfaction of all stakeholders, and development of a quality management system and its distribution to all activities of all departments of the University. The University's website also contains information on the University's Quality Management Department as well as related regulations and binding responsibilities.

According to the SAR, the achievement of learning outcomes is recorded in a monitoring process, which includes the survey of students', graduates', teachers' and employers' satisfaction. The survey is carried out in the form of a questionnaire and focus groups twice a year in November and June. According to the results of the latest survey, it was determined that teachers think graduates achieve 70% of the desired learning outcomes, graduates and employers think that only 60% are achieved. During the Skype call following the audit, the programme coordinators explain that these statistics are estimates made by the coordinators based on regular discussions with students and employers. There is thus far no formalized procedure for summarizing discussion results.

The auditors consider the perceived achievement of desired learning outcomes to be quite low. However, while the students present during the audit discussions confirm that the workload is significant, they do not criticize any parts of the programme. The programme coordinators respond that the standards set by the programmes are very high – higher than, for instance, federal standards. For this reason, some of the students struggle with the programme.

The programme coordinators explain that there is a central feedback system integrated in the University's website. Additionally, there are electronic student surveys conducted via the students' online profiles. Normally, around 10% of the students participate in the surveys. The students confirm that the University regularly conducts surveys, but note that they rarely participate in them. According to the programme coordinators, however, all students in the SE and SEM programmes participate in evaluations, because they are directly asked by the programme coordinators. They explain that the surveys are anonymous and concern the programme in general, not individual disciplines.

As requested by the peers, the University submits an explanation of the University's QA system ("Explanation of the UrFU quality assurance system") following the audit. In this, the University indicates that a major component of the University's QA system is the focus on students' opinions on study programmes, and that for this purpose a complex questionnaire is used. The University also submits a student questionnaire, which the peers assume is the same as the one mentioned in the explanation. The peers see that, as indicated by the programme coordinators, the questions in the survey are of a very general nature: out of 17 questions, three address programme contents. For instance, survey takers are asked

to rate the effectiveness of different teaching methods on a 10-point scale, and to indicate whether or not different teaching methods such as case studies, peer learning, e-learning, etc. are utilized in their study programme. The majority of the questions address the students' general living circumstances, career goals, opinions on the chosen profession, and other general matters.

The University also submits the "Questionnaire for Employers", which asks employers to what extent the various desired learning outcomes of the study programme have been achieved. The peers judge this to be a useful monitoring tool.

After reviewing the different forms, however, the peers see no evidence that the students themselves are asked about learning-outcome achievement. The questionnaire provided to the students is not suited to identify strengths and weaknesses either of the programmes or of the individual modules, as it does not request feedback regarding usefulness of contents, workload, teacher performance or achievement of learning outcomes.

The peers are of the opinion that the University must conduct module-specific surveys in all modules on a regular basis, in order to gather feedback on the usefulness of module contents, teachers' individual performance and teaching methods, student workload and the achievement of learning outcomes. The outcomes of the evaluations and all derived measures must be made known to all participants.

During the audit discussions, the peers ask what changes have been made as a result of student feedback. The programme coordinators respond that they try to react to all feedback but are unable to accommodate all wishes – for example, when students ask for additional scholarships. The programme coordinators are better able to respond to student requests for facility improvements.

In conclusion, the peers see that a variety of stakeholders, including students, teachers, graduates and employers, form part of an informal quality assurance system which provides feedback to the programme coordinators. As mentioned above, however, the peers see an urgent need for improvement in the evaluation system.

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

In its response to the accreditation report, the University provides some statistics regarding drop-out rates. The peers learn that for the last three cohorts of the SE programme, the average cohort size is 10.3 students, of which, on average, 35% drop out. For the SEM programme, the cohort size jumped from 12 students to 36 students – while before the drop-out rate was between 15-20%, in the current large cohort 5 students have dropped out.

The University explains that students are asked questions about the achievement of learning outcomes during annual discussions.

The peers consider the drop-out rates too high for both of the master's programmes. The University must determine the reasons for these high drop-out rates and devise measures to reduce them. The peers do not believe that the current methods to collect feedback are sufficient. The University must formalize the process and conduct module-specific student surveys in all modules on a regular basis, in order to gather feedback on the usefulness of module-specific contents, student workload, teachers' individual performance and teaching methods, and the achievement of learning outcomes. The outcomes of the evaluations and all derived measures must be made known to all participants.

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:

- Sample diploma supplement for the SEM programme
- Translation of official documents containing the binding, programme-specific admission criteria
- Translation of official documents containing regulations with regards to practices (internships)
- Translation of official documents describing general programme characteristics
- Translation of official documentation of cooperation between Engineering and Economics departments for the SE programme
- Statistics regarding the drop-out and completion rates for both programmes for the previous 3 years
- Translation of official regulations for recognizing achievements and competencies acquired outside the higher education institution
- Revised English-language and Russian-language module descriptions containing
    - correct module codes
    - complete information about assessment types
    - more specific learning objectives for the modules “Economics and Organization of Production” and “Financial and Economic Activity”
    - separate module descriptions for each practice in both programmes

E Comment of the Higher Education Institution (30th October 2019)

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

- Module handbooks for both study programmes
- Separate document with module descriptions for SE practices
- Accreditation report with comments
- Questions from Skype Call document with Answers
- Curriculum for the SE programme
- Requirements for Graduation Qualification works (Russian and English translation)
- Behaviour rules for students (Russian and English translation)
- English translation of the cooperation agreement between the Economics and Engineering department

F Summary: Peer recommendations (30.10.2019)

Taking into account the additional information and the comments given by the Ural Federal 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 accreditation
Ma Systems Engineering	With requirements for 1 year	EUR-ACE®	30.09.2025
Ma Small Enterprises Metallurgy	With requirements for 1 year	EUR-ACE®	30.09.2025

Requirements

For all degree programmes

A 1. (ASIIN 1.4) Provide evidence that the programme-specific admission criteria are anchored in binding documentation and that it is publicly available, for example via the website.

A 2. (ASIIN 2.1) Provide evidence of rules for recognizing externally acquired achievements and competencies, which render the transition between higher education institutions easier and ensure that the learning outcomes are reached at the level aimed at.

A 3. (ASIIN 5.1) Provide the complete module descriptions for all modules in the curricula, including correct number of hours and credit points, and make these publicly available in the course language via the website.

A 4. (ASIIN 6) Determine the causes for the high drop-out rates and devise measures to reduce them.

A 5. (ASIIN 6) Conduct module-specific surveys in all modules on a regular basis, in order to gather feedback on the usefulness of module contents, teachers' individual performance and teaching methods, student workload and the achievement of learning outcomes. The outcomes of the evaluations and all derived measures must be made known to all participants.

For the Master's degree programme Small Enterprises Metallurgy

A 6. (ASIIN 1.1) Include a brief and concise description of the programme's objectives and learning outcomes on the programme website.
A 7. (ASIIN 2.1) Make the desired learning outcomes of the module "Economics and Organization of Production" more concise.
A 8. (ASIIN 5.2) Provide diploma supplement for Small Enterprise Metallurgy programme featuring the same English-language programme name.

For the Master's degree programme Systems Engineering

A 9. (ASIIN 1.1) Revise the online description of the desired learning outcomes to make sure they are tied to the study programme and consistently communicate desired learning outcomes across all documents.
A 10. (ASIIN 2.1) Make the desired learning outcomes of the module "Financial and Economic Activity" more concise

Recommendations

For all degree programmes

E 1. (ASIIN 1.3) It is recommended to revise the curricula overviews so that "modules" and "sub-modules" as well as the respective credit points are more easily distinguishable from each other.
E 2. (ASIIN 2.2) It is recommended to use empirical methods and to conduct quantitative measurements of student workload.

For the Master's degree programme Small Enterprises Metallurgy

E 3. (ASIIN 1.1) It is recommended to have only one programme website.
E 4. (ASIIN 1.3) It is recommended to integrate more English-language contents into the programme and increase the internationalisation of the programme by inviting more lecturers from universities abroad and publishing programme-related information in English.
E 5. (ASIIN 2.3) It is recommended to increase the contact hours for the module "Methods of Engineering and Design" to between 30-36 hours.

For the Master's degree programme Systems Engineering

E 6. (ASIIN 2.1) It is recommended to revise the module descriptions of the practices to contain only information relevant to students

G Comment of the Technical Committees (18.11.2019)

Technical Committee 01 - Mechanical Engineering/Process Engineering

Assessment and analysis for the award of the ASIIN seal:

The technical committee discusses the procedure and agrees with the assessment of the peers.

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

The Technical Committee deems that the intended learning outcomes of the degree programme comply with the engineering specific part of Subject-Specific Criteria of the Technical Committee 01.

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

Degree Programme	ASIIN seal	Subject-specific Label	Maximum duration of accreditation
Ma Systems Engineering	With requirements for 1 year	EUR-ACE®	30.09.2025
Ma Small Enterprises Metallurgy	With requirements for 1 year	EUR-ACE®	30.09.2025

Technical Committee 06 – Industrial Engineering

Assessment and analysis for the award of the ASIIN seal:

The members of the expert committee discuss the procedure and, despite the large number of requirements, do not consider the study programmes to be fundamentally problematic, especially as the requirements are mostly of a formal nature. They notice, however, that the lack of laboratory equipment is listed in the accreditation report, but that no corresponding conditions can be found. For this reason, the members of the Technical Committee add a further requirement (A6).

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

The Technical Committee deems that the intended learning outcomes of the degree programme comply with the engineering specific part of Subject-Specific Criteria of the Technical Committee 06.

The Technical Committee 06 – Industrial Engineering recommends the award of the seals as follows:

Degree Programme	ASIIN seal	Subject-specific Label	Maximum duration of accreditation
Ma Systems Engineering	With requirements for 1 year	EUR-ACE®	30.09.2025
Ma Small Enterprises Metallurgy	With requirements for 1 year	EUR-ACE®	30.09.2025

Requirements and recommendations for the applied labels

Requirements

For all degree programmes

A 1. (ASIIN 1.4) Provide evidence that the programme-specific admission criteria are anchored in binding documentation and that it is publicly available, for example via the website.

A 2. (ASIIN 2.1) Provide evidence of rules for recognizing externally acquired achievements and competencies, which render the transition between higher education institutions easier and ensure that the learning outcomes are reached at the level aimed at.

A 3. (ASIIN 5.1) Provide the complete module descriptions for all modules in the curricula, including correct number of hours and credit points, and make these publicly available in the course language via the website.

A 4. (ASIIN 6) Determine the causes for the high drop-out rates and devise measures to reduce them.

A 5. (ASIIN 6) Conduct module-specific surveys in all modules on a regular basis, in order to gather feedback on the usefulness of module contents, teachers' individual performance and teaching methods, student workload and the achievement of learning outcomes. The outcomes of the evaluations and all derived measures must be made known to all participants.

A 6. (ASIIN 4.3) Ensure that sufficient resources and laboratories are available to implement the curriculum adequately.

For the Master's degree programme Small Enterprises Metallurgy

A 7. (ASIIN 1.1) Include a brief and concise description of the programme's objectives and learning outcomes on the programme website.

A 8. (ASIIN 2.1) Make the desired learning outcomes of the module "Economics and Organization of Production" more concise.

A 9. (ASIIN 5.2) Provide diploma supplement for Small Enterprise Metallurgy programme featuring the same English-language programme name.

For the Master's degree programme Systems Engineering

A 10. (ASIIN 1.1) Revise the online description of the desired learning outcomes to make sure they are tied to the study programme and consistently communicate desired learning outcomes across all documents.

A 11. (ASIIN 2.1) Make the desired learning outcomes of the module "Financial and Economic Activity" more concise

Recommendations

For all degree programmes

E 1. (ASIIN 1.3) It is recommended to revise the curricula overviews so that "modules" and "sub-modules" as well as the respective credit points are more easily distinguishable from each other.

E 2. (ASIIN 2.2) It is recommended to use empirical methods and to conduct quantitative measurements of student workload.

For the Master's degree programme Small Enterprises Metallurgy

E 3. (ASIIN 1.1) It is recommended to have only one programme website.

E 4. (ASIIN 1.3) It is recommended to integrate more English-language contents into the programme and increase the internationalisation of the programme by inviting more lecturers from universities abroad and publishing programme-related information in English.

E 5. (ASIIN 2.3) It is recommended to increase the contact hours for the module "Methods of Engineering and Design" to between 30-36 hours.

For the Master's degree programme Systems Engineering

E 6. (ASIIN 2.1) It is recommended to revise the module descriptions of the practices to contain only information relevant to students.

H Decision of the Accreditation Commission (6th December 2019)

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

The Accreditation Commission discusses the procedure. The Commission notes that the peers have identified numerous shortcomings with regards to the fulfilment of the ASIIN criteria. It discusses the suggestion of the TC 06 to add an additional requirement with regards to the laboratory resources.

With regards to the laboratories, the Commission notes that students in the SME programme seem to only have access to metallurgical and foundry facilities provided by employers. Based on the discussions with the programme coordinators, the University's foundry is used for private production and is almost never used by the students. The Commission agrees with the peers that all students in the SME programme must have access to high quality metallurgical / foundry facilities to ensure that the related learning outcomes can be achieved. The University must therefore employ its own foundry facilities for teaching the SME students, or else, convincingly demonstrate that all SME students are taught at high quality external facilities. The Commission therefore adds a related requirement for the SME programme.

The Commission notes that overall there are many shortcomings with regards to the fulfilment of the ASIIN criteria. However, many of the identified shortcomings are of a formal nature (ex: provision of diploma supplements, complete module handbooks, etc.) and can be quickly addressed. Other shortcomings, such as the facilities, evaluation system and the drop-out rates, may take a longer time to address, but can be addressed within one year. The Commission therefore decides to grant a temporary accreditation for 1 year. The accreditation will be extended if the University submits evidence that all of the outstanding requirements have been fulfilled.

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

The Accreditation Commission deems that the intended learning outcomes of the degree programmes comply with the engineering specific parts of Subject-Specific Criteria of the Technical Committees 01 and 06.

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

Degree Programme	ASIIN seal	Subject-specific Label	Maximum duration of accreditation
Ma Systems Engineering	With requirements	EUR-ACE®	30.09.2025
Ma Small Enterprises Metallurgy	With requirements	EUR-ACE®	30.09.2025

Requirements

For all degree programmes

A 1. (ASIIN 1.4) Provide evidence that the programme-specific admission criteria are anchored in binding documentation and that it is publicly available, for example via the website.

A 2. (ASIIN 2.1) Provide evidence of rules for recognizing externally acquired achievements and competencies, which render the transition between higher education institutions easier and ensure that the learning outcomes are reached at the level aimed at.

A 3. (ASIIN 5.1) Provide the complete module descriptions for all modules in the curricula, including correct number of hours and credit points, and make these publicly available in the course language via the website.

A 4. (ASIIN 6) Determine the causes for the high drop-out rates and devise measures to reduce them.

A 5. (ASIIN 6) Conduct module-specific surveys in all modules on a regular basis, in order to gather feedback on the usefulness of module contents, teachers' individual performance and teaching methods, student workload and the achievement of learning outcomes. The outcomes of the evaluations and all derived measures must be made known to all participants.

For the Master's degree programme Small Enterprises Metallurgy

A 6. (ASIIN 1.1) Include a brief and concise description of the programme's objectives and learning outcomes on the programme website.

A 7. (ASIIN 2.1) Make the desired learning outcomes of the module “Economics and Organization of Production” more concise.

A 8. (ASIIN 5.2) Provide diploma supplement for Small Enterprise Metallurgy programme featuring the same English-language programme name.

A 9. (ASIIN 4.3) Ensure that students have wider access to resources and laboratories necessary for implementing the curriculum in an adequate manner.

For the Master’s degree programme Systems Engineering

A 10. (ASIIN 1.1) Revise the online description of the desired learning outcomes to make sure they are tied to the study programme and consistently communicate desired learning outcomes across all documents.

A 11. (ASIIN 2.1) Make the desired learning outcomes of the module “Financial and Economic Activity” more concise

Recommendations

For all degree programmes

E 1. (ASIIN 1.3) It is recommended to revise the curricula overviews so that “modules” and “sub-modules” as well as the respective credit points are more easily distinguishable from each other.

E 2. (ASIIN 2.2) It is recommended to use empirical methods and to conduct quantitative measurements of student workload.

For the Master’s degree programme Small Enterprises Metallurgy

E 3. (ASIIN 1.1) It is recommended to have only one programme website.

E 4. (ASIIN 1.3) It is recommended to integrate more English-language contents into the programme and increase the internationalisation of the programme by inviting more lecturers from universities abroad and publishing programme-related information in English.

E 5. (ASIIN 2.3) It is recommended to increase the contact hours for the module “Methods of Engineering and Design” to between 30-36 hours.

For the Master’s degree programme Systems Engineering

E 6. (ASIIN 2.1) It is recommended to revise the module descriptions of the practices to contain only information relevant to students.

I Fulfilment of Requirements (17.09.2020)

Analysis of the peers and the Technical Committees (04.09.2020)

Requirements

For all degree programmes

A 1. (ASIIN 1.4) Provide evidence that the programme-specific admission criteria are anchored in binding documentation and that it is publicly available, for example via the website.

Initial Treatment	
Peers	Fulfilled. Justification: the admission procedures and criteria have been provided on the Russian-language website.
TC 01	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers
TC 06	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers

A 2. (ASIIN 2.1) Provide evidence of rules for recognizing externally acquired achievements and competencies, which render the transition between higher education institutions easier and ensure that the learning outcomes are reached at the level aimed at.

Initial Treatment	
Peers	Fulfilled Justification: the program's website provides all the necessary information about academic mobility. The rules allow students to transfer from other programmes and provide a process for calculating their previous achievements. They indicate that applicants must demonstrate their compatibility with programme entry requirements before they are accepted.
TC 01	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers
TC 06	Fulfilled

	Vote: unanimous Justification: the committee follows the suggestion of the peers

A 3. (ASIIN 5.1) Provide the complete module descriptions for all modules in the curricula, including correct number of hours and credit points, and make these publicly available in the course language via the website.

Initial Treatment	
Peers	Fulfilled. Justification: the adjusted module descriptions have been submitted and made available in the course language on the website.
TC 01	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers
TC 06	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers

A 4. (ASIIN 6) Determine the causes for the high drop-out rates and devise measures to reduce them.

Initial Treatment	
Peers	Fulfilled. Justification: the University has provided reasons for the drop-out rates, based on interviews with students, as well as planned measures to reduce them.
TC 01	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers
TC 06	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers

A 5. (ASIIN 6) Conduct module-specific surveys in all modules on a regular basis, in order to gather feedback on the usefulness of module contents, teachers' individual performance and teaching methods, student workload and the achievement of learning outcomes. The outcomes of the evaluations and all derived measures must be made known to all participants.

Initial Treatment	
Peers	Fulfilled.

	Justification: the University has submitted a sample survey, including questions aimed at collecting feedback in accordance with the requirements. The University has furthermore submitted an official University decision indicating that the survey will be regularly implemented in the two course programmes.
TC 01	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers
TC 06	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers

For the Master's degree programme Small Enterprises Metallurgy

A 6. (ASIIN 1.1) Include a brief and concise description of the programme's objectives and learning outcomes on the programme website.

Initial Treatment	
Peers	Fulfilled. Justification: a description has been provided.
TC 01	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers

A 7. (ASIIN 2.1) Make the desired learning outcomes of the module "Economics and Organization of Production" more concise.

Initial Treatment	
Peers	Fulfilled. Justification: the desired learning outcomes have been made more concise.
TC 01	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers

A 8. (ASIIN 5.2) Provide diploma supplement for Small Enterprise Metallurgy programme featuring the same English-language programme name.

Initial Treatment	
Peers	Fulfilled.

	Justification: a diploma supplement meeting the requirement has been submitted.
TC 01	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers

A 9. (ASIIN 4.3) Ensure that students have wider access to resources and laboratories necessary for implementing the curriculum in an adequate manner.

Initial Treatment	
Peers	Fulfilled. Justification: the University has provided relevant photographs of laboratories, equipment lists as well as an overview of courses in which labs are used.
TC 01	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers

For the Master's degree programme Systems Engineering

A 10. (ASIIN 1.1) Revise the online description of the desired learning outcomes to make sure they are tied to the study programme and consistently communicate desired learning outcomes across all documents.

Initial Treatment	
Peers	Fulfilled. Justification: the online description has been revised in line with the requirement
TC 06	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers

A 11. (ASIIN 2.1) Make the desired learning outcomes of the module "Financial and Economic Activity" more concise

Initial Treatment	
Peers	Fulfilled. Justification: the desired learning outcomes have been made more concise.
TC 06	Fulfilled Vote: unanimous Justification: the committee follows the suggestion of the peers

Decision of the Accreditation Commission (17.09.2020)

The Accreditation Commission discusses the procedure.

The Accreditation Commission follows the recommendations of the peers and Technical Committees without any changes.

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

Degree programme	ASIIN-label	Subject-specific label	Accreditation until max.
Ma Small Enterprises Metallurgy	All requirements fulfilled	EUR-ACE®	30.09.2025
Ma Systems Engineering	All requirements fulfilled	EUR-ACE®	30.09.2025

Appendix: Programme Learning Outcomes and Curricula

According to the translation of the programme brochure, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Systems Engineering:

“After graduating, students will be able to:

To set formalized tasks on the basis of system research and to organize collective work on them, being guided by informalized (and, possibly, contradictory) information as initial data.

To assess and control the complexity of the system in the process of resolving problem situations in order to quantify the effectiveness of the workflow, as well as to develop their own design criteria for the evaluation of target indicators and conduct Analytics on the workflow.

To apply the method of analogies for the description of complex non - formalized systems with the help of known physical, chemical, biological, economic and other formalized models, as well as to adapt the known mathematical knowledge to the problem to be solved.

To be able to make a decision in the conditions of uncertainty with the help of situational modeling.

■ Possess the necessary system description formalism as well as the applied software for system modeling and design, including the use of multiprocessor servers, computing clusters, grid and cloud technologies.

■ Manage the life cycle of the system, including typical stages: design, requirements analysis, architectural design, fabrication, integration, verification, validation, operation, support, development, replacement and decommissioning.

■To use experimental approaches at different stages of the life cycle of systems, to carry out the formulation and implementation of socio-technical experiments.

■ Propose new solutions for the development of the system in favorable conditions, as well as solutions to ensure the survival of the system in unfavorable conditions, justifying their proposals with an understanding of the requirements, architecture, accumulated by experience, results of computational experiments with computer models

■ Be able to understand new, creative thinking, find innovative solutions to problems, ensuring the development of systems through innovation.

■ Integrate systems within purposeful multi-aspect workflow, having a vision of system systems (or super system), including the target system, systems in the operating environment, as well as providing systems.

■ Proficient in the techniques of design thinking and effective communication, to formalize the intuition of using charts"

The following **curriculum** is presented:

Code	Module Name	1 semester	2 semester	3 semester	4 semester
M 1.2	Philosophy of science and technology	6			
M 1 .1	Self-management and effective communication		6		
M 1 3	Foreign language	3			
M.1.4	Theoretical Foundations of Systems Engineering	6			
M.1.5	Decision support		6		
M.1.6	Designing complex systems	6			
Б1	Elective courses (professional qualification)			18	
Б1	Elective courses	3	12		
Б2 М.2.1	Practice and research	3	9	15	21
Б3 М.3.1	State final certification				6

M.4.1	Minors			3	
	Total credits				

Code	Elective courses name (professional qualification)	1 semester	2 semester	3 semester	4 semester
M 1 9 2	Integrated solutions for design and technological preparation of production			3	
M 1 9 3	Comprehensive modeling of life cycle processes			3	
M 1 9 4	Multi-Domain Simulation			3	
M 1 9 5	Lifecycle management systems			3	
M 1 10 2	Multiscale modeling. Microstructural modeling			2	
M 1 10 4	Multiscale modeling. Material modeling			2	
M 1 11 2	Needs analysis			2	
M 1 1 13	Infrastructure Innovation			3	
M 1 1 14	Social Science and Social Engineering			3	
M 1.11.5	Basics of financial and economic activity			3	
M 1.12.2	Data Visualization in Reports			2	
M 1.12.3	Business Process Reengineering			2	
M 1.12.4	System integration in IT			2	
M 1.3.3	Business English	1			

M 1.7.2	Lifecycle Management		2		
M 1.7.3	Engineering Project Management		2		
M 1.7.4	Management of risks		2		
M 1.8.2	Artificial Intelligence		2		
M 1.8.3	Mechatronics		2		
M 1.8.4	Cloud technologies				

According to the Federal State Educational Standard of Higher Education, Level of Higher Education “Master's degree program” – Direction of Training 04.22.02 METALLURGY, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Small Enterprises Metallurgy:

“Ii. REFERENCES USED

In this federal state educational standard, the following abbreviations are used:

OK - general cultural competence;

MIC - general professional competencies;

PC - professional competence;

GEF VO - Federal State Educational Standard of Higher Education;

network form - a network form of educational programs.

4.4. A graduate who has mastered the master's program, in accordance with the type (s) of professional activity to which (which) the master's program is oriented, should be ready to solve the following professional tasks:

production and technological activities:

- development and implementation of technological processes of enrichment and processing of mineral natural and technogenic raw materials to produce intermediate;

- development and implementation of technological processes of production and processing of metals and alloys, as well as products from them;
- development and implementation of measures to protect the environment from the man-made impacts of production;
- development and implementation of energy- and resource-saving technologies in the field of metalworking metallurgy, development of measures for product quality management;
- design of technological processes using automated systems;
- assessment of innovation and technological risks in the introduction of new technologies;
- assessment of economic efficiency of technological processes;
- organizational and management activities:
- information support of the organization of production, labor and management, metrological support;
- preparation of the necessary technical documentation, as well as the established reporting on the approved forms;
- carrying out work on creating a quality management system, organizing the work of a team of performers, making management decisions;
- preparation of applications for inventions and industrial designs;
- support of the information space of planning and production management at all stages of the product life cycle;
- marketing and preparation of business plans for the production and implementation of promising and competitive products;
- research activities:
- search, analysis, synthesis and presentation of information on materials and processes;
- conducting research and testing, processing, analyzing and presenting their results;
- development of models and methods for researching processes and materials;
- performing literary and patent searches, drawing up scientific and technical reports, publications, protection of intellectual property objects;
- coordination of works and support of the introduction of scientific developments in production;
- marketing of high technologies;
- project activity:
- feasibility study and development of new technological processes;
- development of projects for the reconstruction of existing and construction of new workshops, industrial units and equipment;
- design and calculation of new tooling and its elements.

V. REQUIREMENTS TO THE RESULTS OF THE DEVELOPMENT OF THE MASTER PROGRAM

5.1. As a result of mastering the master's program, a graduate should have common cultural, professional and professional competencies.

5.2. A graduate who has mastered the master program should have the following general cultural competencies:

- ability to abstract thinking, analysis, synthesis (OK-1);
- readiness to act in non-standard situations, to bear social and ethical responsibility for the decisions made (GC-2);
- readiness for self-development, self-realization, the use of creative potential (GC-3);
- the ability to increase their intellectual and general cultural level (GC-4);
- willingness to take the initiative, to take responsibility (OK-5);
- the ability to freely use the state language of the Russian Federation and a foreign language as a means of business communication (GC-6);
- ability to formulate goals and objectives of research (GC-7);
- the ability to study new research methods, change the scientific and industrial profile of their professional activities (GC-8);
- the ability to acquire new knowledge and skills, including in areas of knowledge that are not directly related to the field of activity (GC-9);
- readiness to use databases, application packages and computer graphics tools for solving professional tasks (OK-10);
- readiness to use fundamental general engineering knowledge in professional activities (GC-11);
- the ability to understand, state and use in practice the basics of labor legislation and legal norms (GC-12);
- possession of skills for the formation and argumentation of their own judgments and scientific position (GC-13).
- 5.3. A graduate who has mastered the master's program should have the following general professional competencies:
- the ability to apply innovative methods for solving engineering problems (OPK-1);
- willingness to use the principles of quality management and process approach in order to identify objects for improvement (OPK-2);

- the ability to apply basic principles of rational use of natural resources and environmental protection (OPK-3);
- ability to carry out marketing research (OPK-4);
- the ability to develop a feasibility study of innovative solutions in professional activities (OPK-5);
- ability to conduct a patent search and investigate the patentability and indicators of the technical level of development (OPK-6);
- the ability to develop scientific and technical documentation, execute scientific and technical reports, reviews, publications on the results of the research performed (OPK-7);
- readiness to use intellectual property protection procedures (OPK-8);
- willingness to conduct an examination of processes, materials, test methods (OPK-9);
- readiness to lead the team in their professional activities, tolerantly perceiving social, ethnic, confessional and cultural differences (OPK-10).

5.4. A graduate who has mastered the master's program should have professional competencies corresponding to the type (types) of professional activity to which (which) the master's program is oriented:

Production and technological activities:

- the ability to manage the actual technological processes of enrichment and processing of raw materials, production and processing of metals (PC-1);
- the ability to conduct an analysis of technological processes for the selection of ways, measures and means of product quality management (PC-2);
- the ability to analyze the full technological cycle of obtaining and processing materials (PC-3);
- the ability to predict the performance of materials in various conditions of their operation (PC-4);
- the ability to develop proposals for improving technological processes and equipment (PC-5);
- the ability to develop proposals for technical regulations and standards for the safety of production processes (PC-6);
- organizational and management activities:
- ability to manage projects (PC-7);
- the ability to justify the purpose, necessity and possible scheme of financing the development and application of materials and technologies for their production (PC-8);

- the ability to conduct an economic analysis of the cost and effectiveness of the process (PC-9);
- the ability to use the basic concepts and categories of production management, organization management systems (PC-10);
- the ability to develop proposals for improving the efficiency of resource use (PC-11);
- research activities:
- the ability, on the basis of a systematic approach, to build models for describing and predicting phenomena, to carry out their qualitative and quantitative analysis with an assessment of the limits of applicability of the results obtained (PC-12);
- the ability to plan and conduct analytical, simulation and experimental studies, critically evaluate data and draw conclusions (PC-13);
- the ability to choose methods and conduct tests to assess the physical, mechanical and operational properties of materials (PC-14);
- the ability to analyze the basic laws of phase equilibria and transformation kinetics in multicomponent systems (PC-15);
- project activity:
- willingness to apply engineering knowledge for the development and implementation of projects that meet the specified requirements (PC-16);
- ability to apply design methodology (PC-17);
- willingness to use automated design systems (PC-18);
- skills in the development of technical specifications for the design of non-standard equipment, tooling, process automation (PC-19);
- ability to develop tooling (PC-20).

5.5. When developing a master's program, all general cultural and general professional competencies, as well as professional competencies related to the types of professional activities that the master's program is focused on, are included in the set of required mastering program results.

The following **curriculum** is presented:

Core Courses

Code	Module Name	1 semester	2 semester	3 semester	4 semester
M 1.1.1	Foreign language	3	3		
M 1.1.2	Effective communications	3			
M 1.2.1	Organization of engineering research and projects	3	3	3	
M 1.3.1	Practices of system engineering	3			
M 1.3.2	Economics and organization of production			3	
M 1.4.1	Entrepreneurship in small metallurgy	9			
M 1.5.1	Technical rationing			3	
M 1.5.2	Investment management			3	
M 2.1	Traineeships (internship)	9	15	9	21
M 3.1	Graduating work				9

Code	Elective courses name (professional qualification)	1 semester	2 semester	3 semester	4 semester
M 1.6.1	Technologies, equipment, materials of foundry industries		6		

M 1.7.1	Additive technologies, high-temperature compounds, coatings		6		
M 1.9.1	Business program of foundry		3	3	
M 1.10.1	The activity program of the additive production, high-temperature compounds, coatings enterprise		3	3	
M 1.12.1	Technological design of the foundry			6	
M 1.14.1	Technological design of the additive production, high-temperature compounds, coatings enterprise			6	