ASIIN Seal & Euro-Inf® Label

Accreditation Report

Bachelor's Degree Programmes
Informatics (Computer Science)
Systems of Information Security
Mathematical and Computer Modeling

Master's Degree Programme
Mathematical and Computer Modeling

Provided by
International Information Technology University (IITU), Almaty

Version: 06 December 2019

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A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Информатика	Ba Informatics (Computer Science)	ASIIN, Euro-Inf® Label	Independent Kazakh Agency for Quality Assurance in Education (IQAA); 27.12.2014 – 26.12.2019	04
Ақпараттық қауіпсіздік жүйелері	Ba Systems of Information Security	ASIIN, Euro-Inf® Label		04
Математикалық және компьютерлік моделдеу	Ba Mathematical and Computer Modeling	ASIIN, Euro-Inf® Label	Independent Kazakh Agency for Quality Assurance in Education (IQAA); 27.12.2014 – 26.12.2019	04, 12
Математикалық және компьютерлік моделдеу	Ma Mathematical and Computer Modeling	ASIIN, Euro-Inf® Label	Independent Kazakh Agency for Quality Assurance in Education (IQAA); 27.12.2014 – 26.12.2019	04, 12
Date of the contract: 13.02.2018 **Submission of the final version of the self-assessment report:** 25.07.2018 **Date of the onsite visit:** 10.-11.10.2018				

[1] ASIIN Seal for degree programmes; Euro-Inf®: Label European Label for Informatics.

[2] TC: Technical Committee for the following subject areas: TC 04 – Informatics/Computer Science); TC 12 – Mathematics.

at: Almaty	
Peer panel: Prof. Bettina Harriehausen-Mühlbauer, University of Applied Sciences Darmstadt; Prof. Christoph Schelthoff, University of Applied Sciences Aachen; Prof. Rüdiger Reischuk, University of Luebeck; Luka Georgadze, EPAM Systems	
Representative of the ASIIN headquarter: Dr. Martin Foerster	
Responsible decision-making committee: Accreditation Commission for Degree Programmes	
Criteria used: European Standards and Guidelines as of 15.05.2015 ASIIN General Criteria, as of 10.03.2015 Subject-Specific Criteria of Technical Committee 04 – [Informatics] as of 29.03.2018	

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Informatics (Computer Science)	Bachelor of Natural Sciences	-	6	Full time	-	8 Semester	244 ECTS/ 146 Kazakh CP	Fall, 2010
Systems of Information Security	Bachelor of military affairs and security.	-	6	Full time	-	8 Semester	244 ECTS/ 146 Kazakh CP	Fall, 2016
Mathematical and Computer Modeling	Bachelor of Engineering and Technology	-	6	Full time	-	8 Semester	244 ECTS/ 146 Kazakh CP	Fall, 2010
Mathematical and Computer Modeling	Master of Engineering Sciences	-	7	Full time	-	4 Semester	176 ECTS/ 59 Kazakh CP	Fall, 2012

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

„The CS DP aims to provide foundation for the students' future work and careers in computation-based problem solving. The DP emphasizes development of analytical skills, acquisition of knowledge and understanding of systems, languages and tools required for effective computation-based problem solving.

Objectives of Bachelor DP in CS are:

- to develop students' intellectual ability to acquire fundamental computer science knowledge or/and concepts;
- to provide knowledge of data structures, databases, algorithms, computer architecture;

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

- to develop an ability to apply the principles of analysis and design to software development;
- to apply current technologies in designing and implementing computing solutions in various industries;
- to initiate and participate in innovative computing in various industries;
- to develop students' creative skills;
- to prepare students for competition in the labour market by improving their communication skills."

For the Bachelor's degree programme Systems of Information Security the institution has presented the following profile in the self-assessment report:

„The SIS DP aims at training specialists able to create and maintain the enterprise information security system, using principles and methods of information protection.

The objectives of the program are to develop:

- an ability to analyze facts and make decisions;
- an ability to model, design and forecast, using engineering, technical and economic calculations;
- an ability to identify and troubleshoot errors in technological processes and technical systems;
- an ability to use programming languages and tools for software development and to secure mobile applications;
- an ability to identify threats and develop measures to protect confidential information;
- an ability to work with data and organize their protection;
- an ability to support, implement and use network technologies."

For the Bachelor's degree programme Mathematical and Computer Modeling the institution has presented the following profile in the self-assessment report:

„The aim of the MCM Bachelor DP is competitive specialists with professional skills in the field of mathematical and computer modeling, owning new information technologies in natural, socio-economic spheres and technology; owning methods of management, optimization and forecasting based on empirical data.

Objectives of MCM Bachelor DP are:

- mastering techniques of constructing mathematical models for physical, natural, industrial, and economic processes;
- application of algorithms and methods of computational mathematics;
- mastering the skills necessary for computer modeling;
- training in database development, creation and management;
- development of the ability to program in high-level object-oriented languages;
- enabling students to create complex animation effects. “

For the Master’s degree programme Mathematical and Computer Modeling the institution has presented the following profile in the self-assessment report:

„The aim of the Master’s program is to provide students with a high-quality scientific and technical training, advanced knowledge of and practical experience in applied mathematics and the use of information technology, enable them to perform in-depth research, advanced mathematical procedures, complex mathematical models and simulations.

Objectives of the Master’s DP in MCM:

- to develop an ability to build the logic of reasoning and statements based on the interpretation of data integrated from different fields of science and technology, make judgments based on incomplete data;
- to enable students to handle a range (e.g. physical, industrial and environmental) of problems associated with conceptual models and their solutions;
- to prepare specialists who are able to implement various algorithms of mathematical models using appropriate numerical methods;
- to teach the fundamental analytical techniques and computational methods used to develop insight into the system behaviour;
- to develop the skills of modelling preproduction and production processes using relevant programming languages;
- to provide an understanding of the processes undertaken to arrive at a suitable mathematical model;
- to prepare specialists who are able to search for and solve errors in calculations and constructions to create the most effective practical models.“

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:

- Self-Assessment Report
- Appendix 1.3.d – Objectives Module Matrices
- On-site discussions

Preliminary assessment and analysis of the peers:
For all study programmes, the HEI presented a detailed description of general learning outcomes in the self-assessment report (SAR). The peers approve that for each programme a detailed presentation of learning outcomes is given in the SAR in combination with learning outcome matrices matching the described learning outcomes with the respective modules of the programmes. Thus, it is clear that all students shall have the fundamental knowledge needed for a career in the overarching field of Computer Science with certain specializations according to the respective degree programmes. They will also develop appropriate communication skills, understand the ethical and professional responsibilities of their discipline and acquire the basis for life-long learning being enable to continue their studies on a Master level after graduation. The Master programme in Mathematical and Computer Modelling equally prepares the students for taking up a PhD programme. All graduates are enabled to work individually as well as in teams on practical and research projects, possess presentation skills and have the ability to communicate their research results to the interested public.

For the Bachelor in Mathematical and Computer Modeling (MCM) it is envisaged that students shall be able to master techniques of constructing mathematical models for physical,

[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.

natural, industrial, and economic processes, apply algorithms and methods of computational mathematics and are trained in database development, creation and management. Further, students should gain the competence to program in high-level object-oriented languages and to create complex animation effects. The graduates of the programme are supposed to be able to solve computational problems by using appropriate numerical and statistical procedures with a focus on accuracy, error control, and efficiency and to use computational and statistical software platforms to develop and execute various mathematical procedures, and numerical algorithms.

While these objectives seem to be adequate for the peers for a Bachelor programme the peers point out that for the Master programme nearly identical objectives have been presented. They underline that according to the European Qualification Framework Master degree programmes need to convey a more elaborate level of competencies and skills. Of course, much of the basic knowledge remains equal to the Bachelor level, but students need to acquire in-depth knowledge and advanced qualifications in the respective field. This ambition needs to be made clear in the description of the learning objectives. Consequently, they ask the programme coordinators to review the descriptions and to refine them accordingly. Nevertheless, discussion with the programme coordinators revealed that the requirements, skills and competencies of the Master are higher than those of the Bachelor programme; thus, they are assured that the discrepancy is merely a result of insufficient description instead of lacking quality.

For the Bachelor programme in Computer Science (CS) the learning objectives target development of analytical skills, acquisition of knowledge and understanding of systems, languages and tools required for effective computation-based problem solving. Students should understand data structures, databases, algorithms and computer architecture and be able to apply the principles of analysis and design to software development. Further, they shall be capable to apply current technologies in designing and implementing computing solutions in various industries. Following the acquisition of fundamental skills of mathematics and computing, students will be trained in analysing and evaluating problems, use up-to-date tools and techniques as well as apply, design and develop principles in the construction of software systems of various complexity.

In the Bachelor programme Systems of Information Security (SIS) students will similarly acquire the fundamentals of mathematics and computing. On top they are supposed to be able to model, design and forecast, using engineering, technical and economic calculations, identify and troubleshoot errors in technological processes and technical systems and to use programming languages and tools for software development and to secure mobile applications. Further, graduates shall have the ability to identify threats and develop

measures to protect confidential information, work with data and organize their protection as well as support, implement and use network technologies.

Although the peers consider the described learning objectives in the two programmes of CS and SIS to be praiseworthy and generally adequate for EQF level 6, they do point out that the number of targeted learning objectives is more than ambitious. Given the fact that teaching is also in a foreign language for the students, it seems to be unrealistic that all the named skills and competencies will be conveyed. The peers emphasize that the described learning outcomes serve as an orientation for those interested in the programmes but generally to all stakeholders. The descriptions should be accessible online to everyone and help to give a short information about the skills all graduates of the programmes actually acquire. Hence, the peers recommend reducing the described learning outcomes to a level, which can be assured every graduate really possesses.

In conclusion, the peers agree that all programmes adequately reflect the ASIIN Subject-Specific Criteria as well as the EQF-level 6 for Bachelor programmes and 7 for Master programmes. For all programmes, they also declare that the criteria of the Euro-Inf® Label (European Informatics) regarding the intended learning outcomes are met.

Criterion 1.2 Name of the degree programme

Evidence:

- Self-Assessment Report

Preliminary assessment and analysis of the peers:
The panel considered the names of the study programmes to be adequately reflecting the respective aims, learning outcomes and curricula.

Criterion 1.3 Curriculum

Evidence:

- Self-Assessment Report
- Appendix 1.3.1.c – Curricula for the Bachelor degree programmes
- Appendix 1.3.d – Objectives Module Matrices
- Appendix 1.3.2.a – Curriculum for the Master degree programme
- Appendix 1.e. – Module Handbooks

- On-site discussions

Preliminary assessment and analysis of the peers:
The curricula of all study programmes under consideration were being reviewed by the panel in order to identify whether the described learning objectives can be achieved by the available modules. Course descriptions as well as matrices matching the general learning objectives and the module contents were also presented for a detailed analysis. What was not provided were basic study plans that allowed to understand how students choose their courses and find their respective paths of study. The programme coordinators provided tables indicating all the courses available and in which semesters they could theoretically be taken, but the peers ask for exemplary study plans that will make it understandable how the curricula are best organized.

The general structure of the Bachelor programmes is identical for all three degree programmes under review and largely defined by the Ministry of Education. Hence, all courses are divided into three categories: General Academic Courses of about 28 Kazakh credits including subjects such as English, Kazakh/Russian, History and Philosophy, Basic Courses of a total of 69 Kazakh credits and Specialized Courses of a volume of 32 Kazakh credits. Each category is subdivided into compulsory courses and elective courses that allow for an individual specialization, most importantly in the Specialized Courses. Further, students have to take a minimum of 14 Kazakh credits in additional types of training that could be physical education, fundamentals of research work or professional internships. The fifth column of the curricula is the final examination of a value of 3 Kazakh credits.

In the Master programme students also have to take Basic Courses of 20 Kazakh credits and Specialized Courses of 22 Kazakh credits. Additional types of training are valued at 13 credits and the final examination numbers 4 credits.

The curricula presented seem to be very adequate in terms of job requirements and employability. Discussion with industry representatives revealed that graduates from the IITU are highly appreciated and possess good skills to start their jobs. The peers had the impression that this was largely due to the fact that many courses are very much application-oriented focussing on the conveyance of practical skills by utilizing specific technologies or software. However, the curricula do not or very little include a basic theoretical introduction preparing the students for international academic research. Especially in the curricula of the Bachelor's degree programmes Computer Science and Systems of Information Security the peers were of the opinion that the conveyance of basic scientific approaches to problems needs to be strengthened compared to the practical application of vendor-specific software. Graduates should not only be able to work with already existing software

and systems but to basically understand how the systems work and how they can be further developed. This will better prepare them for a career of independent life-long learning.

The deficits in theoretical knowledge and academic research were further underlined during the review of graduation projects of the respective programmes. Many of the theses lacked the adequate level of analytical depth and skills of scientific writing. Looking at the curricula of the Bachelor programmes the peers understand that Fundamentals of Research work is only a course in the category of additional types of training valued 1 Kazakh credit. In the same category four mandatory courses of Physical Education have to be taken throughout the programme valued at a total of 8 Kazakh credits. This could help to explain why the analytical skills of the students could be further enhanced. Additionally, the value of the final projects is very small and should be enlarged in order to make the quality of the results meet the expectations of the European Qualification Framework.

Criterion 1.4 Admission requirements

Evidence:

- Self-Assessment Report
- Appendix 1.4.1.a – The University admission rules for Bachelor degree programmes
- Appendix 1.4.2.a – The University admission rules for Master degree programmes
- On-site discussions

Preliminary assessment and analysis of the peers:
Admission to Bachelor programmes in Kazakhstan is basically regulated by the Ministry of Education. High School graduates take a unified national test the result of which indicates which programmes at which university they are allowed to study. A proportion of the best students will receive government scholarships, everybody else passing the defined threshold for the respective programmes is allowed to enrol on self-payment. As the University pointed out during the discussions, they are not allowed to initiate their own, subject-specific application process nor can they decline enrollers due to bad English competencies. Since all Bachelor programmes at IITU are taught in English this results in certain difficulties and also to dropouts after the first semesters ore an extension of study duration. In order to best deal with the different level of language, the IITU conducts an English assessment before the start of the first semester; those students with bad results are provided with additional introductory courses.

For admission to Master programmes students have to complete a related Bachelor programme. Before enrolment applicants have to take an exam in English and a comprehensive exam in their respective major subject. Although the English language test counts up to 50% of the total points required for admission English cannot be required for the Master programmes as for the Bachelor programmes. 90% of the students are graduates of Bachelor programmes at IITU, but due to the legal situation, the University has to offer all Master courses equally in Kazakh/Russian for those students that have previously studied at other universities.

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

From the comments and additional material provided by the HEI the peers understand that a revision of the learning outcomes has already been initiated. Revised learning outcomes and objectives for the Master programme MCM were presented in the aftermath of the on-site-visit. Concerning the overly ambitious learning outcomes formulated for the Bachelor programmes CS and SIS the peers appreciate that the HEI has started to revise them and to identify where correction may be necessary. Furthermore, the HEI presented study plans following each semester that very much improve the presentation of the programmes.

Concerning the peers' remark that the theoretical foundations in the CS and SIS programmes should be strengthened the peers welcome that a review process has already been started by the University. The peers understand that requirements from industry were and still are of highest importance during the implementation of the programmes which are comparatively new to Kazakhstan. They emphasize that a revision of the curricula does not have to imply fundamental changes but sometimes only a change of focus or the introduction of one or two new modules.

Regarding the deficits identified with the final projects the HEI acknowledges the peers' critical remarks and envisages to introduce some improvements. This is much appreciated by the peers who understand that there are several contributions to the final project (the research-focused pro-diploma internship or the "professional English" course). However, in order to produce a homogenous research project a merged module including these already existing elements and adding additional research time and support may prove even more efficient. Additionally, the peers understand from the HEI's comment that the 45 hours per credit ratio refers only to theoretical courses, the final assessment amounts to 3 credits, each of 105 hours, thus to a total of 11ECTS credits. While this is helpful additional

information, the peers still recommend to include this information on the expected working hours into the module description of the final project thus outlining how much input is actually required from the student.

In conclusion, the peers see already much improvement but until the development processes indicated have been completed they consider this criterion to be partly fulfilled.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- Self-Assessment Report
- Appendix 1.3.1.c – Curricula for the Bachelor degree programmes
- Appendix 1.3.d – Objectives Module Matrices
- Appendix 1.3.2.a – Curriculum for the Master degree programme
- Appendix 1.e. – Module Handbooks
- On-site discussions

Preliminary assessment and analysis of the peers:
All study programmes under review are divided into modules, which comprise a sum of teaching and learning. The panel found the structure of the modules in general to be adequate and manageable.

As already described, the curricula offer a good variety of electives as well as practical aspects that are well structured in order to prepare students for their professional career as well as to allow for individual specializations with a view to further Master studies. It was previously outlined that the practice-orientation of the programmes is a major strength and deficit at the same time. The peers had no doubt, especially after the discussion with the industry representatives, that the graduates of the respective programmes are well-versed in the contemporary systems and technologies, are easily employable and help the companies effectively after a short time. At the same time, the practice-orientation leaves little or no room for the conveyance of the theoretical foundations as well as the development of skills in scientific writing and analysis. With this regard, the peers strongly recommend a more balanced design of the curricula in order to not only prepare the students for

the current industry demand, but also for the creation of long-term successful academics that will help the Kazakh industry but especially the IITU in future decades.

The modules range in their size and structure usually between 1 and 4 Kazakh credits, but as was mentioned before, it did not become totally clear to the peers according to which logic courses are taken in which semester. Hence, they ask the University to provide exemplary study plans indicating a recommended structure of courses. According to the tables presented, students take about 13 to 26 Kazakh credits with exception of the final semester where more space is left for the graduation project of only 2 or 3 credits. As the calculation of Kazakh credits varies from the ECT System the peers could only estimate that the modules are more or less equally distributed throughout the semesters (workload will be discussed under criterion 2.2). The peers reviewed several examples of final projects and Bachelor and Master theses and came to the conclusion, that the academic standards need still to be improved. It has been argued before that this was seen in connection with the missing theoretical foundations and deficient introduction into academic writing and analysis. Further, the peers emphasized that the capstone projects have to be individually assessable. Currently, projects are carried out by two or more students and the individual contribution of the students to the project as a whole is not identifiable; consequently, it has to be ensured that projects are chosen and carried out in way that guarantees that each students is alone responsible for his own part and work.

Internationalization is, of course, a fundamental aspect of the IITU. The peers understand that the University does as much as possible to enhance the level of internationality. Guest lecturers are regularly invited and exchange programmes developed with a number of international universities. While in the founding years a focus of partnerships was laid on Asian countries, the internationalisation strategy is slowly developing into European countries. If students spend a semester abroad, it is generally possible to have credits recognized back at home. A learning agreement is made with the IITU and the recognition process is regulated and well known to the students. The peers understand that it is not always easy for the IITU to find partners for economic and political reasons but they congratulate the coordinators for the already achieved successes and support their further endeavours.

Criterion 2.2 Work load and credits

Evidence:

- Self-Assessment Report
- Appendix 1.3.1.c – Curricula for the Bachelor degree programmes

- Appendix 1.3.2.a – Curriculum for the Master degree programme
- Appendix 1.e. – Module Handbooks
- On-site discussions

Preliminary assessment and analysis of the peers:
As was outlined above, all modules are assigned with Kazakh credit amounting from 13 to 26 credits each semester. Consequently, the credits do not appear to be equally distributed over eight semesters, but the peers understand that the number of credits alone says little about the actual workload involved. Hence, a module of 3 credits may imply significantly more workload than another course of 3 credits because of the differently weighed work. This calculation of credits and workload make a transfer into the European Credit Transfer Systems extremely complicated. In any case, the peers learned from the students that the workload is manageable, even in the semesters of a very high number of credits; a large number of students works parallel to their studies. They further confirmed that the workload is more or less evenly distributed throughout the semester. Although the estimation of workload seems to be genuine in many cases, the peers learned from the revision of the final projects that the calculation of workload is largely disconnected to the number of awarded credits and that this may also be an explanation for the sometimes weak performance. The peers would consider it much more helpful to have a module description for the final project indicating a range of working hours or weeks that must be invested by each student. Apart from the assessment of the final project, the peers again underlined, that the distribution of the workload could only be assessed reliably after the programme coordinator have presented the exemplary study plans indicating which courses the students actually have to take in which semester.

Criterion 2.3 Teaching methodology

Evidence:

- Self-Assessment Report
- Audit discussions

Preliminary assessment and analysis of the peers:
As already outlined, teaching in the four programmes includes less theoretical foundations but much more practical work following a hands-on-approach comparable to a (German) University of Applied Sciences. Despite the weaknesses of the missing theoretical foundations, peers welcomed at the same time the University's approach to convey practical skills

to the students responding to an increasing demand from international but also national and local industry. In general, teaching includes lectures, classroom exercises, tutorials, group exercises, laboratory work, group and individual projects. The peers could not detect a kind of seminar that implies the students' active, individual participation through presentations, discussions or joint analysis of current research results. The introduction of such a type of course could further enhance the students' qualities in research and writing according to the peers' opinion.

The peers took positive note of the established connections with local industry that are made use of in order to enhance the practical aspects of teaching. Thus, industry representatives are regularly invited to give lessens or presentations as part of the existing courses at the University giving students the possibility to get in contact with real work life. Consequently, the teaching methodology was considered up-to-date and adequate in order to convey the contents envisaged by the programmes.

Criterion 2.4 Support and assistance

Evidence:

- Self-Assessment Report
- Audit discussions

Preliminary assessment and analysis of the peers:
The peers had a very good impression of the offers related to support and assistance of the students at the IITU. In fact, many students declared that the young, dynamic and supportive staff was a major reason why they decided to take up their studies at IITU. They also confirmed that the teaching staff is always available for any questions and supports the students in every possible way. During the on-site-visit, the peers could gain a good impression of the variety of clubs and projects offered to support the students and to give them an opportunity to develop their own projects. A recently opened research lab has created a productive and creative environment, where excellent students have the best opportunities to start their own companies or follow projects under guidance from experienced staff members. Further, they can also receive legal and economic advice for their own business. Consequently, the peers were impressed by the opportunities given to the students.

A major issue of support at IITU and in the respective programmes under review was the English language. As was outlined before, the University has introduced a number of supporting courses to improve the English language level of the students at and before the beginning of the first semester; additional language courses during the summer break have been created and students feel generally well-supported in this regard. However, the peers

gained the impression that in order to achieve the goal of high-quality teaching and learning completely in English the language level of students as well as teachers is still to be continuously improved. Nevertheless, they do understand that the English language has only little tradition in Kazakh High school education and that progress in this context will be achieved at a slow but constant pace.

Information about the courses, modules and study programmes in general are presented on the Kazakh website but also at the beginning of each course. During the discussion, the students confirmed that they received all necessary information concerning the programmes, courses, exams, etc. In conclusion, the peers had no doubt that sufficient support and assistance is given to the students ensuring the best possible success.

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

Following the HEI's explanations and comments, the peers understand the joint final projects are usually supervised by a professor who assigns clearly differentiated tasks to each individual students ensuring individual assessment afterwards. This would be absolutely acceptable for the peers. However, as the HEI admits this practice is not always followed and measures will be taken to improve the situation. Following the accreditation procedure the HEI should define clear rules for this evaluation procedure in order to comply with the ASIIN standards.

The missing module descriptions for the final project were presented in the aftermath of the visit and now outline the expected qualification level as well as the student workload in estimated time hours. However, this last information was not included in the SIS programme and should be added.

Furthermore, the peers understand that the presentation and discussion of research results is not carried out in form of a seminar but during the Teacher Supervised Independent Study. Nevertheless, the HEI will consider this aspect when revising the curricula which is much appreciated by the peers.

Concerning the challenging issue of the English language the peers welcome to hear that the HEI is already working on some improvement. Apart from the English classes, the students have the possibility to participate in the English club conducted by the teachers, who are native speakers, take additional courses in the "Linqua" language centre. The University staff members wishing to raise the English language proficiency level have discounts for the English courses taken at the same centre. These are good improvements and will contribute to the progress aimed at by the University.

In conclusion, the peers consider this criterion to be largely fulfilled.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Self-Assessment Report
- Appendix 1.e. – Module Handbooks
- Appendix 3.1.c – Regulations for administering examinations
- Appendix 3.2.b – Schedule of exams
- On-site discussions

Preliminary assessment and analysis of the peers:
Each course-content in the reviewed study programmes is reflected in exams which are distributed in three examination periods each semester, the mid- and end-of-term exams during the 7th and 15th week of the semester and the final examination in a period of 2-3 weeks after the end of the semester. This generally high amount of exams during one semester was not considered problematic but helpful by the students since it allowed for continuous evaluation of the individual study progress.

If students fail the final exams they can retake the exam if they reached a minimum mark that is accumulated from the previous examinations. If they perform below that, they have to retake the whole course, which means additional costs as students have to pay for each module individually. Courses may be repeated two times but repetitions are only possible in summer, which may result in an extension of the study duration. However, the peers understood that usually there are no interdependencies between courses, so there is little immediate impact if students have to repeat a course. The number of exams in the final examination period is usually not expected to be higher than six to seven and the coordination of students' exams tries to ensure that students have at least one free day between each exam. During the discussion, the students confirm that the examination organization works well and flexible and that the workload implied in the preparation of exams is manageable.

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

The peers consider this criterion to be fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:

- Self-Assessment Report
- On-Site-Discussions

Preliminary assessment and analysis of the peers:
In the self-assessment report, the University presented data about the number and overall qualification of staff for the respective programmes and during the discussion on site, the peers gained a good impression of the quality of the teaching personnel. However, the University did not yet provide more detailed CVs of the staff members and has promised to provide such information in the aftermath of the visit.

However, the peers were convinced that the current staff available is sufficiently qualified and their number enough to manage the programmes under review. Again, the main challenge was considered to be the teaching in English language. From the discussions, the peers learned that often a choice has to be made between either hiring the best-qualified teacher or one who is fluent in English; because of the very specialized nature of the programmes, it turns out to be not always easy to find staff possessing the necessary subject-specific qualification *and* the English language skills. The peers accept that this is an issue, which currently leads in some courses to a mixture of teaching in English and Russian/Kazakh. While it is thus reasonable for them if not all the courses were actually taught in English, they point out that then the University's declaration and promotion to have 100% English Bachelor programmes would not be entirely true and that the University should not promise what it is actually unable to keep. Nevertheless, the peers appreciate the University's endeavour to further develop and improve its teaching capacity in English.

Criterion 4.2 Staff development

Evidence:

- Self-Assessment Report
- On-Site-Discussions

Preliminary assessment and analysis of the peers:

In relation to the previous criterion, the University is offering a number of supportive measures for the teaching staff to continuously improve their skills in the English language. During the discussion with the teaching staff, it was expressed that there are several offers for professional development, be it through guest lecturers giving courses on didactical or subject-specific aspects, or through the many international projects that allow the teaching staff members to spend some time at other Universities. Given the fact that the University aims at constantly increasing its output in academic research, the peers emphasized that there is still some room for improvement as many staff members have, voluntarily, a very high teaching load but dedicate only little time to research. Similarly, the peers understand that it is generally possible to take sabbaticals for individual research projects, but only few do so apparently. Hence, it is recommended to further encourage the staff members to spend time in research projects because only through the continuous involvement in current research can staff members stay up-to-date and share their experience with their students. This is of increasing importance as the University is developing a growing number of Master and PhD-programmes that need to be much more research-related than the Bachelor programmes. Coming back to the peers' main criticism, the practice-orientation of the Bachelor programmes is generally appreciable, but on a Master and even more importantly on a PhD-level the students need to possess the theoretical fundamentals to engage in research.

Criterion 4.3 Funds and equipment

Evidence:

- Self-Assessment Report
- Appendix 4.3.c – Passports of laboratories
- Appendix 4.3.2.a – Description of Software
- Audit discussions
- On-site-visit

Preliminary assessment and analysis of the peers:
From the self-assessment report and its annexes as well as a tour through the University premises, the peers gained a detailed impression of the facilities, equipment and laboratories. While they were generally content with what they saw, the University further informed them about the building of a new campus envisaged for the coming years. This will render more space for labs and an increasing number of students as for the moment the available facilities have reached a limit.

Nevertheless, the peers could see that the programmes use a variety of laboratories and lecture rooms offering sufficient space and up-to-date technology for operating the programmes. To the peers' astonishment, many laboratories are dedicated solely to one system or technology. This appears to be in line with the very application-oriented logic of the programmes, where students are basically trained to manage the existing technology in the best possible environment. Although this is certainly achieved by the IITU, the peers underline that students should not only learn how to manage already existing systems but how to develop their own.

Again, the peers applauded the facilities provided by the University to support individual projects; the research lab as well as other rooms dedicated to clubs and societies provide the students with an encouraging learning environment.

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

CVs of the programmes' teaching staff were presented after the on-site-visit. Concerning the staff members' research activities the peers fully understand that economic pressure sometimes enforces staff members to work overtime and teach more than doing research. The dedication with which the staff members are involved in the programmes is considered to be laudable. Furthermore, the peers accept that the HEI already does a lot to support publications and participation in international conferences. However, in order to close the gap to international top institutions the government or the institution will do good to provide even more support in form of time and money that can be invested into research projects. In conclusion, the peers agreed that in order to reach state of the art expertise in CS and SIS the faculty should try to extend the staff and enlarge research co-operations with international experts. Thus, they consider this criterion to be largely fulfilled.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Self-Assessment Report
- Appendix 1.e. – Module Handbooks
- On-site discussions

Preliminary assessment and analysis of the peers:
The peers appreciated the module descriptions presented beforehand with the self-assessment report. For all courses with the exception of the final project, descriptions were made available and are also made accessible to the students. They give full information about the courses, examinations, contents, learning outcomes and recommended literature.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Appendix 5.2.d – Provision on Diploma Supplements

Preliminary assessment and analysis of the peers:
At graduation, all students are provided with a diploma and a Diploma Supplement in English language. The Diploma Supplement gives all required information about the degree programmes, the individual study performance, the selected courses, a relative grade of the student and an overview over the Kazakh system of higher education. Nevertheless, the peers admonish that only exemplary Diploma Supplements for the Bachelor programmes in MCM and Informatics have been provided. They ask the coordinators to also provide examples for the other programmes.

Criterion 5.3 Relevant rules

Evidence:

- Self-Assessment Report
- Appendix 3.1.c – Regulations for administering examinations

Preliminary assessment and analysis of the peers:
From the documents provided and the discussions during the on-site visit, the peers learned that the IITU follows a policy of transparent and open rules and regulations. All required rules and regulations are made accessible to students at any time online and especially through computer terminals within the university building. The discussion with the students confirmed that they felt well-informed about regulations and comfortable about the access to any information about their degree programmes.

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

Missing module descriptions as well as Diploma Supplements were presented in the aftermath of the on-site-visit. Consequently, the criterion is considered to be fulfilled.

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:

- Self-Assessment Report
- Institutional Accreditation Report
- Audit discussions

Preliminary assessment and analysis of the peers:
The IITU only recently subjected itself to an institutional accreditation by ASIIN that confirmed that the University complies with the required standards of quality management processes.

During the on-site-visit, the peers found this impression confirmed; the University has established a well-organized system of quality assurance, thereby including all stakeholders. All programmes and courses are constantly under review for further development, in particular surveys of each course are carried out at the end of each semester. The only issue detected by the peers was the fact that the students do not receive immediate feedback about the outcome of the respective course evaluations, nor if their comments have led to any kind of improvement. Since the peers consider it extremely important for reasons of

transparency and motivation that students receive feedback from their lecturers about their remarks, they would recommend to carry out the surveys timely during the semester in order to ensure that the results can be discussed with the students. This will further strengthen the open and dialogue-oriented culture at the IITU.

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

The peers underline that the Quality Management in place at IITU and in the respective programmes is outstanding and absolutely fulfils the expectations. From the comments of the HEI it was further understood that new measures are going to be taken to improve the immediate feedback provided to the students. Consequently, the peers consider this criterion to be fulfilled.

D Additional Documents

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

D 1. CV's of academic staff involved in the programmes including a list of publications
D.2 Study plans arranged by semesters
D.3 Diploma Supplements for the Master programme MCM and the Bachelor programme SIS.

E Comment of the Higher Education Institution (15.11.2018)

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

- CVs for all teaching staff members
- Study plans by semester for each programme
- Missing module descriptions
- Diploma Supplements

F Summary: Peer recommendations (22.11.2018)

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

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditaiton
Ba Informatics (Computer Science)	With requirements for one year	Euro-Inf	30.09.2024
Ba Systems of Information Security	With requirements for one year	Euro-Inf	30.09.2024
Ba Mathematical and Computer Modeling	With requirements for one year	Euro-Inf	30.09.2024
Ma Mathematical and Computer Modeling	With requirements for one year	Euro-Inf	30.09.2024

Requirements

A 1. (ASIIN 1.1) The programme objectives of the MCM programmes need to differentiate between Bachelor and Master level; further, the defined programme objectives in CS and SIS need to be reduced to realistic dimension.

A 2. (ASIIN 2.1) Separate evaluation of the final projects needs to be ensured; the individual part of students in joint projects has to be identifiable.

For the Bachelor programmes Computer Science and Systems of Information Security

A 3. (ASIIN 1.3) In the curricula of Computer Science and Systems of Information Security the conveyance of basic scientific approaches to problems needs to be strengthened compared to the practical application of vendor-specific software.

A 4. (ASIIN 2.2; 5.1) The module description for the final project course in SIS needs to indicate the estimated workload including self-study.

Recommendations

E 1. (ASIIN 2.4) It is recommended to continuously develop the English language level of students and staff members.

E 2. (ASIIN 1.3; 2.1) It is strongly recommended to enhance the level of scientific writing and analysis.

E 3. (ASIIN 2.2) It is strongly recommended to straighten out the distribution of student workload in order to avoid unrealistic peaks in certain semesters.

E 4. (ASIIN 4.2) It is recommended to further motivate the teaching staff to apply for sabbaticals to increase the research capacity of the University.

E 5. (ASIIN 6) It is recommended to better close the quality management feedback loops by giving feedback to the students about the results of course evaluations.

G Comment of the Technical Committees

Technical Committee 04 - Informatics (27.11.2018)

Assessment and analysis for the award of the ASIIN seal:

The TC discusses the procedure and agrees with the assessment of the peers.

Assessment and analysis for the award of the Euro-Inf® Label:

The Technical Committee deems that the intended learning outcomes of the degree programmes do comply with the Subject-Specific Criteria of the Technical Committee 04 - Informatics.

The Technical Committee 04 – Informatics recommends the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditaiton
Ba Informatics (Computer Science)	With requirements for one year	Euro-Inf	30.09.2024
Ba Systems of Information Security	With requirements for one year	Euro-Inf	30.09.2024
Ba Mathematical and Computer Modeling	With requirements for one year	Euro-Inf	30.09.2024
Ma Mathematical and Computer Modeling	With requirements for one year	Euro-Inf	30.09.2024

Technical Committee 12 - Mathematics (23.11.2018)

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 Euro-Inf® Label:

The Technical Committee deems that the intended learning outcomes of the degree programmes do comply with the Subject-Specific Criteria of the Technical Committee 04 - Informatics.

The Technical Committee 12 – Mathematics recommends the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditaiton
Ba Informatics (Computer Science)	With requirements for one year	Euro-Inf	30.09.2024
Ba Systems of Information Security	With requirements for one year	Euro-Inf	30.09.2024
Ba Mathematical and Computer Modeling	With requirements for one year	Euro-Inf	30.09.2024
Ma Mathematical and Computer Modeling	With requirements for one year	Euro-Inf	30.09.2024

H Decision of the Accreditation Commission (07.12.2018)

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

The Accreditation Committee discusses the procedure and agrees with the assessment of the peers and the Technical Committees.

Assessment and analysis for the award of the Euro-Inf® Label:

The Accreditation Commission deems that the intended learning outcomes of the degree programmes do comply with the Subject-Specific Criteria of the Technical Committee 04 - Informatics.

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

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditaiton
Ba Informatics (Computer Science)	With requirements for one year	Euro-Inf	30.09.2024
Ba Systems of Information Security	With requirements for one year	Euro-Inf	30.09.2024
Ba Mathematical and Computer Modeling	With requirements for one year	Euro-Inf	30.09.2024
Ma Mathematical and Computer Modeling	With requirements for one year	Euro-Inf	30.09.2024

Requirements

A 1. (ASIIN 1.1) The programme objectives of the MCM programmes need to differentiate between Bachelor and Master level; further, the defined programme objectives in CS and SIS need to be reduced to realistic dimension.

A 2. (ASIIN 2.1) Separate evaluation of the final projects needs to be ensured; the individual part of students in joint projects has to be identifiable.

For the Bachelor programmes Computer Science and Systems of Information Security

A 3. (ASIIN 1.3) In the curricula of Computer Science and Systems of Information Security the conveyance of basic scientific approaches to problems needs to be strengthened compared to the practical application of vendor-specific software.

A 4. (ASIIN 2.2; 5.1) The module description for the final project course in SIS needs to indicate the estimated workload including self-study.

Recommendations

E 1. (ASIIN 2.4) It is recommended to continuously develop the English language level of students and staff members.

E 2. (ASIIN 1.3; 2.1) It is strongly recommended to enhance the level of scientific writing and analysis.

E 3. (ASIIN 2.2) It is strongly recommended to straighten out the distribution of student workload in order to avoid unrealistic peaks in certain semesters.

E 4. (ASIIN 4.2) It is recommended to further motivate the teaching staff to apply for sabbaticals to increase the research capacity of the University.

E 5. (ASIIN 6) It is recommended to better close the quality management feedback loops by giving feedback to the students about the results of course evaluations.

I Fulfilment of Requirements (06.12.2019)

Degree programme	ASIIN-label	Subject-specific label	Accreditation until max.
Ba Informatics (Computer Science)	All requirements fulfilled	Euro-Inf®	30.09.2024
Ba Systems of Information Security	All requirements fulfilled	Euro-Inf®	30.09.2024
Ba Mathematical and Computer Modeling	All requirements fulfilled	Euro-Inf®	30.09.2024
Ma Mathematical and Computer Modeling	All requirements fulfilled	Euro-Inf®	30.09.2024

J Significant Modifications (06.12.2019)

The Bachelor SIS and Bachelor and Master MCM have been split into several separate programmes by order oft he Kazakh ministry for Higher Education and got also an update of their curricula:

- MCM was divided into the programmes Engineering Mathematics, Data Science and Financial Mathematics,
- SIS was divided into the programmes Network, Computer and Hardware Security.

New Curricula and module descriptions as well as revised learning outcomes were provided along with the documents for the fulfilment of requirements.

The documents were reviewed by the peers involved coming to the following conclusion:

It is considered a very good decision to include more algorithmic aspects in the new Data Science curriculum – a point that was already addressed during the site visit last year. Thus, the changes are improvements mainly following the peers‘ line of suggestions.

Financial Mathematics adds a new application area to the previous programme that appear to be equally reasonable and well strcutured.

Concerning SIS that should originally have better been named IT-Security the peers understand less the necessity of a splitting up. At least the new names in English may give the wrong impression that these issues could be studied independently. However, the three new programmes only differ at the very end and could thus as well be achieved by different specialisations within a single programme. Since the split seems to be initiated by order of political regulations the peers understand that it was not the choice of the University. At least the peers agree that less important subjects of the older curriculum such as Physics are replaced by more specific modules that is generally contributing to the improvement of the programmes.

In conclusion, the peers do not see the necessity to have another audit for the new programmes and recommend to extend the current accreditation also the new programme versions based on the documents of last year and the new ones provided. All changes seem to have already been decided formally by the responsible committees and implemented. How much the scientific level really increases has to be judged at the next reaccreditation.

Assessment by the Technical Committee 04 – Informatics

The TC 04 discusses the procedure and agrees with the assessment of the peers. In their opinion, the current accreditation can be extended towards the new programmes.

Assessment by the Technical Committee 12 – Mathematics

The TC 12 discusses the procedure and agrees with the assessment of the peers. In their opinion, the current accreditation can be extended towards the new programmes.

Decision by the Accreditation Committee (06.12.2019)

The Accreditation Committee discusses the procedure and follows the assessment of the peers and Technical Committees. According to their assessment, the modifications are serious but the currently valid accreditation can be extended towards the newly introduced programmes as follows:

Degree programme	ASIIN-label	Subject-specific label	Accreditation until max.
Ba Informatics (Computer Science)	All requirements fulfilled	Euro-Inf®	30.09.2024
Ba Network Security	All requirements fulfilled	Euro-Inf®	30.09.2024
Ba Computer Security	All requirements fulfilled	Euro-Inf®	30.09.2024
Ba Hardware Security	All requirements fulfilled	Euro-Inf®	30.09.2024
Ba Engineering Mathematics	All requirements fulfilled	Euro-Inf®	30.09.2024
Ba Data Science	All requirements fulfilled	Euro-Inf®	30.09.2024
Ba Financial Mathematics	All requirements fulfilled	Euro-Inf®	30.09.2024
Ma Engineering Mathematics	All requirements fulfilled	Euro-Inf®	30.09.2024
Ma Data Science	All requirements fulfilled	Euro-Inf®	30.09.2024
Ma Financial Mathematics	All requirements fulfilled	Euro-Inf®	30.09.2024

Appendix: Programme Learning Outcomes and Curricula

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

“The objectives for the Bachelor’s degree are based on the RK SCES. In general, the objectives of the DP correspond to the University Mission and Strategy of the University (http://www.iitu.kz/article/show/id/132?lang=en) and the requirements of the RK MES, the University has sufficient resources for their accomplishment.

Learning outcomes of Bachelor DP in CS.

Graduates of the CS program will be able to:

- apply the knowledge of fundamentals of mathematics and computing;
- analyse and evaluate problems; spot and define the computing requirements which are appropriate to their solution;
- use the tools and techniques necessary for computing practice;
- apply, design and develop principles in the construction of software systems of various complexity;
- use computer programming for problem solving;
- function effectively in an industrial environment and apply the gained skills to real-world problems;
- work with software and hardware complexes;
- work in a team to accomplish a common goal;
- understand their professional, ethical, and social responsibilities.”

The following **curriculum** is presented:

III. Academic program

№	Code of the discipline	Name of the discipline	Total				Distribution of credits for courses and number of weeks							
			Total number of cre	ECTS	Semester	Course project (work)	15	15	15	15	15	15	15	15
							1,00		2,00		3,00		4,00	
							2017-2018		2018-2019		2019-2020		2020-202	
							1	2	3	4	5	6	7	8
1	1	**I. General Education (GE)**	28											
2	1.1	**1.1 Compulsory component (CC)**	21											
3	SIK 1101	Modern History of Kazakhstan	3	5	1		3							
4	Fil 1202	Philosophy	3	5	3				3					
5	IYa 1103	Foreign Language (English)	3	5	1		3							
6	IYa 1103	Foreign Language (English)	3	5	2			3						
7	K(R) Ya 1104	Kazakh (Russian) Language	3	5	1		3							
8	K(R) Ya 1104	Kazakh (Russian) Language	3	5	2			3						
9	IKT 1102	Informational and Communication Technology	3	5	1		3							
23	1.1	**Total GE CC**	21		1		12	6	3					
24	1.2	**1.2 Component of electives (CE)**	7											
25	IYa 2103	Foreign Language (English)	1	2	1		1							
26	IYa 2103	Foreign Language (English)	1	2	2			1						
27	OET 2201	Fundamentals of Economical theory	3	5	4					3				
28	Pol 2101	Information security policy	2	3	4					2				
55	1.2	**Total GE CE**	7		1		1	1		5				
56	1	**Total GE CC,CE**	28		1		13	7	3	5				
57	2	**2 Basic Disciplines (BD)**	69											
58	2.1	**1.1 Compulsory component (CC)**	20											
59	PK(R) Ya 2102	Professional Kazakh (Russian) Language	2	3	3				2					
60	POIYa 2103	Professionally-oriented foreign language	2	3	3				2					
61	MA1203	Mathematical Analysis 1	3	5	1		3							
62	ASD 1204	Performance, Data Structures & Algorithms (SDP4)	3	5	3				3					
63	YaTP 1205	Programming Languages and Technologies	3	5	2			3						
64	OS 2206	Operating Systems	2	3	3				2					
65	KS 3207	Computer Networks	2	3	5						2			
66	TBD 3208	Theory of Database Systems	3	5	3				3					
79	2.1	**Total BD CC**	20		1		3	3	12		2			
80	2.2	**1.2 Component of electives (CE)**	49											
81	AGLA 1105	Analytical Geometry and Linear Algebra	3	5	1		3							
82	MA 1202	Mathematical Analysis 2	3	5	2			3						
83	DM 2105	Discrete Mathematics	3	5	3				3					
84	TI 3205	Oracle Database 11g: Programming with PL\SQL	3	5	6							3		
85	Iya 3102	Foreign Language for STEAM	2	3	4					2				
86	SDP1 1107	Computation and Problem Solving (SDP1)	3	5	1		3							
87	SDP2 1203	Application Development (SDP2)	3	5	2			3						
88	SDP3 2107	Development of Mobile Applications	3	5	7								3	
89	TVIMS 1204	Probability Theory and Mathematical Statistics	2	3	2			2						
90	VM 3101	Computational Mathematics	3	5	4					3				
91	SDP5 3102	Architecture and Design (SDP5)	3	5	5						3			
92	AKS 3103	Object-oriented Programming in Java	3	5	4					3				
93	SDP8 3202	Java Advanced 1: Development of applications on the Java SE platform	3	5	5						3			
94	SDP6 3203	Java Advanced 2: Development of applications on the Java EE platform	3	5	6							3		
95	SDP9 4102	Data Protection and Information Security	2	3	4					2				
96	3D 3221	Web Programming 2	3	5	5						3			
97	DAA 2204	Design and Analysis of Algorithms	2	3	4					2				

98	WT 2201	Web Programming 1	2	3	4				2				
142	2.2	**Total BD CE**	49		1	6	8	3	14	9	6	3	
143	2	**Total BD CE, CC**	69		1	9	11	15	14	11	6	3	
144	3	**3. Specialized disciplines(SD)**	32										
145	3.1	**1.1 Compulsory component (CC)**	5										
146	BShK 3301	Human/Computer Interaction and Communication (SDP 7)	3	5	6						3		
147	APB 3302	Architecture of Parallel Computing Systems	2	3	6						2		
166	3.1	**Total SD CC**	5		6						5		
167	3.2	**1.2 Component of electives (CE)**	27										
168	3.2.1	**3.2.1 University mandatory component of choice**											
169	NSiIP 2106	Neural Networks and their Applications	3	5	5					3			
170	NBD 4104	Non-relational Database Systems	3	5	7							3	
171	ChM 2205	Numerical Methods	3	5	5					3			
172	TI 3205	Machine Learning	3	5	5					3			
173	SAP 3220	Microsoft Programming 1: development of Desktop applications on ASP.	3	5	6						3		
175	3.2.2	CE № 1											
176	ORCL 3219	Microsoft Programming 2: development of Web applications on ASP.Net	3	5	7							3	
182	3.2.2	CE № 2											
184	DA 3223	Data Science and Machine Learning 1: Mathematics and Python for data	3	5	5					3			
189	3.2.2	CE № 3											
191	SAP 3224	Data Science and Machine Learning 3: Research	3	5	7							3	
196	3.2.2	CE № 4											
197	MAC 3229	Data Science and Machine Learning 2: Learning on marked data	3	5	6						3		
243	3.2	**Total SD CE**	27		5					12	6	9	
244	3	**Total SD CC, CE**	32		5					12	11	9	
245	**1+2+3**	**Sum of credits**	129		1	22	18	18	19	23	17	12	
246	**4**	**4 Additional types of training (ATT)**											
247	4.1	**1.1 Compulsory component (CC)**											
248	FC CS	Physical Education	2	3	1	2							
249	FC CS	Physical Education	2	3	2		2						

250	FC CS	Physical Education	2	3	3			2					
251	FC CS	Physical Education	2	3	4				2				
253	ONIR	OSRW	1	2	7							1	
254	MT CS	Military training											
255	4.1	Total ATT CC	9		1	2	2	2	2			1	
256	**4.2**	**4.2 Professional practice:**	14										
257	TP CS	Educational Internship	2	1	2		2						
259	IP CS	Professional Internship	4	11	4				4				
260	IP CS	Professional Internship	4	11	6						4		
263	UP CS	Pre-diploma Internship	4	11	8								4
266	**4.1+4.2**	**Total practice**	14		2		2		4		4		4
267	4	**Total ATT CC, practice**	23		1	2	4	2	6		4	1	4
268	**5**	**5 Final examination (FE)**											
269	WDT CS	Writing and defense of diploma project	2	3	8								2
270	SES CS	State examination in the degree programme	1	2	8								1
274	5	**Total FE**	3		8								3
275	4+5	**Total ATT, FE**	26		1	2	4	2	6		4	1	7
276	1+2+3+4+5	**Total**	155	268	1	24	22	20	25	23	21	13	7

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

"Upon completion of the Bachelor DP in SIS the graduate will be able to:

- make management decisions;
- use information and communication technologies;
- have the skills to organize the protection of information in accordance with the relevant standards;
- carry out project work using the skills of modeling, designing and forecasting;
- present the results of their design and accounting work;

- use available engineering and technical-economic solutions;
- identify and troubleshoot problems in technological processes and technical systems,
- develop secure applications;
- maintain and test applications;
- maintain uninterrupted network operation;
- employ new network equipment;
- organize and maintain the safe perimeter of an enterprise;
- protect confidential information;
- detect and respond to information security incidents;
- develop and maintain databases;
- secure the corporate network users and resources;
- use methods of cryptography and cryptanalysis.

Learning outcomes for the Bachelor's and Master's DPs are published in the Student's Guide and are available for the students, staff members and other stakeholders on the IITU web site (http://www.iitu.kz/article/show/id/273?lang=en).

The objectives of DPs and modules (according to the ASIIN's Objectives-Module-Matrix) are defined as learning outcomes. The learning outcomes of the courses are based on the aims of a given DP.

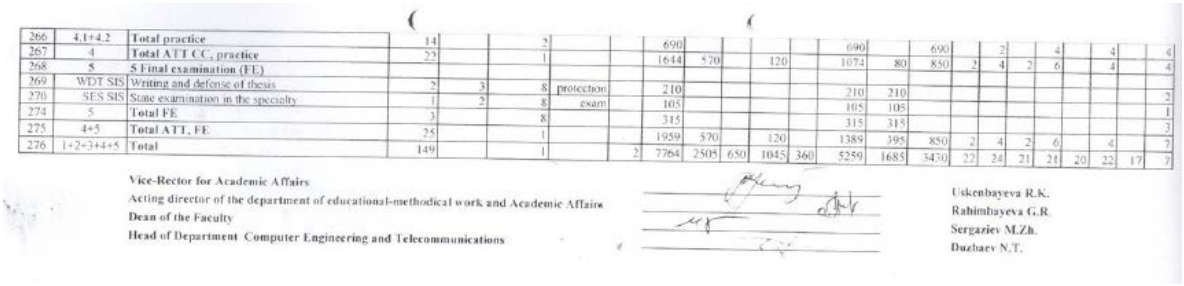
The objectives of all programs are revised taking into account the needs of the society, economy and labor market. The dynamism of the program's goals is confirmed by the coordination of its content with employers, who participate in the creation of the list of elective courses, offer internship opportunities, co-supervise master's dissertations, review projects."

The following **curriculum** is presented:

III. Academic program 2017-2021 academic year

№	Code of the discipline	Name of the discipline	Total						including					including IWS		Distribution of credits for courses and number of weeks							
			Total number of cr	ECTS	Semester	Type of assessment	Course project (work)	Total hours	in auditory	lectures	practicals	laboratory	Total	including IWS	IWS	15 15 1,00	15 15 2,00	15 15 3,00	15 15 4,00				
																2017-2018		2018-2019		2019-2020		2020-2021	
																1	2	3	4	5	6	7	8
1	1	**1. General Education (GE)**	28																				
2	1.1	**1.1 Compulsory component (CC)**	21																				
3	SIK 1101	Modern History of Kazakhstan	3	5	1	exam		135	45	30	15		90	30	60	3							
4	IYa 1103	Foreign Language	6	10	1	exam		270	90		90		180	60	120	3	3						
5	K(R)Ya 1104	The Kazakh (Russian) Language	6	10	1	exam		270	90		90		180	60	120	3	3						
6	IKT 1105	Information and communication technologies	3	5	1	exam		135	45	15	15	15	90	30	60	3							
7	Fil 2102	Philosophy	3	5	4	exam		135	45	15	30		90	30	60				3				
23	1.1	**Total GE CC**	21		1			945	315	60	240	15	630	210	420	12	6		3				
24	1.2	**1.2 Component of electives (CE)**	7																				
25	IYa 1108	Foreign Language	2	3	1	exam		90	30		30		60	20	40	1	1						
26	EiPB 4106	Ecology and Industrial Safety	2	3	7	exam		90	30	15	15		60	20	40							2	
27	EiOP 4107	Economics and Industrial Engineering	3	5	7	exam		135	45	15	30		90	30	60							3	
55	1.2	**Total GE CE**	7		1			315	105	30	75		210	70	140	1	1					5	
56	1	**Total GE CC,CE**	28		1			1260	420	90	315	15	840	280	560	13	7		3			5	
57	2	**2 Basic Disciplines (BD)**	69																				
58	2.1	**1.1 Compulsory component (CC)**	20																				
59	Math 1201	Mathematics	6	10	1	exam		270	90	60	30		180	60	120	3	3						
60	Fiz 1202	Physics	6	10	2	exam		270	90	30	30	30	180	60	120		3	3					
61	AYaiP 1203	Algorithmic Languages and Programming	4	7	1	exam		180	60	30	15	15	120	40	80	4							
62	K(R)Ya 2204	Professional Kazakh (Russian) Language	2	3	3	exam		90	30		30		60	20	40				2				
63	POIYa 2205	The Profession-oriented Foreign Language	2	3	3	exam		90	30		30		60	20	40				2				
79	2.1	**Total BD CC**	20		1			900	300	120	135	45	600	200	400	7	6	7					
80	2.2	**1.2 Component of electives (CE)**	49																				
81	POOIB 1209	Legal Aspects of Information Security	2	3	2	exam		90	30	15	15		60	20	40		2						
82	PYaJ 1210	Java Programming Language	3	5	2	exam		135	45	15	15	15	90	30	60		3						
83	GPIB 1211	Global Policy and Information Security	2	3	2	exam		90	30	15	15		60	20	40		2						
84	DM 2206	Discrete Mathematics	3	5	3	exam		135	45	15	30		90	30	60			3					
85	TVsMS 2207	Probability Theory and Mathematical Statistics	2	3	4	exam		90	30	15	15		60	20	40				2				
86	TEC 2208	Basic Circuit Theory	2	3	4	exam		90	30	15		15	60	20	40				2				
87	OKS 2212	Introduction to Networks (Cisco-1)	3	5	3	exam		135	45	15	15	15	90	30	60			3					
88	SaSSIB 2213	Standardization and Certification of Information Security Tools	2	3	3	exam		90	30	15	15		60	20	40			2					
89	ThS 3214	Theory of Information and Communication	3	5	5	exam		135	45	15	15	15	90	30	60					3			
90	PYaNU 2215	Programming in low-level languages	2	3	3	exam		90	30	15		15	60	20	40			2					
91	OOSL 3216	Linux Operating System Essentials	3	5	5	exam		135	45	15	15	15	90	30	60					3			
92	OUPPP 3317	Principles of Project Management and Staff Recruitment	2	3	6	exam		90	30	15	15		60	20	40							2	
93	OMiK 3218	Routing and Switching Essentials (Cisco-2)	3	5	4	exam		135	45	15	15	15	90	30	60				3				
94	MPZI 3219	Modeling of Information Security Processes	3	5	5	exam		135	45	15	15	15	90	30	60					3			
95	TASS 3220	Theory of social network analysis	3	5	6	exam		135	45	15	15	15	90	30	60						3		
96	AYaS 2221	English for STEM	4	7	3	exam		180	60		60		120	40	80							3	

97	Mic 3222	Microelectronics	3	5	5	exam		135	45	15	15	15	90	30	60					3			
98	WT 3223	Web technologies	3	5	6	exam		135	45	15	15	15	90	30	60						3		
99	ONIR 4224	Research Fundamentals (c.w.)	1	2	7	exam		45	15	5	10		30	10	20							1	
142	2.2	**Total BD CE**	49		2			2205	735	260	310	165	1470	490	980	7	13	19	9	12	8	1	
143	2	**Total BD CE, CC**	69		1			3105	1035	380	445	210	2070	690	1380								
144	3	**3. Specialized disciplines(SD)**	32																				
145	3.1	**1.1 Compulsory component (CC)**	5																				
146	OOS 2301	Operating Systems Organization	3	5	4	exam		135	45	15	15	15	90	30	60				3				
147	MiSZKI 2302	Information Security Methods and Tools	2	3	5	exam		90	30	15	15		60	20	40					2			
166	3.1	**Total SD CC**	5		4			225	75	30	30	15	150	50	100				3	2			
167	3.2	**1.2 Component of electives (CE)**	27																				
168	3.2.1	**3.2.1 University mandatory component of choice**																					
169	PKSZI 4305	Integrated system design for information security (c.w.)	3	5	7	exam	8	135	45	15	15	15	90	30	60							3	
170	OUSZiBI 3304	Organization and Management of Information Security Department (c.w.)	2	3	7	exam	8	90	30	15	15		60	20	40							2	
171	OZSUBD 4305	Organization and protection of database management systems	4	7	6	exam		180	60	30	15	15	120	40	80						4		
172	TsK 4306	Digital Forensics	3	5	7	exam		135	45	15	15	15	90	30	60							3	
173	KB 3307	Enterprise Cybersecurity	3	5	6	exam		135	45	15	15	15	90	30	60					3			
174	KMZI 3308	Cryptographic Methods of Information Security	3	5	5	exam		135	45	15	15	15	90	30	60					3			
175	3.2.2	CE № 1			5	exam														3			
176	MS 3309.1	Scaling networks (Cisco-3)			5	exam														3			
177	MTiP-1 3309.2	Mobile Technologies and Applications-1			5	exam																3	
178	PSZI3309.3	Programming Tools for Information Security																				3	
182	3.2.2	CE № 2	3	5	6	exam		135	45	15	15	15	90	30	60							3	
183	OS 3310.1	Connecting networks (Cisco-4)			6	exam																3	
184	MTiP-2 3310.2	Mobile Technologies and Applications-2			6	exam																	
185	ViVPO 3310.3	Software verification and validation																					
189	3.2.2	CE № 3	3	5	7	exam		135	45	15	15	15	90	30	60							3	
190	SV 4311.1	Network Security (Cisco-5)			7	exam																3	
191	BMP 4311.2	Securing Mobile Applications			7	exam															6	10	11
192	ZPiSM 4311.3	Securing Applications and Scripts																		3	8	10	11
243	3.2	**Total SD CE**	27		5			1215	405	150	135	120	810	270	540						6	10	11
244	3	**Total SD CC, CE**	27		4			1440	480	180	165	135	960	320	640								
245	1+2+3	**Sum of credits**	124		1			5805	1935	650	925	360	3870	1290	2580	20	20	19	15	20	18	17	
246	4	**4 Additional types of training (ATT)**																					
247	4.1	**1.1 Compulsory component (CC)**																					
248	FC SIS	Physical Culture	2	3	1	exam		90	30		30		60	20	40	2							
249	FC SIS	Physical Culture	2	3	2	exam		90	30		30		60	20	40		2						
250	FC SIS	Physical Culture	2	3	3	exam		90	30		30		60	20	40			3					
251	FC SIS	Physical Culture	2	3	4	exam		90	30		30		60	20	40				2				
254	MI SIS	Military training						594	450				144										
255	4.1	Total ATT CC	8		1			954	570		120		384	80	160	2	2	2	2				
256	4.2	**4.2 Professional practice:**	14																				
257	TP SIS	Teaching practice	2	3	2	report		30					30		30		2						
259	IP SIS	Internship	4	7	4	report		300					300		300				4				
260	IP SIS	Internship	4	7	6	report		300					300		300						4		
263	UP SIS	Undergraduate practice	4	7	8	report		60					60		60								4



266	4.1+4.2	Total practice	14			2			690				690		690	2		4		4	4
267	4	Total ATT CC, practice	22			1			1644	570		120	1074	80	850	2	4	2	6		4	4
268	5	5 Final examination (FE)																					
269	WDT SIS	Writing and defense of thesis	2	3	8	protection			210				210	210									2
270	SES SIS	State examination in the specialty	1	5	8	exam			105				105	105									1
274	5	Total FE	3		8				315				315	315									3
275	4+5	Total ATT, FE	25		1				1959	570		120	1389	395	850	2	4	2	6		4		7
276	1+2+3+4+5	Total	149		1		2	7764	2505	650	1045	360	5259	1685	3430	27	24	21	21	20	22	17	9

Vice-Rector for Academic Affairs — Uskenbayeva R.K.
Acting director of the department of educational-methodical work and Academic Affairs — Rahimbayeva G.R.
Dean of the Faculty — Sergaziev M.Zh.
Head of Department Computer Engineering and Telecommunications — Duzbaev N.T.

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

"The objectives for the Bachelor's degree are based on SCES. In general, the objectives of the DP correspond to the mission and strategy of the University (http://www.iitu.kz/article/show/id/132?lang=en) and the requirements of the RK Ministry of Education and Science (MES), they tally with the available University resources and the labor market requirements. The specificity of the DP lies in the elective courses. There is a systematic evaluation of the effectiveness of attaining the objectives of the MCM DP.

The MCM Department members collaboratively formulated the learning outcomes taking into account the labor market requirements as well as the alumni feedback.

Learning outcomes of Bachelor DP in MCM.

By the end of the program the students will be able:

- to demonstrate profound knowledge of the fundamentals of abstract and applied mathematics;
- to solve simple practical problems by applying fundamental mathematical methods;
- to create simple, realistic mathematical models;
- to use information and communication technologies, tools and techniques necessary for computing practice;
- to use computer programming for problem solving;
- to solve computational problems by using appropriate numerical and statistical procedures with a focus on accuracy, error control, and efficiency;
- to use computational and statistical software platforms to develop and execute various mathematical procedures, and numerical algorithms, ;
- to communicate mathematical ideas orally and in writing, with precision, clarity and organization, using proper terminology and notation;

- to function effectively in an industrial environment and apply the gained skills to real-world problems, in addition, to work in a team to accomplish a common goal;
- to understand professional, ethical, and social responsibilities;
- to demonstrate knowledge of the Kazakh, Russian, English languages at the level of social and professional communication, to apply special vocabulary and professional language terminology.

The DP is designed to develop intended competences, which should be acquired across the curriculum. Students who have completed the Bachelor DP in MCM possess enough knowledge and skills to continue the Master's studies in the field."

The following **curriculum** is presented:

III. Academic program 2017-2021 academic year

№	Code of the discipline	Name of the discipline	Total						including							Distribution of credits for courses and number of weeks							
			Total number of cr	ECTS	Semester	Type of assessment	Course project (work)	Total hours	IWS							15	15	15	15	15	15	15	15
									including							1,00		2,00		3,00		4,00	
									in auditory	lectures	practicals	laboratoty	Total	including IWST	IWS	2017-2018		2018-2019		2019-2020		2020-2021	
																1	2	3	4	5	6	7	8
1	1	**I. General Education (GE)**	28																				
2	1.1	**1.1 Compulsory component (CC)**	21																				
3	SIK 1101	The Modern History of Kazakhstan	3	5	1	exam		135	45	15	30		90	30	60	3							
4	Fil 2102	Philosophy	3	5	4	exam		135	45	15	30		90	30	60				3				
5	IYa 1103	Foreign Language	3	5	1	exam		135	45		45		90	30	60	3							
6	IYa 1103	Foreign Language	3	5	2	exam		135	45		45		90	30	60		3						
7	K(R) Ya 1104	Kazakh (Russian) language	3	5	1	exam		135	45		45		90	30	60	3							
8	K(R) Ya 1104	Kazakh (Russian) language	3	5	2	exam		135	45		45		90	30	60		3						
9	IKT 1105	Informational Communication Technology	3	5	2	exam		135	45	15	15	15	90	30	60		3						
23	1.1	**Total GE CC**	21		1			945	315	45	255	15	630	210	420	9	9		3				
24	1.2	**1.2 Component of electives (CE)**	7																				
25	IYa 1103	Foreign Language	1	2	1	exam		45	15		15		30	10	20	1							
26	IYa 1103	Foreign Language	1	2	2	exam		45	15		15		30	10	20		1						
27	OET 4201	Fundamentals of Economic Theory	3	5	7	exam		135	45	15	30		90	30	60							3	
28	GPIS 3101	Global Policy and Information Security	2	3	6	exam		90	30	15	15		60	20	40						2		
55	1.2	**Total GE CE**	7		1			315	105	30	75		210	70	140	1	1				2	3	
56	1	**Total GE CC,CE**	28		1			1260	420	75	330	15	840	280	560	10	10		3		2	3	
57	2	**2 Basic Disciplines (BD)**	69																				
58	2.1	**1.1 Compulsory component (CC)**	21																				
59	PK (R) Ya 2201	Professional Kazakh (Russian) Language	2	3	3	exam		90	30	15	15		60	20	40			2					
60	POIYa 2202	Professionally-oriented Foreign Language	2	3	3	exam		90	30	15	15		60	20	40			2					
61	MA(1) 1203	Mathematical Analysis 1	3	5	1	exam		135	45	15	30		90	30	60	3							
62	MA(2) 1204	Mathematical Analysis 2	3	5	2	exam		135	45	15	30		90	30	60		3						
63	LA 1205	Linear Algebra	2	3	1	exam		90	30	10	20		60	20	40	2							
64	DU 2206	Differential Equations	3	5	3	exam		135	45	15	30		90	30	60			3					
65	OOPC 2207	Object-Oriented Programming in C ++	3	5	3	exam		135	45	15	15	15	90	30	60			3					
66	ChMAA 3208	Numerical Methods of Analysis and Algebra	3	5	5	exam		135	45	15	15	15	90	30	60					3			
79	2.1	**Total BD CC**	21		1			945	315	115	170	30	630	210	420	5	3	10		3			
80	2.2	**1.2 Component of electives (CE)**	48																				
81	MA(3) 2209	Mathematical Analysis 3	3	5	3	exam		135	45	15	30		90	30	60			3					
82	VRP 1210	Computation and Problem Solving (SDP1)	3	5	1	exam		135	45	15	15	15	90	30	60	3							
83	IyaS 2211	Foreign Language for STEAM	2	3	4	exam		90	30		30		60	20	40				2				
84	AG 1212	Analytical Geometry	2	3	2	exam		90	30	15	15		60	20	40		2						
85	LA 1213	Linear Algebra	1	2	1	exam		45	15	5	10		30	10	20	1							
86	PAYa 1214	Programming in Algorithmic Languages	3	5	2	exam		135	45	15	15	15	90	30	60		3						
87	ASD 2215	Performance, Data Structures & Algorithms (SDP 4)	3	5	4	exam		135	45	15	15	15	90	30	60				3				
88	TVMS 2216	Probability Theory and Mathematical Statistics	3	5	4	exam		135	45	15	30		90	30	60				3				
89	DMML 1217	Discrete Mathematics and Mathematical Logic	3	5	2	exam		135	45	15	30		90	30	60		3						
90	TM 3218	Theoretical Mechanics	3	5	4	exam		135	45	15	30		90	30	60				3				
91																							
92	UMF 2219	Equations of Mathematical Physics	3	5	5	exam		135	45	15	30		90	30	60					3			
93	F 2220	Physics	3	5	3	exam		135	45	15	30		90	30	60			3					

94	BDKSP 2221	Database and Client/Server Applications (SDP 6)	3	5	4	exam		135	45	15	15	15	90	30	60				3				
95	3DMD 3122	3D Modeling and Design	2	3	5	exam		90	30	15		15	60	20	40					2			
96	PDKV 2223	Elective - 2.1																					
97	Java 1	Programming in Java 1	3	5	3	exam		135	45	15	15	15	90	30	60				3				
98	CI # 1	Programming in C # 1	3	5	3	exam		135	45	15	15	15	90	30	60				3				
99	PDKV 2224	Elective - 2.2																					
100	Java 2	Programming in Java 2	3	5	4	exam		135	45	15	15	15	90	30	60				3				
101	CI # 2	Programming in C # 2	3	5	4	exam		135	45	15	15	15	90	30	60				3				
102	IBPSAP 4225	Complex Analysis and its Applications	2	3	7	exam		90	30	10	10	10	60	20	40								2
142	2.2	**Total BD CE**	48		1			2565	855	285	395	175	1710	570	1140	4	8	9	17	5	3	2	
143	2	**Total BD CE, CC**	69		1			3510	1170	400	565	205	2340	780	1560	9	11	19	17	8	3	2	
144	3	**3. Specialized disciplines(SD)**	32																				
145	3.1	**1.1 Compulsory component (CC)**	5																				
146	OMM 3301	Fundamentals of Mathematical Modelling	2	3	5	exam		90	30	15		15	60	20	40					2			
147	MKMFP 3302	Mathematical and Computer Modeling of physical Processes	3	5	6	exam		135	45	15	15	15	90	30	60						3		
166	3.1	**Total SD CC**	5		5			225	75	30	15	30	150	50	100					2	3		
167	3.2	**1.2 Component of electives (CE)**	27																				
168	3.2.1	**3.2.1 University mandatory component of choice**																					
169	MSP 3303	Modeling of Statistical Processes (R Programming)	3	5	5	exam		135	45	15	30		90	30	60					3			
175	3.2.2	CE № 1																					
176	MREZ 3304	Methods for Solving Extremal Problems	3	5	6	exam		135	45	15	15	15	90	30	60						3		
177	LP 3304	Linear Programming			6	exam															3		
178	IO 3304	Operations Research (Linear Problems)			6	exam															3		
182	3.2.2	CE № 2																					
183	MMPEPT 4305	Mathematical Models of Energy Saving Problems in an Undergr	3	5	7	exam		135	45	15	15	15	90	30	60								3
184	ZPNT 4305	Problems of Oil Transportation by Pipeline			7	exam																	3
185	TPT 4305	Heat Transfer in an Underground Pipeline			7	exam																	3
189	3.2.2	CE № 3																					
190	MEP 4312	Modeling of Environmental Problems	3	5	7	exam		135	45	15	15	15	90	30	60								3
191	NKZODU 4313	Methods of Solving the Nonlinear Boundary Value Problems for			7	exam																	3
192					7	exam																	3
196	3.2.2	CE № 4																					
197	PNRZ 4307	Problems of Nonlinear Difference Schemes	3	5	6	exam		135	45	15	15	15	90	30	60						3		
198	MRSU 4307	Methods for Solving Grid Equations			6	exam															3		
199	PRS 4307	Projection Difference Schemes			6	exam															3		
202	3.2.2	CE № 5																					
203	NEZ 4308	Nonlinear Extremal Problems	3	5	7	exam		135	45	15	15	15	90	30	60								3
204	KVP 4308	Quadratic and Convex Programming			7	exam																	3
205	TGP 4308	Graph Theory and Applications			7	exam																	3
209	3.2.2	CE № 6																					
210	VSAP 4309	Introduction to SAP	3	5	6	exam		135	45	15	15	15	90	30	60						3		
211	ORCL1 4309	Oracle Database 11g: Basics of SQL (Oracle 1)			6	exam															3		
212	VAD 4309	Introduction to Data Analysis			6	exam															3		
216	3.2.2	CE № 7																					
217	SAP 4310	Integration of business processes SAP	3	5	7	exam		135	45	15	15	15	90	30	60								3
218	ORCL2 4310	Oracle Database 11g: Basics of PLSQL (Oracle 2)			7	exam																	3
219	APA 4310	Advanced algorithms analysis			7	exam																	3
222	3.2.2	CE № 8																					
223	MMPTMO 3311	Mathematical Model of Heat Transfer in a Multi-region	3	5	5	exam		135	45	15	15	15	90	30	60					3			
224	KAP 3311	Complex Analysis and its Applications			5	exam														3			
225	PLIZ 3311	Laplace Transform in Engineering Problems			5	exam														3			
243	3.2	**Total SD CE**	27		5			1215	405	135	150	120	810	270	540					6	9	9	

244	3	**Total SD CC, CE**	32		5			1440	480	165	165	150	960	320	640					8	12	9	
245	1+2+3	**Sum of credits**	129		1			6210	2070	640	1060	370	4140	1380	2760	19	21	19	20	16	17	14	
246	4	**4 Additional types of training (ATT)**																					
247	4.1	**1.1 Compulsory component (CC)**																					
248	FC MCM	Physical Education	2	3	1	exam		90	30		30		60	20	40	2							
249	FC MCM	Physical Education	2	3	2	exam		90	30		30		60	20	40		2						
250	FC MCM	Physical Education	2	3	3	exam		90	30		30		60	20	40			2					
251	FC MCM	Physical Education	2	3	4	exam		90	30		30		60	20	40				2				
253	ONIR	Fundamentals of Research Work	1	2	7	exam		45	15	5	10		30	10	20							1	
254								594	450				144										
255	4.1	**Total ATT CC**	9		1			999	585	5	130		414	90	180	2	2	2	2			1	
256	4.2	**4.2 Professional practice:**	14																				
257	TP MCM	Educational practice	2	3	2	report		30					30		30		2						
259	IP MCM	Professional Internship	4	7	4	report		300					300		300				4				
260	IP MCM	Professional Internship	4	7	6	report		300					300		300						4		
263	UP MCM	Pre-diploma Internship	4	7	8	report		60					60		60								4
266	4.1+4.2	**Total practice**	14		2			690					690		690		2		4		4		4
267	4	**Total ATT CC, practice**	23		1			1689	585	5	130		1104	90	870	2	4	2	6		4	1	4
268	5	**5 Final examination (FE)**																					
269	WDT MCM	Writing and defense of diploma project	2	3	8	protection		210					210	210									2
270	SES MCM	State examination in the degree programme	1	2	8	exam		105					105	105									1
274	5	**Total FE**	3		8			315					315	315									3
275	4+5	**Total ATT, FE**	26		1			2004	585	5	130		1419	405	870	2	4	2	6		4	1	7
276	1+2+3+4+5	**Total**	155		1			8214	2655	645	1190	370	5559	1785	3630	21	25	21	26	16	21	15	7

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

“Learning outcomes of the Master’s DP in MCM.

By the end of the program the graduates will be able:

- to construct complex mathematical models of the processes under study;
- to understand modern approaches and methodology used in creating mathematical models;

- to carry out computational experiments and analyse their results;
- to work with a wide range of techniques and software applied to solving the practical problems of optimisation, numerical simulation and mathematical research;
- to critically read research articles and practically implement the findings;
- to write scientific and technical reports, reviews, publications based on the results of the studies;
- to demonstrate knowledge of English at the level of social and professional communication, to apply special vocabulary and professional language terminology;
- to understand the complex interaction between society, teaching and learning.

Learning outcomes for the Master's program are formed on the basis of the requirements of the RK SCES and demands of stakeholders

Learning outcomes of the Bachelor's and Master's Programs in MCM are annually discussed and revised at the meetings of the MCM Department and adjusted to changes in the environment. But due to the limited academic freedom and the need to comply with the RK SCES we cannot make significant changes. However, it should be noted that the state has initiated the policy of expanding the academic and managerial freedom of higher education institutions, Of late, the University has devised experimental DPs with a broader range of educational trajectories to choose from."

The following **curriculum** is presented:

III. Academic program 2017-2019 academic year

№	Code of the discipline	Name of the discipline	Total						including							Distribution of credits for number of weeks			
			Total number	ECTS	Semester	Type of assessment	Course project	Total hours	including				IWS			15	15	15	15
									in auditory	lectures	practicals	laboratory	Total	including 1	IWS	1,00		2,00	
																2017-2018		2018-2019	
																5	6	7	8
57	2	**2 Basic Disciplines (BD)**	20																
58	2.1	**1.1 Compulsory component (CC)**	8																
59	IFN 5201	History and Phylosophy of Science	2	3	1	exam		120	30	15	15		90	30	60	2			
60	Iya 5202	Foreign language (professional)	2	3	1	exam		120	30		30		90	30	60	2			
61	Psi 6204	Psyhology	2	3	1	exam		120	30	15	15		90	30	60	2			
62	Ped 6203	Pedagogy	2	3	1	exam		120	30	15	15		90	30	60	2			
79	2.1	**Total BD CC**	8					480	120	45	75		360	120	240	8			
80	2.2	**1.2 Component of electives (CE)**	12																
81	PRUN 5203	Decision Making under Conditions of Uncertainty	3	5	2	exam		180	45	15	30		135	45	90		3		
82	MKAMPP 5204	Methods of Complex Analysis in Modeling of Industrial Processes	3	5	3	exam		180	45	15	30		135	45	90			3	
83	RPP 5205	Parallel Computing	3	5	2	exam		180	45	15	30		135	45	90		3		
84	MPP5306	Modeling of Enumeration Processes	3	5	3	exam		180	45	15	30		135	45	90			3	
142	2.2	**Total BD CE**	12					720	180	60	120		540	180	360		6	6	
143	2	**Total BD CE, CC**	20					1200	300	105	195		900	300	600	8	6	6	
144	3	**3. Specialized disciplines(SD)**	22																
145	3.1	**1.1 Compulsory component (CC)**	2																
146	SMMM 5301	Modern methods of mathematical modeling	2	3	1	exam		120	30	15	15		90	30	60	2			
166	3.1	**Total SD CC**	2					120	30	15	15		90	30	60	2			
167	3.2	**1.2 Component of electives (CE)**	20																
168	3.2.1	**3.2.1 University mandatory component of choice**																	
175	3.2.2	CE № 1																	
176	NZOK 5307	Ill-posed Problems of Enclosing Structure	3	5	2	exam		180	45	15	30		135	45	90		3		
177	OZMO 5302	Inverse Problems in the Multilayer Region				exam													
182	3.2.2	CE № 2																	
183	MPVNV 5303	Simulation of Oil Displacement by Water	3	5	2	exam		180	45	15	30		135	45	90		3		
184	MSIVN 5306	Modeling of Selective Water Shutoff in Oil Reservoir				exam													
185	CHMPVR 5304	Numerical Simulation of Waterproofing Processes in the Reservoir				exam													
189	3.2.2	CE № 3																	
190	KZPMR5305	Applications of the Boundary Problems and Methods of their Solutions	3	5	2	exam		180	45	15	30		135	45	90		3		
191	PIGTZhCh 5314	Prediction of Changes in the Boundaries of the Solid and Liquid Parts of the Pipeline				exam													
196	3.2.2	CE № 4																	
197	KMZI 6307	Cryptographic Methods of Information Security	2	3	1	exam		120	30	15	15		90	30	60	2			
209	3.2.2	CE № 5																	
210	MZI 5308	Modeling of Information Security	3	5	3	exam		180	45	23	23		135	45	90			3	
216	3.2.2	CE № 6																	
217	MPPSUA5310	Modeling Process in the Poroelastic Medium by Acoustic Equations	3	5	2	exam		180	45	15	15	15	135	45	90		3		
218	TPZhGPS 5312	Natural Fluids Flow in Porous Media				exam													
219	HMROZG 5309	Numerical Methods of Solving Inverse Problems of Geophysics				exam													
222	3.2.2	CE № 7																	
223	OZTT5311	Inverse Problems of Oil Transportation by Pipeline	3	5	3	exam		180	45	23	23		135	45	90			3	
224	NZPNT 6312	Nonlinear problems of Oil Transportation by Pipeline				exam													
225	NZPVNPT 6313	Transportation Problems for High Viscosity Oil Underground Pipeline				exam													
243	3.2	**Total SD CE**	20					1200	345	143	188	15	1035	345	690	2	12	6	
244	3	**Total SD CC, CE**	22					1320	375	158	203	15	1125	375	750	4	12	6	
245	1+2+3	**Sum of credits**	42					2520	675	263	398	15	2025	675	1350	12	18	12	
246	4	**4 Additional types of training (ATT)**																	
247	4.1	**1.1 Compulsory component (CC)**																	
255	4.1	**Total ATT CC**																	
256	4.2	**4.2 Professional practice:**	14																
258	PP 6401	Pedagogical Internship	2	3	2	report		30					30		30		2		
259	IP 6402	Research Internship	4	7	3	report		60					60		60			4	
260	NIRM 6403	Scientific Research	1	2	1	report		15					15		15	1			
261	NIRM 6403	Scientific Research	2	3	2	report		30					30		30		2		
262	NIRM 6403	Scientific Research	2	3	3	report		30					30		30			2	
263	NIRM 6403	Scientific Research	2	3	4	report		30					30		30				2
266	4.1+4.2	**Total practice**	13					195					195		195	1	4	6	2
267	4	**Total ATT CC, practice**	13					195					195		195	1	4	6	2
268	5	**5 Final examination (FE)**																	
269	OZMD 6501	Dissertation Preparation and Defense	3	5	4	protection		315					315	315					3
270	GES 6502	State Examination	1	2	4	exam		105					105	105					1
274	5	**Total FE**	4					420					420	420					4
275	4+5	**Total ATT, FE**	17					615					615	420	195	1	4	6	6
276	1+2+3+4+5	**Total**	59					3135	675	263	398	15	2640	###	1545	13	22	18	6