



ASIIN Seal Accreditation Report

Bachelor's Degree Program

Mathematics

Mathematical and Computer Modeling

Master's Degree Program

Mathematics

PhD Program

Mathematics

Provided by

SDU University

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A About the Accreditation Process

Name of the degree program (in original language)	(Official) English translation of the name	Labels applied for ¹	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC) ²
BSc in Mathematics	BSc in Mathematics	ASIIN	IAAR: 28.01.2022 - 27.01.2029	12
BSc in Mathematical and Computer Modeling	BSc in Mathematical and Computer Modeling	ASIIN		12
MSc in Mathematics	MSc in Mathematics	ASIIN	IAAR: 28.01.2022 - 27.01.2029	12
PhD in Mathematics	PhD in Mathematics	ASIIN		12
<p>Date of the contract: 09.12.2022</p> <p>Submission of the final version of the self-assessment report: 14.04.2023</p> <p>Date of the onsite visit: 07.06.2023</p> <p>at: SDU Campus in Kaskelen City</p>				
<p>Expert panel:</p> <p>Prof. Dr. Norbert Kalus, Berlin University of Applied Sciences and Technology</p> <p>Prof. Dr. Manfred Berres, University of Applied Sciences Koblenz</p> <p>Bolatzhan Kumalakov, PhD, Astana IT University</p> <p>Talgat Zhardayev, senior Associate at KPMG</p> <p>Roza Sabiriva, PhD student at Al-Farabi Kazakh National Universtiy</p>				

¹ ASIIN Seal for degree programs.

² TC: Technical Committee for the following subject areas: TC 12 - Mathematics.

Representative of the ASIIN headquarter: Dr. Andrea Kern	
Responsible decision-making committee: Accreditation Commission for Degree Programmes	
Criteria used: European Standards and Guidelines as of May 15, 2015 ASIIN General Criteria, as of December 10, 2015 Subject-Specific Criteria of Technical Committee 12 – Mathematics as of December 9, 2016 ASIIN Additional Criteria for Structured Doctoral Programmes as of March 15, 2021	

B Characteristics of the Degree Programs

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
Mathematics	B.Sc.	Mathematics, Pure Mathematics, Applied Mathematics	6	Full time	-	8 Semester	240 ECTS	2007, annually in September
Mathematical and Computer Modeling	B.Sc.	Mathematical Modeling, Computational mathematics and scientific computing, Computer modeling	6	Full time	-	8 Semester	240 ECTS	2019, annually in September
Mathematics	M.Sc.		7	Full time	-	4 Semester	120 ECTS	2017, each semester
Mathematics	Ph.D.		8	Full time	-	6 Semester	180 ECTS	2020, each semester

The Suleyman Demirel University (SDU) was founded in 1996 as a private university in Kazakhstan. The initiative to establish this university came from the former president of Kazakhstan, Nursultan Nazarbayev, and the former president of Turkey, Suleyman Demirel, from whom the university got its name. In 2011, the university moved to its new campus in Kaskelen City, which is located outside Almaty.

Today, the university has expanded their education programs and now operated a business school and the faculties of Engineering and Natural Sciences, Education and Humanities, Law and Social Sciences, and of Multidisciplinary Education. In addition, SDU has established a Continuing Education Center and an Education and Methodical Center.

³ EQF = The European Qualifications Framework for lifelong learning

SDU develops strategies and defines their mission and vision for five years. The last plan lasted from 2018 to 2023 and included the establishment of a new student government and opportunities for innovation and entrepreneurship. This led to the creation of a new TechnoPark and entrepreneur center on campus as well as new collaborations with universities and industry partner in order to increase the potential for all students. SDU has established staff and student exchange programs with 80 global partners and provides the opportunity for several double degrees. They highlight a close cooperation with Hof University of Applied Sciences, SolBridge International School of Business, MSU Malaysia and the University of Warsaw. The university has currently 7,447 students (June 2023); in September 2023, SDU will surpass more than 8,000 students in total. This includes 517 master students, 71 PhD students and 116 international students. Of all these students, 70% receive governmental funding whereas 30% have received internal scholarships. SDU employs 556 academic staff members and 264 administrative staff for the offered 60 academic programs.

For the upcoming five years, SDU develop their new strategy considering external national and international stakeholders. The mission of SDU encompasses providing outstanding knowledge and educate skilled graduates, who are global citizens following principles of a humanistic education. Their vision encompasses the goal to become one of the leading international education providers in Central Asia, recognized for teaching and learning technologies, innovative ideas, passion for discovery, and in-demand graduates. They plan to focus important topics for the modern society such as digitalization and financial sustainability. The motto of SDU is “Making your dreams reality.”

The four study programs under review are part of the Faculty of Engineering and Natural Sciences, which focuses in particular on various areas of IT and mathematics. The department of Mathematics currently has 644 students, of whom 607 are enrolled in bachelor students, 26 doing their master and 11 pursue their PhD degree. Of all students in the Department of Mathematics, 61% are female.

For the bachelor program Mathematics, the institution has presented the following profile in the self-assessment report:

“The goal of the BSc in Mathematics education program is to prepare highly qualified specialists who combine deep knowledge in mathematics with the skills of creative thinking, research activity, the ability to independently formulate new goals and tasks of scientific research, and assess the innovative potential of scientific developments. Thus, the program is focused on preparing full-fledged participants in the research process, preparing specialists with innovative problem-solving skills and preparing students for successful admission to a master's or doctoral program in applied or fundamental mathematics. Graduate of the

program are able to find, analyze, and apply mathematical algorithms in practice, formulate and solve problems in the natural sciences; to use professional literature in their field to obtain information that contributes to the development of professional competence; recognize and understand the forms and structures that are typical of both oral and written professional communication; to use fundamental knowledge in the field of mathematical analysis, complex and functional analysis, algebra, analytical geometry, differential geometry and topology, differential equations, discrete mathematics and mathematical logic, probability theory, mathematical statistics and random processes, numerical methods, and theoretical mechanics in their future professional activities.”

For the bachelor program *Mathematical and Computer Modeling (MCM)*, the institution has presented the following profile in the self-assessment report:

The goal of the BSc in Mathematical and Computer Modeling education program is to provide students with a strong foundation in mathematics and computer science, as well as the tools and techniques needed to apply these disciplines to real-world problems. Students take courses in calculus, linear algebra, probability and statistics, discrete mathematics, and computer programming. They also learn about modeling techniques such as simulation, optimization, and data analysis, and how to apply these methods to problems in fields such as finance, engineering, biology, and social sciences. The program aims to prepare students for careers in a variety of fields, including data analysis, financial modeling, computer science, and operations research. Graduates of the program may also choose to pursue further education in graduate or professional programs in areas such as mathematics, computer science, or business. The program is designed to provide students with a strong quantitative foundation and the ability to apply their knowledge to real-world problems, preparing them for success in a rapidly evolving technological landscape.”

For the master program *Mathematics*, the institution has presented the following profile in the self-assessment report:

“The goals of the MSc in Mathematics program are achieved through various activities during the 2-year study period. In the fundamental courses in algebra, real analysis, probability theory and statistics, students study the basics of advanced classical mathematics, important results, and proof methods. These courses enhance students' mathematics portfolios, their critical and analytical thinking skills, and develop problem-solving abilities. The Research Tools and Methods discipline, as well as the Master's Scientific Research Work

courses, help students develop their research-related skills, including creative work development, ability to work independently, and exchange mathematical ideas. Within the specialization, students study elective courses such as neural networks, differential equations, and additional chapters in algebra. Graduates of the program are able to critically analyze global problems that arise in mathematics, reason quantitatively and create effective solutions; to carry out independent research in the field of mathematics, and analyze and interpret their research results; to use mathematical models and methods to solve practical problems and make decisions in various areas of human activity; to communicate the results of their research, both orally and in writing, to both specialist and non-specialist audiences, and participate in scientific discussions.”

For the doctoral program Mathematics, the institution has presented the following profile in the self-assessment report:

“The goals of the PhD in Mathematics program are to provide advanced training in mathematical theory, research methodology, and analytical reasoning, and to prepare graduates for careers in academia, industry, government, or other research-oriented fields. As the program is designed to follow the MSc in Mathematics, students undertake courses such as Research Methods and Academic Writing in addition to specialized courses in their chosen research area. They receive training in research methods such as problem formulation, literature review, experimental design, data analysis, and presentation of results. The program aims to foster independent and creative thinking, as well as effective communication skills, through opportunities such as presenting at conferences, publishing in academic journals, and collaborating with faculty and experts on research projects. Graduates of the program are expected to have the skills and knowledge necessary to make significant contributions to the field of mathematics through original research. They may pursue careers as university professors, researchers in industry or government, or as consultants in various fields that require advanced mathematical expertise. PhD in Mathematics program is designed to produce highly skilled and knowledgeable mathematicians who can tackle complex problems and make important contributions to the advancement of the field.”

C Expert Report for the ASIIN Seal

1. The Degree Program: Concept, content & implementation

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

Evidence:

- Self-assessment report
- Webpage SDU <https://sdu.edu.kz/>
- Webpages of each study program
- SDU regulations
- Diploma Supplement
- Discussion during the audit

Preliminary assessment and analysis of the experts:

In its self-assessment report, SDU describes the objectives of the study programs under view and how these were established.

SDU characterizes the bachelor program *Mathematics* as a program, which teaches the students a combination of mathematics and creative thinking, research skills and the ability to independently define new goals for scientific and innovative processes. Therefore, graduates of the program have the following abilities:

- find, analyze, and apply mathematical algorithms in practice, formulate and solve problems in the natural sciences;
- use professional literature in their field to obtain information that contributes to the development of professional competence;
- recognize and understand the forms and structures that are typical of both oral and written professional communication;
- use fundamental knowledge in the field of mathematical analysis, complex and functional analysis, algebra, analytical geometry, differential geometry and topol-

ogy, differential equations, discrete mathematics and mathematical logic, probability theory, mathematical statistics and random processes, numerical methods, and theoretical mechanics in their future professional activities.

SDU further defines these program learning outcomes (PLOs) for the bachelor program *Mathematics*:

PLO1	Apply a fundamental knowledge in the field of mathematical analysis, complex and functional analysis, algebra, analytical geometry, differential geometry and topology, differential equations, discrete mathematics and mathematical logic, probability theory, mathematical statistics and random processes, numerical methods, theoretical mechanics in the future professional activities, by learning theoretical materials of listed disciplines.
PLO2	Analyze and use in practice mathematical algorithms by solving typical problems of subjects related to analysis.
PLO3	Solve and formulate problems in the field of natural sciences by applying theoretical knowledge.
PLO4	Solve standard tasks with the use of information and communication technologies by using basic methods of programming.
PLO5	Develop the motivation and opportunity to publish findings in the national and international periodical journals, in accordance with academic principles and ethical values by using obtained methods of scientific research.
PLO6	Solve the problems related to one of the tracks of the program, which depends on the chosen direction by using the received knowledge.
PLO7	Gain an understanding of the functioning of government, markets and institutions, relations to society, major ethical theories and problems, and demonstrate fluency in several languages through learning non-area subjects (i.e. economics, sociology, philosophy, Russian/Kazakh language, Turkish language, and etc.).

Graduates from this program can find jobs in various occupations across industries. SDU outlines the following career path as the most common:

- Finance and Banking: The finance industry relies heavily on mathematical models for risk assessment, asset valuation, quantitative analysis, and algorithmic trading.

Mathematicians are sought after for roles such as quantitative analysts, financial consultants, and risk managers.

- **Data Science and Analytics:** Data-driven decision-making is crucial in today's business landscape. Mathematicians with expertise in statistics, data analysis, and machine learning are highly valued in the field of data science. They can analyze and interpret complex datasets, build predictive models, and extract actionable insights.
- **Technology and Software Development:** Mathematics forms the foundation of many technological innovations. Industries such as software development, computer graphics, cryptography, and cybersecurity require mathematicians to develop algorithms, solve complex problems, and ensure system efficiency and security.
- **Research and Academia:** Mathematicians often pursue careers in research and academia. They contribute to advancing mathematical theory, developing new mathematical models, and solving complex mathematical problems. Opportunities exist in universities, research institutes, and government agencies.
- **Engineering and Manufacturing:** Mathematics plays a critical role in engineering disciplines such as civil engineering, mechanical engineering, and electrical engineering. Mathematicians can work on mathematical modeling, optimization, and simulation projects to solve engineering challenges and improve processes.
- **Insurance and Actuarial Science:** The insurance industry relies on mathematical models and statistical analysis for pricing, risk assessment, and predicting future events. Actuaries, who assess and manage risk, use mathematical tools to analyze data and calculate probabilities.
- **Consulting and Operations Research:** Mathematicians are sought after by consulting firms and companies specializing in operations research. They help optimize business operations, improve efficiency, and solve complex
- **Logistical problems using mathematical modeling and optimization techniques.**

Moreover, graduates can continue their education in MSc and PhD programs.

In the bachelor program MCM, the university combines competences from mathematics and computer science in order to solve real-world problems. In addition to the foundations in both subjects, the students learn modeling techniques such as simulations, optimization, and data analysis. These allow the students to contribute especially in the fields of finance, engineering, biology, and social sciences.

SDU describes PLOs for the bachelor program MCM:

PLO1	Apply the underlying unifying structures of mathematics (i.e. matrices, sets, relations and functions, logical structure, groups, fields, graphs, etc.) and the relationships among them on paper and oral exams based on theoretical questions.
PLO2	Demonstrate logical skills in programming in a variety of languages (i.e. R, Python, MATLAB, etc.) achieved by laboratory works and exams based on problem-solving.
PLO3	Reveal deep knowledge of differential equations by solving applied problems.
PLO4	Design different types of mathematical models and simulations including dynamical systems, statistical models, differential equations, and game theoretic models by learning fundamental mathematical courses (Calculus, Ordinary differential equations, Numerical Methods, Statistics, etc.) and practical courses on simulations.
PLO5	Apply methods of mathematical and computer modeling for solving scientific, applied, production, and technological problems by using professional software, computer graphics, visualization, and developing their own software packages.
PLO6	Show basic knowledge in Financial Mathematics, Applications of Number Theory, Data management, and analysis by learning elective courses.
PLO7	Analyze collected information and present the research results achieved through work on individual and group projects.
PLO8	Gain an understanding of the functioning of government, markets and institutions, relations to society, major ethical theories and problems and demonstrate fluency in several languages through learning non-area subjects (i.e. economics, sociology, philosophy, Russian/Kazakh language, Turkish language, and etc.)

Graduates from the bachelor program MCM have a wide range of opportunities on the job market. SDU considers the following career choices:

- Data Science and Analytics: Mathematical and computer modeling skills are in high demand in the field of data science. Companies and organizations rely on data anal-

ysis to make informed decisions and gain insights into their operations. Professionals who can apply mathematical techniques, statistical modeling, and machine learning algorithms to large datasets are highly sought after.

- **Financial Services:** The finance industry heavily relies on mathematical models for risk assessment, asset valuation, portfolio optimization, and algorithmic trading. Skills in mathematical modeling and computer programming are essential for roles such as quantitative analysts, financial engineers, and data scientists in finance.
- **Engineering and Manufacturing:** Mathematical modeling is crucial in engineering disciplines such as civil engineering, mechanical engineering, and electrical engineering. Computer modeling is used to design and simulate complex systems, optimize processes, and analyze structural integrity. Skills in mathematical modeling and computer-aided design are valuable in these fields.
- **Research and Academia:** The combination of mathematics and computer modeling is essential in scientific research and academia. Researchers in fields such as physics, chemistry, biology, and environmental sciences often use mathematical models to analyze experimental data, simulate complex phenomena, and develop theories. Computational modeling and simulation are also prevalent in academic research.
- **Government and Public Policy:** Mathematical and computer models play a crucial role in informing public policy decisions. Government agencies and research institutes often employ experts in mathematical modeling to analyze social, economic, and environmental data, assess policy outcomes, and make recommendations.
- **Consulting and Technology:** Consulting firms and technology companies often require professionals with expertise in mathematical modeling and computer simulation. These skills are useful for developing models, conducting simulations, and providing data-driven solutions to clients' problems in various industries.

During the two-year master program Mathematics, the students receive fundamental and advanced courses in pure and applied mathematics. The courses are intended to enhance the students' mathematical skills as well as their capabilities in analytical thinking and problem solving. Furthermore, the master program Mathematics focuses stronger on research tools and methods and foster their abilities to work independently and exchange mathematical ideas on a professional level. Students can specialize in the areas of e.g. neural networks, differential equations, and additional chapters of algebra.

SDU defines the following PLOs for the master program Mathematics:

PLO1	Solve advanced problems in the theory of classical and modern mathematics and construct proofs of results in the field achieved by laboratory
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	works, practical classes, exams based on problem-solving and writing a Master's thesis.
PLO2	Analyze theoretical and applied problems and utilize necessary mathematical techniques to develop solutions, conduct an independent inquiry and develop creative work evidenced by a Master's thesis and research publications.
PLO3	Demonstrate ability to critically analyze global problems arising in Mathematics, reason quantitatively and create effective solutions by solving theoretical and (or) applied problems.
PLO4	Develop and maintain theory and problem-solving skills with a deep understanding of their area of specialization by learning elective courses, writing a Master's thesis and research publications.
PLO5	Communicate mathematical ideas to a mathematics audience both in writing and oral form achieved by participation in scientific conferences.
PLO6	Able to plan the development of the personality and managerial resource of the leader, mastery of psychological techniques and modern communication technologies of business communication, neutralize the negative impact of interpersonal relationships and intergroup communication, know replica clichés of speech etiquette, reflecting the country's culture and regional geographic information from authentic sources, enriching social experience, conduct conversation in situations of professional communication; skills of professional communication in a foreign language, raising and developing one's intellectual level, designing the educational process in conditions of socialization of a person; compliance with professional and ethical standards accepted in international practice achieved by learning compulsory courses.

Graduates from the master program Mathematics can work in different industries or continue their academic or scientific career. SDU considers these opportunities as the most common:

- PhD Pathway: An MSc in mathematics can serve as a stepping stone for those interested in pursuing a doctoral degree in mathematics or related fields. It provides a solid foundation in advanced mathematical concepts and research methodologies, preparing students for further studies and potential careers in academia.

- **Data Science and Analytics:** In today’s data-driven world, MSc mathematics graduates can leverage their analytical and mathematical skills to excel in the field of data science. The program equips students with the necessary tools and techniques to handle complex datasets, develop mathematical models, and apply statistical analysis to extract meaningful insights.
- **Teaching Opportunities:** Graduates of an MSc in mathematics may find opportunities to become instructors or lecturers in higher educational institutions. With their advanced knowledge and ability to convey complex mathematical concepts, they can inspire and educate the next generation of mathematicians and scientists.
- **Applied Mathematicians:** The practical application of mathematics is increasingly valued in industries such as engineering, computer science, and healthcare. MSc mathematics graduates can pursue careers as applied mathematicians, utilizing their problem-solving abilities and mathematical expertise to address real-world challenges and develop innovative solutions.

Furthermore, the doctoral program Mathematics is under review. SDU describe the main goal of this program is to provide and advanced training in mathematical theory, research methodology, and analytical reasoning, and to prepare graduates for careers in academia, industry, government, or other research-oriented fields. Students specialize in their area of interest while also learning additional skills in research methods and academic writing. This includes problem formulation, literature review, experimental design, data analysis, and presentation of results. Within the PhD program, students foster their abilities in independent and creative thinking as well as communication skills for a professional career (conferences, academic publications, research collaborations).

For the doctoral program Mathematics, SDU has defined the following PLOs:

PLO1	Produce, communicate and defend an original contribution to knowledge, as evidenced by the writing and defense of a thesis involving significant original research.
PLO2	Communicate mathematical ideas, results, context, and background effectively and professionally in written and oral form achieved by doing homework, exams based on problem-solving, writing scientific papers, doing presentations and giving talks at scientific seminars, conferences.

PLO3	Demonstrate advanced knowledge and understanding of their area of specialization and reproduce proofs of classical results in the field by learning theoretical courses.
PLO4	Create, implement, and disseminate knowledge in mathematics by producing high quality and original research.
PLO5	Demonstrate abilities in the critical analysis and quantitative reasoning of global problems arising in Mathematics by the writing and defense of a thesis.
PLO6	Plan and conduct lessons in advanced mathematics, create an effective learning environment for university students, and give appropriate assessment and feedback by passing a pedagogical practice.

Graduates from this program have diverse career opportunities. Some might want to continue their research activities in academia or the industry (e.g. finance, technology, data science), whereas others will consider becoming a teacher or consultant.

The experts are interested in the history of the study problems and SDU's motivation to create these rather new study programs. The representatives of the rector's office describe that the faculty started with a strong focus on IT, while mathematics was mainly provided a service to other technology-oriented study programs. However, they saw the potential and created the Department of Mathematics, where they initially focuses on scientific mathematics. In addition, they recently initiated the bachelor program MCM to increase the collaboration with the computer science on campus. Because of the success of these programs and the demand by the students, SDU has also offered the master and doctoral program in Mathematics. The most recent development was to split the bachelor program Mathematics to scientific Mathematics (under review) and pedagogic Mathematics to clearly allow the students to develop their skills and competences based on their interests.

The partners from the industry confirm to the experts that they are very satisfied with the qualifications of students and graduates from these four study programs under review. Several add that they were or are members of the advisory board and were therefore involved in the creation of new study programs and the review of existing programs. They highlight that the established advisory boards distinguishes SDU from other Kazakh universities. In their experience, many suggestions the industry partners provided during the curricular review were later implemented. This included also the suggestions of new topics to the curriculum in order to accommodate the needs of the industry. Nevertheless, the industry partners complain that they noticed these changes only one year later in the next advisory board meeting. Instead, they would prefer to receive direct feedback after SDU

made their final decisions. Some of the industry partners are also alumni, who state that they have also been invited to review the curriculum several years after graduation. Topics they suggested to the study programs at the Department of Mathematics included various aspects of applied mathematics including financial mathematics and elective courses in economy. Currently, they discuss how to include new developments in IT and big data into the curriculum of the different study programs in the field of mathematics.

The experts conclude, that the presented objectives and learning outcomes of all four study programs under review are described briefly and concisely. They are transparently anchored and published and thus are available to students, lecturers and interested third parties. In the opinion of the experts, these objectives and learning outcomes reflect the targeted academic qualification level of each study program are feasible and equivalent to the relevant and match the SSC criteria of the ASIIN Technical Committee 12. The experts confirm that with the intended competence profile, a professional activity corresponding to the level of qualification (according to the European Qualifications Framework) can be taken up (professional classification). This qualification level EQF 6 is reached in the bachelor program Mathematics and Mathematics and Computer Modelling, the EQF 7 in the master program Mathematics and EQF 8 in the doctoral program Mathematics. All study programs support their graduates with adequate skills and competences for both the labor market and society. The experts confirm that these are regularly reviewed in a process that involves the relevant stakeholders (in particular from higher education and professional practice) and, if necessary, the objectives are revised accordingly. Here, the experts see room for improvements between SDU and their external stakeholders. Although the experts verify the involvement of alumni and partners from the industry, the feedback back towards the industry on implemented changes should be improved.

Criterion 1.2 Name of the degree program

Evidence:

- Self-assessment report
- Webpage SDU <https://sdu.edu.kz/>
- Webpages of each study program
- SDU regulations
- Diploma Supplement
- Discussion during the audit

Preliminary assessment and analysis of the experts:

For the bachelor, master and doctoral program, SDU describes in their self-assessment report that the name represents the core competences of these study program. It is based on the significance and relevance of the discipline of mathematics and considers both pure and applied mathematics in the foundations and advanced studies. Since 2019, the study programs in Mathematics are divided from the study programs in Mathematics Education to show the distinct orientation of the three programs under review.

The bachelor program “Mathematics and Computer Modeling” focuses on mathematical models and computer simulations; therefore combining mathematics and computer science. This requires the students to gain skills in mathematics, computer science as well as statistics in order to analyze large data sets and build models. According to SDU, the program’s name reflects the importance of modeling as well as simulations and allows the graduate to express their knowledge in both fields.

In summary, the experts consider the title of the degree programs under review reflects the intended objectives and learning outcomes as well as the teaching and learning content and, also the teaching language of the program. The program titles are used consistently in all relevant documents. The experts add that in rare cases on the webpage, there is a variation between “Mathematics and Computer Modelling” and “Mathematics and Computer Modeling” which should be unified in the future.

Criterion 1.3 Curriculum

Evidence:

- Self-assessment report
- Curricular overview of the study programs
- Objective-module matrix
- Module handbook of all study programs
- Discussion during the audit

Preliminary assessment and analysis of the experts:

Structure of the program

The bachelor program Mathematics and MCM need 240 ECTS credits in order to complete the studies. The standard study duration is eight semesters, considering full-time studying. In both programs, a Bachelor of Science degree is awarded. The master study program Mathematics requires 120 ECTS credits in order to receive a Master of Science degree.

These should be completed within four semesters or two academic years. The doctoral program Mathematics covers 180 ECTS credits within the six semester study program. A PhD in *Mathematics* is awarded after graduation. SDU describes that the sequence of courses in disciplines has been built in a logical manner, ensuring the continuity of education.

The experts want to verify the language of instruction for the four study programs under review. The program coordinators confirm that all classes are conducted in English; the only exception are language classes. They offer courses on Kazakh and Russian, which are mandatory by the government. As a university component, they offer additional language course on Turkish. They add that there are Turkish high schools in Kazakhstan, which are connected to SDU due to their history.

The experts confirm that each module in the four study programs under review represents a well-matched unit of teaching and learning. SDU has established a clear structure for the students to acquire knowledge, skills and competences in each module. The experts consider that the order of the modules ensures that the learning outcomes can be achieved and that the programs can be completed within the standard period of study. Furthermore, the experts highlight that the program allows the students to select their own study plan and gives them the opportunity to select elective courses in their field of interest.

Content

SDU describes in their self-assessment report, that the students deepen their knowledge through the bachelor and master programs towards the PhD program. In the bachelor studies, the students complete their skills in order to apply theoretical principles, ideas and methods, simple algorithms and technologies to solve specific practical problems in individual areas of activity, and make effective decisions about the prospect of improving developed systems. During their master studies, students build on their skills in order to improve finding solutions, and apply them in new industries and tasks. Based on the continuity of the studied disciplines from theoretical to more complex ones, students are able to more deeply and thoroughly study all areas of activity in the field of their specialization. The study programs are organized to allow the students to develop their profile by selecting suitable electives modules to complete their set of competences in their field of interest. In the bachelor and master program *Mathematics*, SDU includes competences of the wide range of mathematics combining pure and applied mathematics. Theoretical and practical aspects are applied to complement each other and allow the students to individually practice their skills in solving mathematical problems. Students can develop their interdisciplinary professional skills through courses such as applied mathematical programming to solve real-world problems.

In the discussion with the program coordinators, the experts raise several questions on the content of single modules. In general, the program coordinators describe that several changes in the content of the modules was done during the last years. Therefore, several topics, which used to be in the syllabus previously, might have been changed to today. The experts continue, why several modules combine theoretical topics with practical education, such as the module “Galois Theory + Educational practice” for example. The program coordinators explain that topics like Galois Theory are too complex to teach is within three hours per week; therefore, they added the educational practice after the end of the module to get additional classes after the end of the semester. Based on this, the experts inquire how the workload in ECTS credits is determined for each module considering the division of theoretical lectures, laboratory work and seminar. The program coordinators explain that they use their own portal to calculate the ECTS credits for each module. They explain that each component does contribute to a different extent to the ECTS credit. Therefore, they have to carefully consider the amount of workload for each module. In their opinion, the workload at these study programs used to be higher than it is now, but some might still consider the current workload as high as well. The partners from the industry describe to the experts that they consider the skills of the students and graduates from SDU as very good. Nevertheless, they consider that the students could need more experience that is practical. They admit that this is a problem with all Kazakh universities, but from an industry perspective, this should be improved in the future.

The experts have a specific question for the module “Introductory Mathematics”, which seem to thematically overlap with other modules. The program coordinators mention that the students come from different region includes non-prestigious schools. In this module, the students will receive a foundation; however, the government does not favor this sort of courses anymore, so it will be removed in the fall semester. A similar explanation is given for lectures at the beginning of the master program Mathematics. Currently, in this program, 18 students out of 28 completed their bachelor degree outside SDU; therefore, they want to ensure that all students have a comparable basic knowledge. For this reason, they have included a short review of this topic at the beginning of their modules. The students confirm that short repetitions at the beginning of the modules are integrated at the beginning of the course; they add that they consider them useful, as they are aware of the different background of students studying in their programs.

The experts are further concerned about the programming skills of the students and wonder if they receive enough training. According to the program coordinators, the initial idea was that bachelor students in Mathematics need less programming skills compared to students in MCM. MCM students have more opportunities and practice hours and therefore

receive a fair amount of training for their programming skills. They are aware, that nowadays, also graduates from the bachelor program Mathematics need to have good skills in programming in order to be successful on the job market. They support the suggestion of the experts to increase the amount of programming practice in the next curriculum updates for this program. Nevertheless, the program coordinators want to point out, that the students already receive a solid foundation in programming and have additional option to advance their skills in elective courses. This includes elective courses from the Department of Computer Sciences. Still, there are students who have a scientific focus on topics such as algebra, who are not too much interested in programming. The experts mention, that also in algebra software like “Mathematica” requires programming skills; however, this is not included in the current curriculum. The main programming is done in Python and MATLAB. Additionally R is used for various applications. The experts further inquire if Maya is used for 3D modeling as it is missing in the module descriptions, which the program coordinators can confirm.

Moreover, the experts require an explanation on the module involving pedagogical and research practice (PRC 1000). The program coordinators state that pedagogic practice is mandatory according to government regulations. In this practice, students need to prepare a syllabus for a tutor course, observe teaching and give classes. Another question is on the module MSC 1000 (research oriented), which the program coordinators describe as support for writing a scientific article or conference abstract. Thus, this course already prepares the students for research work including reading articles.

The experts also discuss the topic of soft skills with the students. They describe to the experts that they have various opportunities to practice their presentation skills since most courses involve at least short presentations. In particular, they learn and practice presentation skills in the course in “Methods on Scientific Research” and their introduction on academic writing. They confirm that these courses strongly benefited their writing and presentation skills. In addition, they participated in events like the science week, which is a regular event at SDU where students are also invited to give presentations. Upon the questions of the experts, the students also state that in some cases, they are asked to present mathematical proofs; however, this depends on the lecturer. The partners from the industry admit that the soft skills in some students could be improved. They are aware, students in mathematics are often more used to working with numbers than with people. However, in their companies, they often need to interact with clients, investors and partners, which require certain soft skills. They remark that especially team work is of great importance in a company. Still, they see a gradual development with younger students, who became better with their soft skills as universities except nowadays that soft skills are as important as technical skills of the graduates’ future.

According to the module handbook, the students can perform an “Industrial project 1-4”, but the organization is unclear to the experts. The program coordinators say that according to the state standards, an internship is mandatory in their study programs whereas the university can determine the duration of the internship. Students in their fourth year can work for 15 weeks in the industry, for which they receive 25 ECTS credits. Evaluation includes weekly reports, which they have to submit to their supervisor at SDU as well as their supervisor at the industry. During the last years, the number of students participating in this internship has significantly increased. At SDU, they can split the internships in four phases, to observe how the students improve their skills; therefore, they offer four different modules for internships currently. The duration of the internships depends on the duration the students select for their internship. Most students spend around 30 hours of internship, which require them to spend one or two weeks in one company. Most students are motivated to test their abilities in one job. The program coordinators mention that they consider changing the internship regulations to offer one longer internship in the seventh semester. According to the changed regulations, the students could start their internship during the summer, and continue it in fall to fulfill the workload of 20 ECTS credits. At the moment, internships are mainly taken in summer. The experts are curious, how the internships with a duration of one to two weeks are accepted by the industry. The program coordinators admit that the industry partners would prefer longer internships, which is one reason they try to change the internship course. However, they add that at the moment, the students have already remained in the company for a longer period after finishing their two-week internship. Furthermore, SDU collaborates with their industry partners in a job fair and advertises internship in the industry on their webpage. The students confirm to the experts that they are interested in participating in their internships. They usually receive information from their advisors and lecturers by email on open internships as well as research grants. Offers for internships are further distributed on social media (mainly telegram and Instagram). The PhD students add that the information to spend time abroad in their study program was mainly available on the webpage. However, they prefer to discuss the opportunities with their advisors. The partners from the industry confirm their involvement in internships to the experts, mainly in the fields of IT, finances, insurance and other fields for applied mathematics. In addition, they also draw the experts’ attention to the beta career program, which represents a good connection to the industry. However, the partners from the industry remark that the university does not systematically contact them on feedback on the students’ performance during the internship. Although the students have to submit reports, the companies are not required to share their feedback, which they would consider as important. The alumni confirm that this program was created based on the students’ need to get closer to the industry in order to be successful on the job market.

Currently, the list of industry partners for the internship and beta career contains 137 companies and 209 students are involved. During the internship or the beta career program, the students practice or learn abilities used in the industry today. This includes machine learning and data analysis. The partners from the industry consider that there is room for improvement to increase the IT competences for the students in both bachelor and the master study programs under review in order to address the changes in demands on the job market.

The students highlight to the experts that in addition to their internship they also have the beta career program. This program offers them the possibility to work instead of studying in order to understand the tasks in a company better. Alternately, they can also assist professors at SDU and support them in their work, such as grading mid-term exams or observe how to teach students. The students confirm that also for the beta career program, SDU provides them with a list of companies they can apply to. They also state that the companies give them feedback independently from the feedback of their supervisor. In addition, SDU organizes a “Career Day” to which companies as well as alumni are invited. Another event is called Pi Day, where alumni are invited to work together with students to share their impression on their job and give the students support in putting together their CV and writing motivation letters. The industrial partner summarize that SDU holds about 15 events during the year, which involve companies. All these offer programs for students and give the industry opportunities to give feedback to SDU. They add that one event is also organized in Almaty to be closer to the companies’ main offices.

Master students need to select their thesis topic at latest two months after the beginning of their studies. The government regulations requires the students to publish at least one scientific article or one conference abstract in order to graduate.

In their discussion with the experts, the PhD students raise the topic on elective courses. They describe that the option for elective courses was very limited; therefore, they would be very grateful to have a more opportunities to choose.

In conclusion, the experts ensure that the curriculum enables students to achieve the intended learning outcomes. The experts verify that learning outcomes are defined for each module, which enable the achievement of the overarching program objectives of the study programs. The experts consider the inclusion of an internship as well as the beta career program as very positive. This is well-integrated into the curriculum and strengthens the graduate profile on the job market. SDU assumes responsibility for the quality of the internship in terms of its content and structure. To this end, the university coordinates with the participating companies and supervises the students during the internship. Nevertheless, the experts support the opinion of the partners from the industry and encourage SDU

to continue to strengthen the students' skills and competences in IT. This should include a review of the integrated software in their study programs. The experts emphasize, that all used software should either be open source or licenses should officially be provided by SDU. In addition, the experts also consider that the practical skills of the students in mathematics require further improvement. This includes the application of sciences during practical and laboratory hours in order to raise the number of opportunities on the job market. Although the experts support the implementation of an internship, the experts consider SDU needs to strengthen their involvement with the industrial partners, especially in receiving feedback on the students' capabilities.

Periodic Review of the Curriculum

SDU constantly tries to improve their curriculum considering internal and external stakeholders. Updates on the curriculum consider the feedback from the advisory board as well as alumni. Further input is based on the satisfaction surveys of the students as well as the development in the fields of science. Due to continuous monitoring of the study programs, adaptations on the curriculum can occur annually.

In the discussion with the experts, the representatives of the rector's office highlight, that they have an advisory board, which contains members of collaborating partners from the industry and other research institutions. The program coordinators are responsible to oversee the updates of the curriculum, which primarily considers feedback from staff, students and colleagues. Afterwards, the curriculum is reviewed on university level, including a financial consideration, before the curriculum is presented to the advisory board. There, everyone is free to comment on the curriculum and make suggestions. Finally, the curriculum has to be accepted by the university council. They add that the advisory board meetings are conducted twice a year.

The experts have seen evidence that shows that the curriculum is periodically reviewed with regard to the implementation of the program objectives; curricular changes are documented. This review also includes whether the order of modules enables students to graduate within the standard period of study.

Student mobility

According to the SDU strategy, an international orientation of the study programs is essential to achieve graduations who are global citizens. SDU has implemented the Bologna Process as their standard of education. As a result, all syllabus have been updated accordingly and the curriculum was fully transferred to using ECTS credit points. SDU has established sixty existing agreements with universities in Europe, Asia, the CIS, the USA, Australia, and

Kazakhstan. The Exchange Students Program, based on Memorandum of Understanding with other universities and aims to facilitate academic mobility and enhance the University's global reach.

In the discussion with the representatives of the rector's office, they explain to the experts that they are actively advertising to study at SDU internationally. At SDU, currently there are 116 international students, but this number will increase due to their strong marketing. SDU organized scientific Olympiad in various countries including Malawi, Kenya and Indonesia. In these events, they test especially the competences in English and Mathematics, and provide scholarships to the best. In addition, they have to conduct an interview to verify their English skills in talking and comprehension. The international office helps them to relocate and provides them with services in order to receive visa. In addition, the representatives of the rector's office describe that SDU also has several international collaborations with partners in the field of mathematics. The representatives of the rector's office they collaborate also with international school in order to recruit applications. For international students, SDU offers events, which support these students to adapt to Kazakhstan and a specific supervisor for international students.

In the discussion between the experts and the students, the students confirm that they are aware about the possibilities for student exchange. However, they admit that they would appreciate if SDU could provide them with a wider range of collaborating universities, for examples universities in Europe or the USA.

The experts confirm that SDU promotes student mobility through an appropriate framework (structural design of the degree program, recognition of qualifications and support services).

Criterion 1.4 Admission requirements

Evidence:

- Self-assessment report
- Webpage SDU <https://sdu.edu.kz/>
- Webpages of each study program
- Admission rules SDU
- Discussion during the audit

Preliminary assessment and analysis of the experts:

The admission to SDU follow the government regulations of the Republic of Kazakhstan. The admission of students is controlled by the Ministry of Higher Education and Science. SDU can update their admission regulations annually and publishes them on their webpage for all interested third parties.

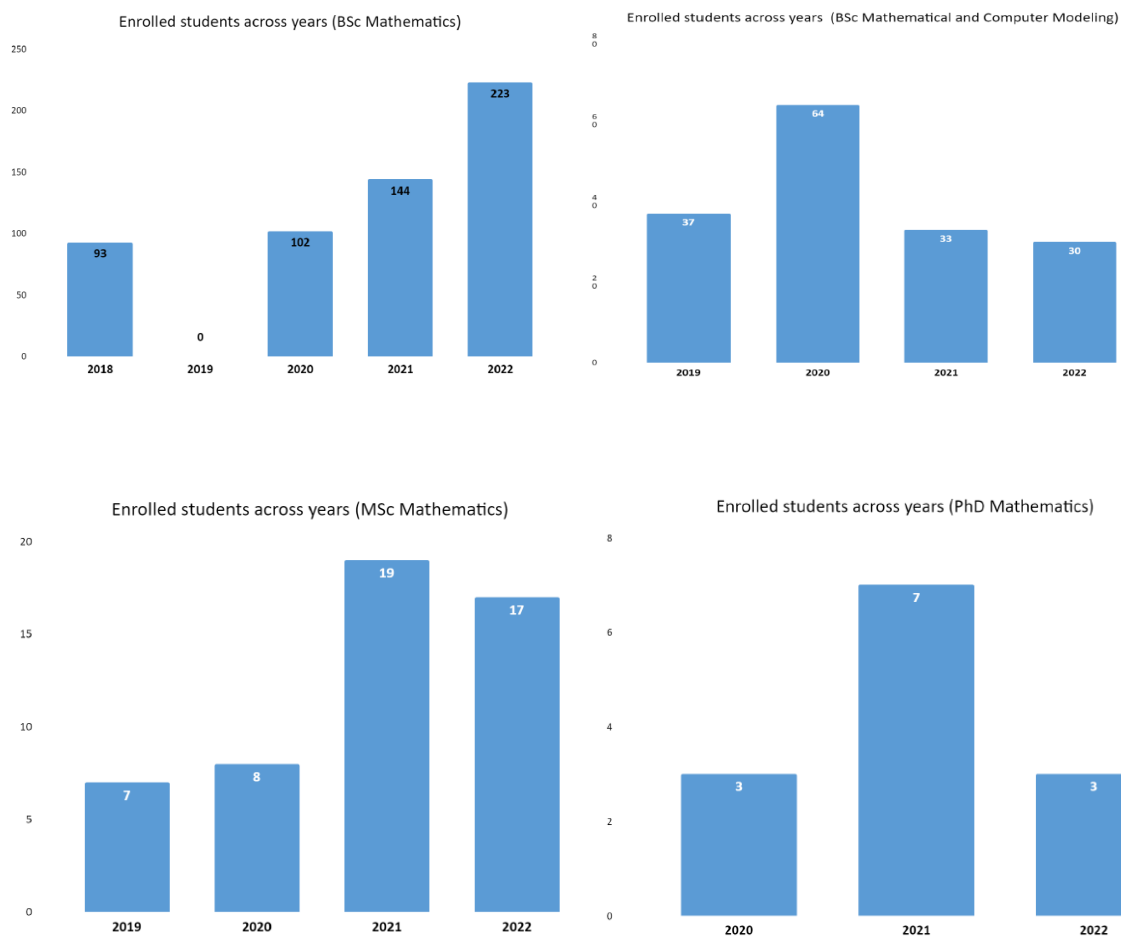
In general, the application requirements for the bachelor programs include:

- A completed secondary education;
- An attestation (diploma) for completion of high school or professional vocational school (authentic copy);
- From Kazakh citizens: the original Unified National Testing (UNT) or Comprehensive Testing (KTA) certificate issued for the current year with passing scores as set by the Ministry of Higher Education and Science of the Republic of Kazakhstan.
- From foreign citizens an interview with the program management;
- Minimum required English proficiency.
- Submission of the established set of documents for admission

Each university in Kazakhstan can set a certain score, which national applicants need to pass in the UNT or KTA in order to be eligible to enroll in the programs. This level is currently set to a score of 80 for the bachelor program Mathematics and 100 for the bachelor program MCM. Since all study programs are conducted in English, SDU requires the students to provide proof they have reached at least intermediate proficiency in English. This includes an initial English test, which includes four tests in reading, writing, pronunciation and listening. If the English skills of the applicants are too low, they can attend additional classes in English during the first semester to improve their level of English proficiency. Afterwards, the students have to take a second test in order to demonstrate their required improvements.

SDU advertises their university at various schools across the country. In addition, it organizes open days offering guided tours to students and presentations by faculty members. During the last open days in October 2022, more than 1,000 people participated. Furthermore, SDU works on their presentations online by providing all necessary information on their webpage. This also includes news and information around the university as well as campus social life. SDU also advertises on social media, with special pages also for the Faculty of Engineering and Natural Sciences.

The university provides the following statistics for enrolled students for the last few years.



Specific regulations are available for applicants from the Nazarbayev Intellectual School, who can transfer several of their advanced skills from school into ECTS credits at SDU.

For the master program *Mathematics*, the applicants are required to hold a bachelor degree and have the following prerequisites:

- Ordinary Differential Equations (5 ECTS);
- Mathematical Statistics & Theory of Probability 1 (5 ECTS);
- Linear Algebra (5 ECTS);
- Real analysis (5 ECTS).

For the PhD program *Mathematics*, the applicants need to provide a master degree as well as these listed competences in order to enroll in the program:

- Ordinary Differential Equations (5 ECTS);
- Mathematical Statistics & Theory of Probability 1 (5 ECTS);
- Algebraic Structures (5 ECTS);

- Functional Analysis (5 ECTS).

All applications need to be submitted online, where all documents are uploaded for review.

The experts wonder about the different score level between the two bachelor programs MCM and Mathematics. The representatives of the rector's office explain that the government defines one score threshold for each study program, which can be raised by each university based on their demand. Since the program MCM is part of the computer sciences, it receives a higher number of applications. Since they cannot limit the number of students for each study program, they raise the score threshold to a higher number in order to accept only the best students. Due to a more recent increase in application, the demanded score will be changed in the next semester to 95 in Mathematics and 105 in MCM. The experts continue to inquire about the English entrance requirements, which the representatives of the rector's office explain as government-based. In this regard, they did not make any addition changes and requirements for English.

In conclusion, the experts confirm that the admission requirements and procedures presented by SDU for the four study programs under review are binding and transparent. They ensure that students are in principle able to successfully graduate from the program. Regulations are further in place that ensure sufficient (subject-related) prior knowledge of the students.

Criterion 1.5 Workload and Credits

Evidence:

- Self-assessment report
- Module handbook of each study program
- Curricular overview
- Objective-Module matrix
- Discussion during the audit

Preliminary assessment and analysis of the experts:

The curriculum of all four programs under review presents a list of compulsory courses in each semester as well as the amount of ECTS credits for elective courses. For each module, SDU defines a clear workload, which is expressed using ECTS credit points. The university uses the terminology of university components for compulsory courses as well as elective components, which the students can select.

The academic workload includes all educational activities of the student such as lectures, seminars, coursework (projects), practical and laboratory work, studio activities, industrial practice (for dual education), professional practice, thesis (project), independent work, including supervised work with a teacher. Based on SDU's regulation, one academic credit equals 30 academic hours. Therefore, a regular academic course will have a workload of 150-180 hours, of which approximately 30% are contact hours.

Both bachelor program require the students to complete 240 ECTS credits, while the master program *Mathematics* requires 120 ECTS credits and the PhD program 180 ECTS credits.

The workload in each module is equally distributed across the entire semester. The academic year consists of two semesters, who span 15-weeks of teaching each. In between the academic years, there is a six-week summer school. The academic workload for each semester is 30 ECTS credits. On average, the basic and specialized disciplines award five ECTS credits, which allows the students to take six disciplines each semester. Students are allowed to create their own study plan using the online system at SDU, who receive support from advisors. This includes also assistance in choosing their scientific trajectory with selecting the most suitable modules on an individual basis.

Monitoring of the student workload as well as the surveys on the real student workload is conducted each semester using module evaluations. In addition, attention is paid on the duration of the studies until graduation.

In discussion, the program coordinators confirm that the workload on one semester in all bachelor programs is 30 ECTS credits. Based on their regulations, each year should have at least 60 ECTS credits, although there are no restriction in one semester. The students receive a study plan with a suggestion of a selection of courses; however, the students can build their own study plan.

In the discussion with the experts, the students express a good understanding of the workload definitions at SDU and that the workload is adequate. They confirm that the first semester is challenging for some students since the teaching of mathematics at university and school can be quite different depending on their school background. However, this is not related to the actual workload in the modules. In comparison, switching from bachelor to master studies or from master to doctoral studies was easy in their opinion.

The experts conclude that SDU has established a credit system, which is based on the student workload. The workload includes contact hours and self-study time. All compulsory components of the study program are included and that these credits are awarded for every module based on the respective workload. The experts consider the estimated workload is realistic and well-founded, so that the study programs can be completed in the

standard period of study. Structural peaks in the workload are avoided. Furthermore, a process is implemented, which regularly monitors whether the credits awarded for each module correspond to the actual student workload and whether the distribution of the workload across all semesters enables graduation within the standard period of study. Students are involved in these processes by conducting surveys and interview. If adjustments are made, they are well documented.

Criterion 1.6 Didactic and Teaching Methodology
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Evidence:

- Self-assessment report
- Module handbook of each study program
- Regulation on preparing and execution of the syllabus
- Regulations on training and professional development of the e
- Discussions during the audit

Preliminary assessment and analysis of the experts:

In the self-assessment report, SDU describes that they include innovative techniques and technologies to enhance the student learning. They include project-based learning as well as active and interactive learning in the lectures. They use techniques to foster critical thinking and provide the students opportunities to learn with task-based and case-based methods. The teaching staff further focuses on a competence-based approach. They integrate information and communication technologies, interactive and video lectures, seminars, project-based as well as research-based teaching methods if suitable to the intended learning outcomes.

SDU works using the digital platforms Moodle and WebEx for lectures and managing the learning activities throughout the year. Teachers aim to provide up-to-date course content in theoretical and practical classes. At SDU, all modules are organized using a syllabus which provides the students a detailed overview of the topics and teaching methods applied in the classroom. In addition, google classroom and google drive are used to share data and tasks with the students. To implement the University's Strategic Plan and enhance students' research skills and academic writing abilities, the department has recommended that teachers of various subjects incorporate written tasks, such as writing reports, articles, and abstracts, into their course.

The experts discuss the teaching methods with the program coordinators. They inquire how they teach the mathematical topics in their study programs. The program coordinators describe that they start to introduce the students slowly to proof mathematical theorems. In topics like algebra, the proof is given at the beginning in complex cases. However, in the first courses, the students already have to give simple proofs as well (2-3 lines). In more advanced courses, students learn how to proof theorems that are more complex (e.g. in 10 steps) before they have to give proofs by themselves. The experts discuss the modules also with the teaching staff and wonder, if students have enough time to gain enough practice in their lectures. They admit that for certain courses, the time frame is tight, but manageable. In introductory classes, the practical part is less intense as students do not have to work too much in developing proofs. They point out to the experts, that several subjects are also divided in various lectures across the different semesters, as for example “Linear algebra” and “Algebra.” They further tell the experts, that they also have to operate within tight governmental guidelines, which does not allow them to distribute the credit points freely across the modules.

The experts also raise the topic on online teaching with the program coordinators. They explain, that based on regulations by the Ministry, they are allowed to conduct 50% of the teaching online and 20% of one lecture. In general, most courses are given offline at SDU, but individual courses might still be offered online. For online courses, the program coordinators confirm the use of WebEx. Since the number of students was strongly increasing during the last years in Kazakhstan, the government still has a very tolerant policy towards online teaching. This also benefits SDU, since several of their new facilities are still in construction to better accommodate the increased number of students. The program coordinators add that many students actually prefer online teaching. Their main reason is that the SDU campus is located outside Almaty; however many students still live in Almaty and need to commute every day to campus.

The experts address the teaching staff, how they integrate science into their lectures. The teaching staff explains that they mainly integrate their research in the final projects of their students as well as project works, but not on a daily basis in their lectures. This includes bachelor theses and especially master theses. However, it is not mandatory to include one’s own research into the final projects, but they use their research projects to attract students. There are lecturers, who organize weekly seminars on ongoing research at the institute, which everyone is welcome to join. In addition, there is the option to create a new course on their research topics, which can be used to promote their scientific activity and reach out to students to join a research team.

In the opinion of the experts, SDU supports a variety of teaching methods and didactic means, which are used to promote achieving the learning outcomes and support student-

centered learning and teaching. The degree program contains an adequate balance of contact hours and self-study time. The experts confirm that students receive an introduction to independent scientific work is an integral part of the study program. In addition, SDI regularly reviews whether the utilized learning and teaching methods support the achievement of the program objectives.

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

[...]

2. Exams: System, Concept and Organisation

Criterion 2 Exams: System, concept and organisation

Evidence:

- Self-assessment report
- Module handbook of each study program
- SDU Assessment policy
- Examples of exams
- Discussion during the audit

Preliminary assessment and analysis of the experts:

SDU is a member of the Academic Integrity League, which requires the majority of students' knowledge assessment to be provided in written form. Based on this, 90% of all final assessments are conducted in written form.

Based on SDU regulation, the lecturers are required to provide the students with an overview of the applied assessment methods and criteria at the beginning of each course as well as before the end of the lecture. In addition, all assessment criteria are also clearly stated in the module handbook and course syllabus (online in the university system as well as offline). The achievement and development of each students during one module is monitored by current, interim and final assessment, which includes tests, oral and written examinations or other assessments. The lecturers record all results in an electronic gradebook, which is part of the students personal account. For each module, the value of the single assessments are determined based on the type of module. Currently, 60% of the

final grade is based on the assessment during the semester, whereas 40% is based on the final examination. SDU applies a scale for grading, where positive grades range from A (best) to D (pass). Additional negative grades use “FX” and “F”, where “FX” allows the students to retake the final assessment without re-studying the entire course. In contrast, if students receive an “F”, they must retake the entire module.

The assessments prior to the final examinations need to be created in order to provide the student with the opportunity to demonstrate their skills and creativity through project work, written assignments and thematic research.

Different regulations apply in the master and doctoral programs *Mathematics*. Other criteria are defined such as for example in the module “Research Methods”, where students need to write a research proposal and give a presentation. In the elective module “Applied Mathematical Programming”, students are required to work on a project. In several other compulsory modules, a combination of oral and written assessments is applied.

The experts are interested in the grading of the examinations. The program coordinators state that the final grade at SDU is usually consisting of several parts including mid-term and final terms. The university regulations suggest 60% of the grade should be based on pre-final assessment (during the semester) while 40% is based on the final examination. The students summarize for the experts their usual examination methods. They confirm that usually, the pre-final assessment account for 60% of their grade, which includes two mid-term exams with possible quizzes, assignment and attendance. They confirm that most examinations are in written form, because they involve proofs; however, some exams are also done orally. Although there are group works, the final exam is always done on an individual basis. Instead, mid-term exams can be replaced by (group) projects. This depends on the lecturer. The teaching staff adds that they include test questions and open questions in their examinations.

The experts inquire how students can appeal grades at SDU. The program coordinators describe that there is a form, which students need to fill out in order to appeal the grade. The students can also submit their application in the dean’s office and discuss the results. After the grade is entered into their system, the students have one day to appeal their grades. The faculty will then form a committee to reexamine the grade. In addition, an external examination can be involved. The program coordinators add that they often apply blind marking in their examinations to remove any personal bias in grading. Every student is further welcome to visit them in their office and discuss the grade before they submit an appeal. The students are aware of their option to appeal their grades. They add that they usually go directly to their teachers to talk about their examination if they consider it nec-

essary. The lecturers then explain and give them detailed feedback. The teaching staff confirms that students often come to them in order to receive feedback on their examinations. The staff members usually have defined criteria for their grading, therefore they can clearly present to the students, what would have been the correct answer for each question. They state that some lecturers give comments on the examination form; however, this is very time intense in large courses. Instead, most offer the students to come to their office and discuss the results in person.

For the final thesis, the experts are interested if the final thesis is checked for plagiarism. The program coordinators confirm that a suitable software is included in moodle. The lecturers have to select this check for each assignment. According to the moodle description, their software can also detect the use of artificial intelligence applications such as ChatGPT.

The experts conclude that the exams in the four study programs under review assess the extent to which the defined learning objectives in each module have been achieved. The exams relate to specific modules. Students are provided with feedback on the competencies that they have acquired. All study programs under review include a compulsory final thesis or final project, which demonstrates that the students are able to work independently on a task at the intended level of the degree program. Within the study programs under review, the experts see various assessment methods are applied. Students are informed about the conditions for completing the module (coursework, exams etc.) latest at the beginning of the module. There are transparent rules for make-up exams, non-attendance, cases of illness as well as compensation of disadvantages in the case of students with disabilities or special needs (e.g. pregnancy, childcare, caring for relatives) etc.

The experts consider the number and distribution of exams ensure an adequate workload as well as sufficient time for preparation. The organization of the exams ensures a smooth study process. The experts remark especially positive on the use of blind grading to avoid any sort of bias. The examinations are marked according to transparent criteria. The experts gain the impression that students have the opportunity to consult their lecturers about the results of their exams.

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

[...]

3. Resources

Criterion 3.1 Staff and Development
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Evidence:

- Self-assessment report
- Staff handbook
- Regulations of hiring new employees
- Regulations on simulating teaching staff
- Reflective teaching observation policy
- Discussion during the audit

Preliminary assessment and analysis of the experts:

SDU describes in the self-assessment report that they have established an objective and transparent personnel policy. This includes regulations in recruitment, professional development, maintenance of professional competences, promotions, and dismissals. All regulations and guidelines are available for each employee in their online system.

In the self-assessment report, SDU states the following key objectives in their personnel policy:

- “Implementation of a comprehensive system for qualitative and quantitative planning of human resources
- Enhancement of the personnel selection and recruitment processes
- Improvement of the personnel training system
- Enhancement of the personnel assessment system
- Creation and development of a personnel reserve
- Improvement of the remuneration and material incentive system for employees
- Enhancement of the social support system for employees.”

The teaching staff involved in the four study programs under reviews consist mainly of full time members. Their qualifications include doctoral of sciences, candidate of sciences (equivalent to PhD in Russia), as well as lecturers holding a PhD. All employed master students are currently continuing their PhD education. Of the entire teaching staff, 62.8% are male. The following table shows the development of the scientific staff members of these programs:

Table 3.1.1. Quantitative and qualitative composition of the teaching staff

Indicators		Academic year			
		2019-2020	2020-2021	2021-2022	2022-2023
Number of teaching staff	total	25	39	40	46
	including full-time	25	39	38	32
Qualifications	Doctor of Sciences	2	3	4	5
	Candidate of Sciences	8	8	5	5
	PhD	5	7	11	12
	PhDc and MSc	12	21	25	17
Proportion of staff members with an academic degree		56%	46%	42%	47%

SDU highlights that several members have completed their degrees abroad, which positively contributes to the education in these programs as well as the scientific profile. In addition, several staff members also conduct research at the Kazakh National Academy of Sciences. Scientific successful staff members further have the possibility to apply for a Teaching + Research (TR) position. A contest is held every year among the researchers; once someone receive a TR position, it lasts for two years with the option for a renewal if the key performance indicators are met. Once a lecturer has reached a TR position, their teaching load is cut in halves while receiving the full salary.

Table 3.1.2. The number of TRs at SDU

Academic year	2019-2020	2020-2021	2021-2022	2022-2023
Number of TR	17	21	18	20

In general, all teaching staff receives incentives for publishing scientific work. The value of the incentives is determined by the quality of the journal the article is published in. SDU also supports their teaching staff members to join conferences by offering specific funding.

The Faculty of Engineering and Natural Sciences organizes regular research and methodological seminars. In these seminars, staff members have the possibilities to present their scientific research and results as well as inviting guest speakers. In addition, SDU offers courses on staff development in their Center for Professional Development and Innovation, which also organizes summer and winter schools. Further possibilities for staff development include in pursuing in specific certificates and qualification, which are fully funded by SDU. In order to participate in international internships, the teaching staff members can apply in the Bolashak Scholarship program. Staff members have the possibility to receive

grants to do research projects abroad for up to six months. Since 2020, SDU offers additionally funding options for one year projects.

Recruitment of new staff members follows open application calls in all information sources of the university. The department makes a first selection based on the qualifications and recommendations of the candidates. Suitable applicants are invited for an interview and to give a lesson in class for the members of the committee. New staff members can take part in the Jas Maman University program, which provides young scholar the possibility to continue their higher education for master or doctoral degree.

SDU further conduct an annual assessment of the quality of teaching of each lecturer using the student evaluations. Furthermore, they apply reflective teaching observation to ensure the quality of the study programs and support the personal development of the teachers. Each teacher undergoes the observation procedure once a year. Observes consists of members of the faculty management (dean, head of department), staff members and the program coordinator. The reflective observation procedure contains the following steps according to the self-assessment report:

- “Pre-observation meeting/talk (20 minutes): The objective is to discuss the overall process and objectives of the assessment, intended learning outcomes of the session, learning strategies that will be used to achieve the results, and any specific areas for feedback requested by the instructor.
- Observation (50 minutes): During the lesson, a certain form is filled out.
- Meeting after observation (40 minutes): Within 24-48 hours after the observed lesson, the instructor should email their general thoughts about the lesson to the observer. This step is necessary as the observer may not have noticed some points. Such data is copied and pasted into the report form. A post-observation meeting is scheduled within 48-72 hours of the observation to discuss the instructor's views, review the session, find solutions to problems, and set future goals. In this meeting, 70% or more of the speaking time must be given to the instructor.”

The teaching observation was implemented since 2021 at SDU. Several issues could be identified in this process, including time management, teaching methods, and language of teaching. The observer provided the teacher with recommendation to help to improve their level of teaching.

The experts are very interested in the TR positions and how reduced teaching load is compensated. The program coordinators state that currently the faculty of Engineering and Natural Sciences has eight TR positions. For receiving a TR position, the lecturers needs to

have five master students or three PhD students. In fall, the department will have an increase in TR positions; therefore, they are hiring new staff members in order to compensate for their reduced teaching load. The call for TR positions usually takes place between May and July, together with job openings for teaching. In rare cases when the lecturer position cannot be filled, they have the chance to hire external lecturers instead. The teaching staff confirm to the experts that their teaching hours differ. TR positions only each between six and eight hours whereas teachers have ten to twelve hours of teaching per week. Everyone agrees, that fourteen hours of teaching per week is hard as it does not leave enough time to do research. The lecturers continue that there is also the possibility to reduce their teaching hours to conduct more research (e.g. to finish their PhD degree), but this leads also to a cut in the salary. Part-time lecturers at their department usually received a research project, which pays part of their salary. Thus, they reduced their teaching hours to conduct more research. In addition, the teaching staffs remarks that they can choose one day a week, where they are working from home. In comparison to other universities in Kazakhstan, the teaching staffs consider the balance between teaching and research as very positive.

The program coordinators confirm that SDU provides incentives for scientific publications. If they publish one article in a top journal, SDU will award them with almost 2000 USD incentives. The teaching staff also confirms to the expert, that SDU offer special research grants in addition to the governmental grants they are usually applying for.

The experts further are interested, how SDU ensures the English proficiency of their staff members. The program coordinators state that newly hired staff needs to have a level 6.0 certificate in English or pass a test to verify their English skills. Their English certificates usually expire within two years. SDU supports renewal of the lecturer's English certificates with a financial bonus. They add that newly hired staff receives a three months trial period, where they track their progress on campus. During this period, a special attention is also paid on the English competences of the person, especially in the classroom.

The experts further ask what the lecturers consider as office hours. The program coordinators explain that office hours are additional contact hours, the professors are available in their office to discuss with the students. Some lecturers use an online schedule while other prefer walk-ins. The teaching staff confirms that they use their office hours in various ways. These hours are considered in addition to the teaching hours. Some teachers book a special room for their office hours if they expect a large group of students to join. In these cases, the lecturers can repeat content from the lectures, which the students might have problems with. Therefore, they consider their office hours especially important for poor students. Students are also invited to attend the office hours in order to discuss their assign-

ments. They point out that each lecturer can plan their office hours as they consider suitable for their module. The attendance can vary from zero up to 70% of the class joining these office hours. Upon the questions of the experts, the teaching staff confirm that there are four hours of office hours, no matter how many modules they teach.

The experts raise the question on the industry collaborations to the teaching staff. They state that several members of their staff have good connection to industry partners. For example, one lecturer also works at the national bank next to their research at SDU. For other fields of mathematics, industry collaborations are less important. They highlight the beta career program, which allows students to get closer to companies and learn more on their job opportunities. Furthermore, they refer to the advisory board for industry input to their curriculum. This has recently lead to more advanced courses in data science.

The experts consider the composition, professional orientation and qualification of the teaching staff are suitable for successfully delivering the study programs under review. They consider especially the creation of TR positions as very positive. Thus, the research and development of the teaching staff contributes to the desired level of education, including the doctoral program Mathematics. Lecturers have the opportunity to further develop their professional and didactic skills and are supported in using corresponding offers. In addition, the experts confirm that SDU regularly reviews whether the subject-specific and didactic qualifications of the lecturers contribute adequately to the delivery of the lectures due to the implementation of the teaching observation method.

Criterion 3.2 Funds and equipment

Evidence:

- Self-assessment report
- Visit of the campus, classrooms and laboratories
- Discussion during the audit

Preliminary assessment and analysis of the experts:

According to the self-assessment report, SDU puts a high focus on using modern and innovative technologies in their teaching process. This includes modern equipment in all classrooms. Moreover, SDU offers computer access for students with the most relevant software. In addition, SDU offers a TechnoPark, which offers the student the possibility to continue their applications by using high capacity computers in order to enhance their interest in modeling and simulations and foster their skills in entrepreneurship.

During COVID-19, SDU introduced online teaching tools and implemented the platform Moodle and Google classroom. This supported the students distance learning and allowed the lecturers to conduct examinations online.

The SDU library offers students and staff access to support their academic tasks. SDU is constantly improving the library. The library provides assistance in their service department. The library is divided on two floors offering next to the access to books and journals also spaces to work for students. The library is open on six days of the week from 9 am to 9 pm; additional access can be granted upon requests (including students). The SDU library offers an online catalogue and online resource system. The online subscription gives access to electronic journals and books including Elsevier, Taylor & Francis, Wiley Online Library as well as various other sources in English, Kazakh and Russian. If material is unavailable, SDU members can also access the Nazarbayev University Library.

SDU also provides dormitories for 1,120 students as well as 37 guesthouses.

Satisfaction surveys on the facilities are done on an annual basis by the quality assurance department.

The Program coordinators confirm to the experts, that PhD students receive a desk. All PhD students share one room next to the science department. They are currently looking for new spaces for PhD students, as some of them are currently occupying the room for part-time employees and guests. In addition, PhD students receive computer access. SDU provides also laptops for students, who cannot afford to buy a computer. Currently, around 50 laptops are available at SDU.

The students describe to the experts that they have enough possibilities to study and do group works on campus. This includes the study spaces in the library. The students from the PhD program *Mathematics* add that they additionally use the laboratories for their studies. The students also consider that there are enough computers available at SDU. To use them, they need to log-in with their account, which allows them to save their files in their online system. Still, the majority of students bring their own laptops to work. The students from the program MCM add that they know about the additional option to use higher than-normal computer set-ups to test their models on data sets. While discussing the used computer software with all students, they mention to use Python mainly. Some also use MATLAB and Maya with a university license. Additional software like Wolfram Alpha is available in the online library with an online book. Master students in algebra also use Mathematica, but with a personal license. They add that the software used in their studies strongly depend on the field of mathematics the students choose. Nevertheless, they are satisfied with the available software in their study programs. This includes also the technical support they receive from SDU.

The experts conclude that the financial resources and the available equipment constitute a sustainable basis for delivering the degree programs. This includes secure funding and reliable financial planning, sufficient infrastructure in terms of both quantity and quality as well as binding regulation of internal and external cooperation.

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

[...]

4. Transparency and documentation

Criterion 4.1 Module descriptions

Evidence:

- Self-assessment report
- Module handbook of each study program
- SDU webpage <https://sdu.edu.kz/>
- Discussion during the audit

Preliminary assessment and analysis of the experts:

SDU provides the students with a module handbook as well as a syllabus for the study program and each module. The syllabus contains a more detailed outline of the purpose and objectives of the course and provides detailed descriptions in the intended learning outcomes, instructional activities, course content and assessment methods. SDU uses a standard template for their syllabi as well as to the module handbooks.

The module is published on the webpage of each study program under review and therefore available for all third parties. The syllabus is provided to the students using their online learning systems.

The experts conclude that the module descriptions reflect the curricula adequately and contain meaningful information about the individual modules. In particular, the descriptions provide comprehensive information about the persons responsible for each module, the teaching methods and workload, the credit points awarded, the intended learning outcomes, the applicability, the admission and examination requirements, and the forms of assessment, and details explaining how the final grade is calculated.

Criterion 4.2 Diploma and Diploma Supplement

Evidence:

- Example of a diploma certificate
- Example of a diploma supplement
- Example of a transcript of records
- Discussion during the audit

Preliminary assessment and analysis of the experts:

SDU issues a diploma certificate shortly after graduation; this document is provided in Kazakh and English. Initially, the students receive a transcript of records in Kazakh, Russian and English, which gives an overview of their personal data, as well as, their entire courses, grades and workload. Additional information is available for internships and the final project. Starting from 2023, SDU additionally offers the EuroPass diploma supplement and transcript of records, which gives additional information on the qualifications of the students, the assessment criteria and the program learning outcomes of the study program and its EQF level. It gives detailed information on the completed courses and their awarded ECTS credit points.

The experts confirm that SDU issues a diploma (degree certificate) together with a diploma supplement shortly after graduation. Both are provided in with translations to English. These documents provide information on the student's qualifications profile and individual performance as well as the classification of the degree program with regard to the respective education system. In the additional transcript of record, the grades of individual modules are presented and the way in which the final mark is calculated is explained.

Criterion 4.3 Relevant rules

Evidence:

- Self-assessment report
- SDU webpage <https://sdu.edu.kz/>
- Discussion during the audit

Preliminary assessment and analysis of the experts:

Every year, SDU hold an orientation week for all new students in the final week of August. During this event, the students can attend various activities to introduce them to activities

and regulations on campus life. The students receive guidebooks and explanations on the University regulations. Students further receive information on their enrolled modules.

The experts ask the representatives of the rector's office, if SDU has also issues a diversity policy. They confirm that SDU is intensely working on inclusivity. Since 2019, they have arranged various workshops before the drafted their own policy. As a consequence, they have issues their "Equality, diversity and inclusivity policy at SDU" and opened a position for inclusivity and diversity at SDU. The document is also available on their webpage. The representatives of the rector's office add that they are currently working on supportive infrastructure to increase the social-well-being of all students. In addition, they are looking for a new specialist, who should contribute to the further development of this policy. SDU offers in their application the option to inform the university on their special needs.

The experts confirm that the rights and duties of both SDU and the students are clearly defined and binding. All rules and regulations are published on the university's website in in Kazakh, Russian and English and hence available to all stakeholders. In addition, the students receive all relevant course material in the language of the degree programs at the beginning of each semester.

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

[...]

5. Quality management: quality assessment and development

Criterion 5 Quality management: quality assessment and development

Evidence:

- Self-assessment report
- Quality assurance policy at SDU
- IAAR certificates
- IAF certificate
- Discussion during the audit

Preliminary assessment and analysis of the experts:

In the self-assessment report, SDU describes their quality assurance department. This department is responsible for improving quality of teaching and learning, monitoring academic activity, analyzing and evaluating stakeholders' feedback and assuring standards of educational process. This department has established an internal quality management system (QMS), which has received ISO certification. The QMS is responsible for ongoing monitoring, evaluations, and revision of the study programs.

For external assessment of the study programs, SDU uses accreditation for their external quality assessment. For internal quality assessment, evaluation of the study programs is conducted by considering the feedback of students and stakeholders. The assessment considers, if the content of the study program still meets the needs of society and considers all advances and developments in the respective field. It further observes the performance of students and their graduation time as well as the satisfaction of students. All this information is gathered in order to make modifications in the study programs. All updates and modifications are made public.

The mechanism of internal monitoring further considers surveys among employers and strategic partners, students and graduates and faculty member involved in the development and implementation of the study programs. Results of the monitoring are discussed in the Faculty's Advisory Board to develop a strategy on how to continue the development of each program. In addition, the results of the monitoring are regularly reviewed at meetings at the university, such as meetings of the department, the faculty council, or the Academic Council. This monitoring also ensures that the quality of the study programs matches ESG standards. Furthermore, SDU conducts satisfaction survey among their students, teaching and administrative staff.

In addition, students are encouraged to participate in a course and teaching evaluations survey at the end of each semester. The main purpose of this evaluation is to gather student feedback on the satisfaction of the students and their opinion of the applied teaching methods, course content and assigned workload. The course and teaching evaluations survey is conducted online; students receive an invitation by email, social network and the University online portal. Each student receives a link to the survey, which will be online for two weeks. In this survey, students can rate the courses and teaching and have the opportunity to give free feedback in open-ended questions. The results of the survey will be available for every lecturer, head of the department and all relevant departments and the top management of SDU. The results will further be distributed to the faculties in order to develop their strategies to improve. The results of the Course and Teaching Evaluation Survey primarily determine the need for the development of certain changes in the curriculum,

subject content, methods of assessment and teaching, and can also be aimed at identifying systemic violations.

Since 2021, SDU also conducts annual meetings of the management with all employees and students (Town Hall meetings). In these meetings, SDU provides an overview of the last year and shares their plan for the upcoming years. They also include the results of the course and teaching evaluations surveys as well as the results of the satisfaction surveys. The purpose of this meeting is to further personally discuss questions and problems. After the meeting, a questionnaire is sent to all participants to get feedback on their impression of this event.

In the discussion with the representatives of the rector's office, the experts raise the topic of drop-out rates. They admit that in the past, the entrance requirements were lower than today; therefore, several students considered the studies at SDU in English challenging. SDU did already provide English training for their students; however some could still not reach the essential level and changed to another university. The students confirm that English can be a drop-out criterion for certain students. However, in their classes, 70% of all the students have already reached a high level of English before they started to study at SDU. The remaining students have joined the English beginner courses and significantly improved during the semester.

One main issue in the quality assurance at SDU the experts can identify is the low number of responses. The representatives of the rector's office are aware of the low numbers in the past. The department of quality assurance is actively working on this problem trying new approaches to increase the response rate. SDU has subscribed recently to survey monkey, which will allow them to create digital. This will facilitate the distribution of surveys to internal and external stakeholders. For the regular surveys at the end of the semester, they have now included the evaluation into their online system, which increased the response rate to 40%. The representatives of the rector's office expect that a similar increase should be expected for the satisfaction surveys. They admit that they are fully aware that the low response number are not fully representative of the entire study program; therefore, they are working on new approaches to improve their surveys in the future. The representatives of the rector's office specify that they perform a qualitative and quantitative analysis of the survey results. In addition, they conduct interviews to collect direct response. The students also remark that they usually use direct feedback to the lecturer if problems arise instead of waiting until the course evaluation. They confirm that SDU conducts surveys at the end of each course. In the past, these surveys used to be compulsory, but now they are optional. The students admit that they do not like these surveys. While some mention they fear it might not be anonymous or simply forget about the surveys, others consider the direct approach is a more effective solution. They point out that in general their courses are very

good and therefore, there is not much to criticize in the surveys. However, they admit that they would like to be informed if changes are integrated based on their comments. Currently, students notice improvements only when talking to students of different years. The teaching staff adds that many of them also ask the students for direct feedback in the classroom. This includes questions on their teaching methods and the course content.

In particular, the expert add a question on the employability of the graduates in the study programs under review. The representatives of the rector's office state that they collect all available information in order to see how many are entering the job market and who many will continue their higher education. They can say that the employability is currently around 80% of the graduates from the two bachelor programs as well as the master program Mathematics.

Moreover, the experts are interested how the surveys are organized and what improvements were done based on negative results. The representatives of the rector's office describe to the experts that they have a survey schedule, which shows all upcoming surveys at SDU. Each survey starts with an explanation of the grading and scale systems used in this survey. Surveys are available in Kazakh, Russian and English, which will be analyzed together. In the last survey, they used a scale of seven. In their analysis, they calculated only the mean values but no ranges. As examples from the faculty staff satisfaction survey, they criticized the instable WIFI access. This issue was addressed during their Town Hall meeting, where they explained their plan to improve the WIFI quality by increasing the number of access points in the mail building. The representatives of the rector's office stats that in their experience, the discussion during the Town Hall meetings has proven to have a positive effect in their work. They group the results of the various surveys in order to discuss them at this event. They point out that not all problems can be easily resolved; however, they consider listening to the different comments as very important in order to improve the discussion between the departments as well as staff and students. In addition, the staff has regular informal meeting with the students and with members of other departments. Usually, they meet at "tea points" to have a tea and the possibility to discuss.

The experts continue to discuss the reflective teaching observation. The representatives of the rector's office state that an international consultant originally suggested this procedure four years ago. The first issue they wanted to address was the self-development of the teaching staff members. In the last years, this was mainly done with newly hired staff members in order to give them guidance. Since this process is rather new, none of the staff members could be observed twice. Nevertheless, they consider that the program has a positive effect on the teaching quality at SDU. The result of the observation is a step-by-step plan, which gives detailed suggestions what the instructor should improve. In the future, they plan to have the observation of one teacher at least every two years. In case,

several issues are detected in the teaching quality, the lecturer will be observed in higher frequency. In addition, the teachers are encouraged to join the pedagogic training in the summer school at SDU.

Furthermore, the experts mention the teaching evaluation survey and their feedback back to the students. The program coordinators state that they do not thoroughly discuss the results of the evaluation with their students. They encourage students to come to the head of the office directly and address their complaint. In addition, there is a student government. The president of the student government has monthly meeting with the university education methodological committee, which includes the heads of the departments.

In conclusion, the experts have seen evidence that all study programs under review are subject to periodical internal quality assurance, which includes internal and external stakeholders. The results of these processes are incorporated into the continuous development of the programs. Processes and responsibilities are defined for the further development of the programs. SDU uses various quality assurance instruments to measure these results. However, the experts recognize certain problems arise due the low response rate in their surveys. The experts recognize that SDU has applied various ways to improve this situation, which the experts strongly support. Nevertheless, the experts consider that SDU has to commit their teaching staff to discuss the results of the evaluations in a structured and systematical manner with their students to show them the impact of their evaluation. In addition, a similar increase in communication should be implemented between the industry and SDU, to show the positive impact on their involvement (see criterion 1.1).

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

[...]

D Additional Criteria for Structured Doctoral Program

Criterion D 1 Research

Evidence:

- Self-assessment report
- Module descriptions of the doctoral program Mathematics
- Graduate Programs Dissertation Guideline

- Rules for Awarding Degrees
- Discussions during the audit

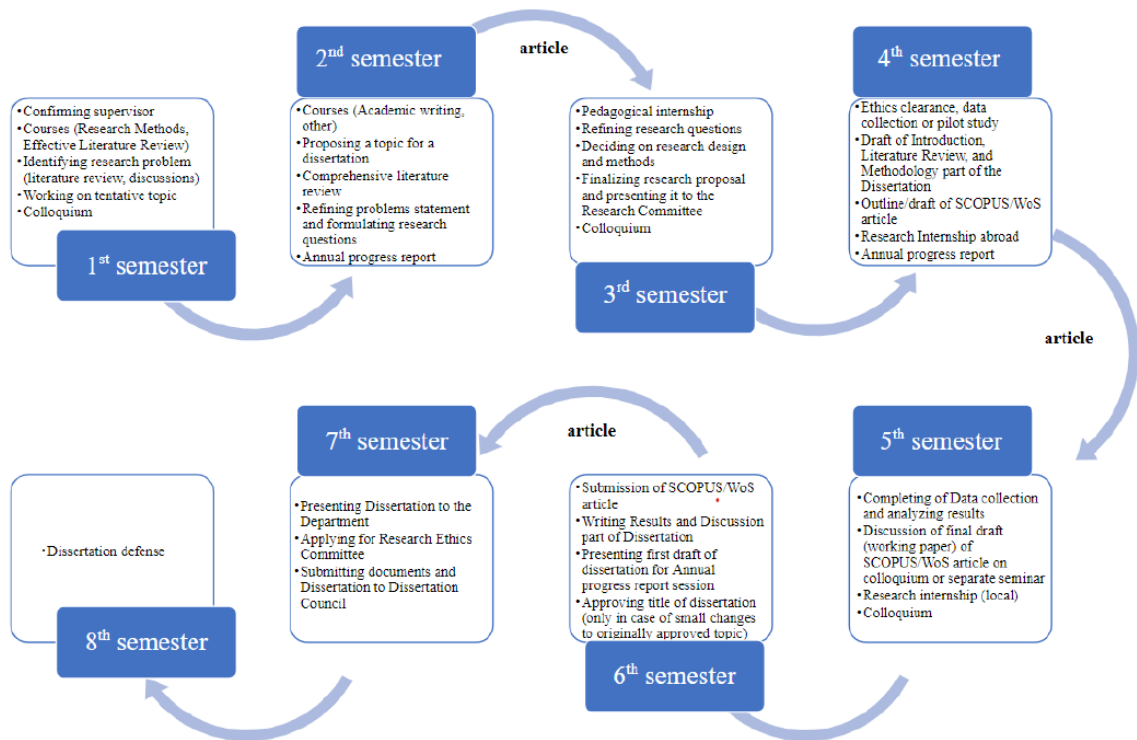
Preliminary assessment and analysis of the experts:

SDU established the doctoral program in *Mathematics* in 2020; therefore, no students have graduated yet. Within this program, all students have to join online and offline seminars, conferences and workshops. In addition, students have to participate in research courses as part of their supervision and research program. To monitor the progress of the doctoral students, they have to present their most recent research results in front of a committee formed by faculty members each semester. The Department of Mathematics offers students a wide range of opportunities to participate in research on campus. All scientific staff members are actively involved in research projects with national and international partners. During the last years, the research output in international journal has continuously increased and has reached 22 publications in 2022. The doctoral program places a great emphasis on the research activity of all students in order to expand their research capabilities. Regular seminars at SDU and online provide the students with opportunities to exchange their scientific ideas and form a network. SDU further holds an annual research conference, where doctoral students are encouraged to join. Additional seminars are offered by the SDU library to improve the students' research skills. Furthermore, SDU plans to introduce PhD seminars in the near future.

All students have two supervisors, of which one is at SDU and the second has to be at a foreign university. These are carefully selected on the basis of their expertise and experience. The doctoral program curriculum includes nine courses, which improve the students' research abilities and prepares them for finishing their doctoral degree. In addition, students also need to finish an international internship with the duration of at least one month.

The students have the first semester to define the research topic of their dissertation. During the initial semester, the students typically develop their final topic by identifying the research questions and outlining a research plan. At the end of the semester, each student has to present their topics in a colloquium. At the beginning of the second semester, the PhD topic is further displayed to the faculty council, who support the students to redefine their research.

Figure D1.1. PhD journey



Student can defend their PhD thesis each semester. In order to be eligible for dissertation defense, it is expected that the primary scientific findings must be published in scientific journals that are included in the list of recommended publications for scientific activity, or in an internationally peer-reviewed scientific journal with an impact factor according to Journal Citation Reports (JCR) and indexed in the Web of Science Core Collection (Arts and Humanities Citation Index, Science Citation Index Expanded, or Social Sciences Citation Index), or with a CiteScore percentile of at least 25% in the Scopus database. The final dissertation has to be submitted in electronic and printed form. To assess the dissertation, the experts committee considers the quality, the originality and the significance of the provided research. This includes an evaluation of the research methodology and a consideration of the reached conclusions.

The experts confirm that SDU has defined the core component of doctoral training to ensure the advancement of knowledge through original research. They have gained a strong impression that graduates can acquire advanced, cutting-edge knowledge and are able to demonstrate, on the level of internationally recognized scientific research, a deep and comprehensive understanding of their research field at SDU. The students can demonstrate the ability to design and carry out an original research project at the forefront of the discipline, contribute to the advancement of science, and are able to adequately present the results to different audiences.

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

[...]

Criterion D 2 Duration and Credits

Evidence:

- Self-assessment report
- Curricular overview
- Module handbook of the doctoral program Mathematics
- Discussion during the audit

Preliminary assessment and analysis of the experts:

The structure of the doctoral program at SDU follows the educational standards of the Ministry of Science and Higher Education. To complete the doctoral program *Mathematics*, the students have to complete 180 ECTS credits, which can be acquired within three academic years or six semesters. The study program includes major mandatory disciplines and elective components as well as practical training. The academic workload for one academic year equals 60 ECTS credits, where each semester can range between 20 and 40 ECTS credits. In the first, third and fifth semester, the students are required to pass a colloquium, where they present the preliminary findings of their ongoing scientific work.

The experts conclude that the structured doctoral program *Mathematics* operates within an appropriate time duration of three years. They confirm that the university applies a credit point system using ECTS credits to express their students' workload.

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

[...]

Criterion D 3 Soft Skills and Mobility

Evidence:

- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:

SDU as well as the scientific staff in the Faculty of Engineering and National Sciences has a great number of international collaborations. Students of the doctoral program have to spend at least one month abroad during their international internship. Since a second international supervisor is mandatory in the PhD program *Mathematics*, students are considered to spend their internship with their international supervisor. In addition, students are supported in attending international scientific conferences. Furthermore, the Center of Professional Development and Innovations offers workshops and summer/winter school to developed the scientific and personal skills. Their courses offer cover a wide variety of courses fostering soft skills as well as pedagogic skills. PhD students are also able to work as instructors at the university, allowing them to further develop their teaching skills alongside their research.

The experts confirm that doctoral students are offered a wide range of opportunities for their personal and professional development. They further consider the institutional support of the students in terms of career development and mobility as suitable for a doctoral program. This includes support structures for professional development, training in transferable skills, and preparation for career choices. The experts remark that they consider international supervisors as positive and verify that SDU supports the international mobility of their PhD students.

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

[...]

Criterion D 4 Supervision and Assessment

Evidence:

- Self-assessment report
- Rules for awarding scientific degrees
- Discussion during the audit

Preliminary assessment and analysis of the experts:

The study program is designed to ensure that the students receive guidance and supervision during their research project in order to ensure the quality of their higher education.

D Additional Criteria for Structured Doctoral Program

All supervisors involved in teaching within a PhD program or supervising students have to hold a doctoral degree (or equivalent). Each student receives two supervisors; one affiliated with SDU and one working at a foreign research institution. These two supervisors are responsible for guiding the students through their doctoral studies including their research activities. They are supposed to have regular meetings and provide continued feedback on the students' progress.

To ensure one supervisor at SDU does have a suitable number of PhD students, 0.5 contact hours per week are mandatory for each supervisor.

During the process of writing a doctoral thesis, the university requires that each chapter of the thesis has to be reviewed and discussed in details. The supervisors are required to give feedback in a defined time period. In case of any miscommunication, a student can submit a request to the advisor, coordinator of the program or to the head of the department directly. In discussion with the experts, the program coordinators confirm that they carefully select their international supervisors. Usually, they can offer several contacts for one specific topic. For example, for algebra, they have network connections in Novosibirsk (Russia) and Sao Paulo (Brazil). The university of the supervisor needs to rank among the top 1000 universities around the world. The program coordinators specifically highlight their connections to Ghent University (Belgium), where students can complete a double degree and stay up to six months.

During the on-site visit and the review of the documentation, the experts gain the impression that SDU has established a transparent contractual framework of shared responsibilities between doctoral candidates, supervisors, and the institution. Regulations are in place to ensure a continuous support by their supervisors is provided. The experts confirm that all assessment rules are clearly formulated and binding.

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

[...]

Criterion D 5 Infrastructure

Evidence:

- Self-assessment report
- Visit of the facilities during the audit
- Discussion during the audit

Preliminary assessment and analysis of the experts:

SDU is committed in providing all PhD candidates all necessary resources in order to perform their scientific research. These include access to a well-equipped library with a vast collection of books, scientific publications and databases of references to journals. Moreover, SDU provides the students with designated study spaces as well as co-working spaces. Currently, all eleven PhD students in the Department of Mathematics have designated rooms and access to computers on campus. SDU provides the financial support for each PhD students to visit their international supervisor.

The experts consider the facilities at SDU as adequate to conduct PhD studies. In their opinion, they see a suitable infrastructure is provided to each student to facilitate their scientific research.

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

[...]

Criterion D 6 Funding

Evidence:

- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:

Doctoral students at SDU have to provide proof how to financially support their studies. The first option is governmental funding, the second is internal university funding, and the third option is on a paid basis. Governmental funds for PhD students are issued each year. Each university submits their desired amount of PhD scholarships, which are granted based on the university's performance. The funding is directly transferred to each university, who are paid on an ECTS-basis. Governmental funding is only available to Kazakh nationals. The scholarship is limited to three years. Internal funding from SDU is awarded within the "Jas Maman" scholarship. Accepted doctoral students are employed as part-time instructors and receive a monthly salary. They are involved in teaching (six to ten hours per week); in the remaining time, they are supposed to work on their PhD project. At the end of each academic year, they have to submit a report, which shows the progress of their scientific work. This scholarship lasts for three years. In addition, students might also enroll in the PhD program on a paid basis. SDU requires the payment of an annual fee, which varies due

D Additional Criteria for Structured Doctoral Program

to nationality of the candidate. These tuition fees are stated in the webpage of the study program.

Additionally, students receive a funding for their international internship as well as a honorarium for publications.

In the opinion of the experts, SDU provides clear regulation on funding in regard to the doctoral program. The experts highlight positively that SDU supports their students in visiting their international supervisors, which they consider important to establish their scientific network and gain experience at other universities.

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

[...]

Criterion D 7 Quality Assurance

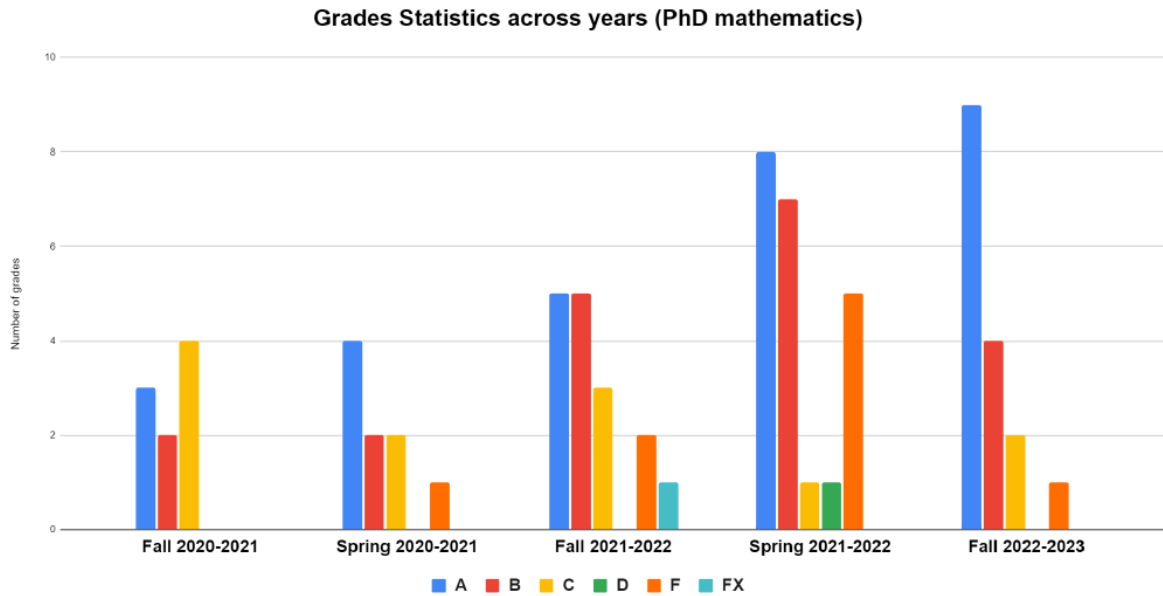
Evidence:

- Self-assessment report
- Quality assurance policy at SDU
- IAAR certificates
- IAF certificate
- Discussion during the audit

Preliminary assessment and analysis of the experts:

The organization of SDU includes a specific department on Quality Assurance, which is responsible for internal and external quality management ensure the study program meets national and international standards. The monitoring and evaluation processes described in criterion 5 include also the doctoral program *Mathematics*. This involves also the use of course and teaching evaluations surveys and the monitoring of the student progress. The PhD program *Mathematics* was established in 2020. In the year 2020, three students were admitted to the study program, followed by seven in 2021 and three in 2022. SDU further records the final grade of the report, students have to submit twice a year. This report is assessed by the Educational Methodological Council, which issued the following statistics on the grade distribution:

E Additional Documents



The university guarantees that rules of good scientific practice are followed. During their studies, doctoral students have to closely follow the guidelines developed with their supervisors as the study at ADU requires a timely and efficient performance.

The experts confirm that the faculty collects data related to individual progression, net research time, completion rate, dissemination of research results, and career tracking and uses this data to continuously assess the quality of the structured doctoral program.

Final assessment of the experts after the comment of the Higher Education Institution regarding criterion D 7:

[...]

E Additional Documents

No additional documents needed.

F Comment of the Higher Education Institution (08.08.2023)

The institution provided a short statement, confirming that they agree with the report.

G Summary: Expert recommendations (11.08.2023)

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

Degree Program	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Mathematics	Without requirements	30.09.2029	–	-
Ba Mathematics and Computer Modeling	Without requirements	30.09.2029	–	-
Ma Mathematics	Without requirements	30.09.2029	–	-
PhD Mathematics	Without requirements	30.09.2029	–	-

Recommendations

For all degree programs

- E 1.(ASIIN 1.1 and ASIIN 5) It is recommended to increase the feedback from SDU on a strategic level (including changes in the study program) back to the students and the industry.
- E 2.(ASIIN 1.3) It is recommended to improve the application of fundamental sciences in the modules (practical hours or laboratory work) in order to improve the transition from university to the job market.
- E 3. (ASIIN 1.3) It is recommended to improve the communication between SDU and the companies during internships.
- E 4.(ASIIN 5) It is recommended to explore new option to receive and give feedback to and from the students.

For the bachelor degree programs and the master degree program

E 5.(ASIN 1.3)It is recommended to improve the competences in IT for students and provide all necessary software.

H Comment of the Technical Committee 12 - Mathematics (04.09.2023)

Assessment and analysis for the award of the ASIIN seal:

The Accreditation Commission discusses the accreditation procedure and follows the assessment of the experts without any changes.

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

Degree Program	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Mathematics	Without requirements	30.09.2029	–	-
Ba Mathematics and Computer Modeling	Without requirements	30.09.2029	–	-
Ma Mathematics	Without requirements	30.09.2029	–	-
PhD Mathematics	Without requirements	30.09.2029	–	-

Recommendations

For all degree programs

E 1.(ASIIN 1.1 and ASIIN 5) It is recommended to increase the feedback from SDU on a strategic level (including changes in the study program) back to the students and the industry.

E 2.(ASIIN 1.3) It is recommended to improve the application of fundamental sciences in the modules (practical hours or laboratory work) in order to improve the transition from university to the job market.

E 3. (ASIIN 1.3) It is recommended to improve the communication between SDU and the companies during internships.

E 4.(ASIIN 5) It is recommended to explore new option to receive and give feedback to and from the students.

For the bachelor degree programs and the master degree program

E 5.(ASIIN 1.3)It is recommended to improve the competences in IT for students and provide all necessary software.

I Decision of the Accreditation Commission (22.09.2023)

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

The accreditation commission follow the assessment of the experts and the Technical Committee without further changes.

The Accreditation Commission decides to award the following seals:

Degree Program	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Mathematics	Without requirements	30.09.2029	–	-
Ba Mathematics and Computer Modeling	Without requirements	30.09.2029	–	-
Ma Mathematics	Without requirements	30.09.2029	–	-
PhD Mathematics	Without requirements	30.09.2029	–	-

Recommendations

For all degree programs

E 1.(ASIIN 1.1 and ASIIN 5) It is recommended to increase the feedback from SDU on a strategic level (including changes in the study program) back to the students and the industry.

E 2.(ASIIN 1.3) It is recommended to improve the application of fundamental sciences in the modules (practical hours or laboratory work) in order to improve the transition from university to the job market.

E 3. (ASIIN 1.3) It is recommended to improve the communication between SDU and the companies during internships.

E 4.(ASIIN 5) It is recommended to explore new option to receive and give feedback to and from the students.

For the bachelor degree programs and the master degree program

E 5.(ASIIN 1.3)It is recommended to improve the competences in IT for students and provide all necessary software.

Appendix: Program Learning Outcomes and Curricula

According to self-assessment report, the following **program learning outcomes** shall be achieved by the bachelor program Mathematics:

Program learning outcomes (PLOs)

PLO1	Apply a fundamental knowledge in the field of mathematical analysis, complex and functional analysis, algebra, analytical geometry, differential geometry and topology, differential equations, discrete mathematics and mathematical logic, probability theory, mathematical statistics and random processes, numerical methods, theoretical mechanics in the future professional activities, by learning theoretical materials of listed disciplines.
PLO2	Analyze and use in practice mathematical algorithms by solving typical problems of subjects related to analysis.
PLO3	Solve and formulate problems in the field of natural sciences by applying theoretical knowledge.
PLO4	Solve standard tasks with the use of information and communication technologies by using basic methods of programming.
PLO5	Develop the motivation and opportunity to publish findings in the national and international periodical journals, in accordance with academic principles and ethical values by using obtained methods of scientific research.
PLO6	Solve the problems related to one of the tracks of the program, which depends on the chosen direction by using the received knowledge.
PLO7	Gain an understanding of the functioning of government, markets and institutions, relations to society, major ethical theories and problems, and demonstrate fluency in several languages through learning non-area subjects (i.e. economics, sociology, philosophy, Russian/Kazakh language, Turkish language, and etc.).

The following **curriculum** is presented:

0 Appendix: Program Learning Outcomes and Curricula

Module Code	Module name	C/UC/E	ECT S	Theory, hrs	Practice, hrs
Semester 1					
MAT 1001	Mathematical analysis 1	C	5	2	2
	Introductory mathematics	C	3	1	1
MAT 1002	Linear Algebra and Analytic Geometry	C	5	2	1
CSS 1001	Fundamentals of Programming	C	3	1	1
MDE 1001	Modern History of Kazakhstan	C	5	2	1
MDE 1002	Physical Education 1	C	2	0	1
MDE 1003	Foreign language (English)	E	5	1	2
MDE 1004	Turkish language	UC	3	0	2
Semester 2					
CSS 1001	Programming Technologies for Mathematics	C	5	2	2
	Information and Communication Technologies	C	5	2	1
MAT 1002	Additional chapters of linear algebra	C	3	1	1
MAT 1001	Mathematical analysis 2 and Educational practice	C	6	2	2
MDE 1002	Physical Education 2	C	2	0	1
MDE 1003	Foreign language (English)	E	5	0	3
MDE 1004	Turkish language	UC	3	0	2
Semester 3					
MAT 108	Algebra	C	5	2	1
MAT 201	Discrete mathematics	C	5	2	1
MAT 1001	Mathematical analysis 3	C	5	2	2
MAT 205	Ordinary differential equations	C	5	2	1
MDE 1002	Physical Education 3	C	2	0	2

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MDE 1003	Kazakh / Russian language	E	5	0	3
MDE 1004	Turkish language	UC	3	0	2
Semester 4					
MAT 1001	Mathematical analysis 4	C	5	2	1
MAT 221	Classical mechanics	C	5	2	1
MAT 1004	Theory of Probability and Mathematical Statistics	C	5	2	1
MDE 1001	Philosophy	C	5	2	1
MDE 1002	Physical Education 4	C	2	0	1
MDE 1003	Kazakh / Russian language	E	5	0	3
MDE 1004	Turkish language	UC	3	0	2
Semester 5					
MAT 213	Introduction to Real Analysis	C	5	2	1
MAT 218	Introduction to Numerical Analysis	C	5	2	2
MAT 1004	Mathematical Statistics & Theory of Probability 2	C	5	2	2
MAT 1014	Internship 1	C	1	1	0
MDE 1001	Module of Social and Political Knowledge (Political Science)	C	2	1	0
	Module of Social and Political Knowledge (Sociology)	C	2	1	0
MAT 1005	Introduction to Partial Differential Equations	E	5	2	1
	Topics in Algebra	E	5	2	1
	Differential geometry and topology	E	5	2	1
MDE 1005	Economy	E	5	1	2
	Law	E	5	1	2
	Entrepreneurship	E	5	1	2
	Leadership	E	5	1	2

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	Innovative Trends	E	5	1	2
Semester 6					
MAT 307	Complex analysis	C	5	2	1
MAT 371	Functional analysis	C	5	2	1
MAT 1014	Internship 2	C	1	0	1
MDE 1001	Module of Social and Political Knowledge (Cultural Studies)	C	2	1	0
	Module of Social and Political Knowledge (Psychology)	C	2	1	0
MAT 1006	Number theory	E	5	2	1
	Database Management Systems 1	E	5	2	1
MAT 1007	Logic and Model theory	E	5	2	1
	Cryptography	E	5	2	1
MAT 1008	Enumerative Combinatorics	E	5	2	1
	Theory of interest rates and random processes in life insurance	E	5	2	1
	Equations of mathematical physics	E	5	2	1
Semester 7					
MAT 370	Methods of Scientific research	C	5	2	1
MAT 1014	Internship 3-4	C	5	0	2-1
MAT 1009	Computer Vision	E	5	2	1
	Algebraic structures	E	5	2	1
MAT 1010	Contemporary model theory	E	5	2	1
	Mathematical and computer modeling of physical processes	E	5	2	1
MAT 1011	Introduction to Machine Learning	E	5	2	2
	Topics in combinatorics	E	5	2	2

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MAT 1012	Introduction to Natural Language Processing	E	5	2	2
	Representation Theory	E	5	2	2
BETA	Industrial project 1-4	E	20		
Semester 8					
MAT 1014	Pregradual practice	C	12	0	8
MAT 412	Diploma preparation	C	6	4	0
MAT 1013	State exams	E	12	0	8
	Graduation thesis	E	12	0	8

According to self-assessment report, the **program learning outcomes (intended qualifications profile)** shall be achieved by the bachelor program Mathematical and Computer Modeling

PLO1	Apply the underlying unifying structures of mathematics (i.e. matrices, sets, relations and functions, logical structure, groups, fields, graphs, etc.) and the relationships among them on paper and oral exams based on theoretical questions.
PLO2	Demonstrate logical skills in programming in a variety of languages (i.e. R, Python, MATLAB, etc.) achieved by laboratory works and exams based on problem-solving.
PLO3	Reveal deep knowledge of differential equations by solving applied problems.
PLO4	Design different types of mathematical models and simulations including dynamical systems, statistical models, differential equations, and game theoretic models by learning fundamental mathematical courses (Calculus, Ordinary differential equations, Numerical Methods, Statistics, etc.) and practical courses on simulations.

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PLO5	Apply methods of mathematical and computer modeling for solving scientific, applied, production, and technological problems by using professional software, computer graphics, visualization, and developing their own software packages.
PLO6	Show basic knowledge in Financial Mathematics, Applications of Number Theory, Data management, and analysis by learning elective courses.
PLO7	Analyze collected information and present the research results achieved through work on individual and group projects.
PLO8	Gain an understanding of the functioning of government, markets and institutions, relations to society, major ethical theories and problems and demonstrate fluency in several languages through learning non-area subjects (i.e. economics, sociology, philosophy, Russian/Kazakh language, Turkish language, and etc.)

The following **curriculum** is presented:

Module Code	Module name	C/UC/ E	ECT S	Theory, hrs	Practice, hrs
Semester 1					
MCM 1001	Mathematical analysis 1	C	5	2	2
	Introductory mathematics	C	3	1	1
MCM 1002	Linear Algebra and Analytic Geometry	C	5	2	1
CSS 1001	Fundamentals of Programming	C	3	1	1
MDE 1001	Modern History of Kazakhstan	C	5	2	1
MDE 1002	Physical Education 1	C	2	0	1
MDE 1003	Foreign language (English)	E	5	1	2
MDE 1004	Turkish language	UC	3	0	2
Semester 2					
CSS 1001	Programming Technologies and Educational Practice	C	5	2	2
	Information and Communication Technologies	C	5	2	1

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MCM 1002	Additional chapters of linear algebra	C	3	1	1
MCM 1001	Mathematical analysis 2	C	6	2	2
MDE 1002	Physical Education 2	C	2	0	1
MDE 1003	Foreign language (English)	E	5	0	3
MDE 1004	Turkish language	UC	3	0	2
Semester 3					
MAT 108	Algebra	C	5	2	1
MAT 201	Discrete mathematics	C	5	2	1
MCM 1001	Mathematical analysis 3	C	5	2	2
MAT 205	Ordinary differential equations	C	5	2	1
MDE 1002	Physical Education 3	C	2	0	2
MDE 1003	Kazakh / Russian language	E	5	0	3
MDE 1004	Turkish language	UC	3	0	2
Semester 4					
MAT 221	Classical mechanics	C	5	2	1
MAT 312	Theory of Probability and Mathematical Statistics	C	5	2	1
MCM 201	Mathematical and Complex analysis	C	5	2	2
MDE 1001	Philosophy	C	5	2	1
MDE 1002	Physical Education 4	C	2	0	1
MDE 1003	Kazakh / Russian language	E	5	0	3
MDE 1004	Turkish language	UC	3	0	2
Semester 5					
CSS 330	Data wrangling and visualization	C	5	2	1
MCM 302	Numerical methods	C	5	2	1
MCM 1014	Internship 1-2	C	2	1	0
MDE 1001	Module of Social and Political Knowledge (Political Science)	C	2	1	0

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	Module of Social and Political Knowledge (Sociology)	C	2	1	0
MCM 1003	Introduction to Partial Differential Equations	E	5	2	1
	Topics in Algebra	E	5	2	1
MCM 1004	Differential geometry and topology	E	5	2	1
	Database Management Systems 1	E	5	2	1
MDE 1005	Economy	E	5	1	2
	Law	E	5	1	2
	Entrepreneurship	E	5	1	2
Semester 6					
MAT 304	Equations of mathematical physics	C	5	2	1
MDE 1001	Module of Social and Political Knowledge (Cultural Studies)	C	2	1	0
	Module of Social and Political Knowledge (Psychology)	C	2	1	0
MCM 1005	Applied mathematical programming	E	5	2	1
	3D modeling	E	5	2	1
MCM 1006	Logic and Model theory	E	5	2	1
	Theory of interest rates and random processes in life insurance	E	5	2	1
MCM 1007	Natural Language Processing	E	5	2	1
	Enumerative Combinatorics	E	5	2	1
MCM 1008	Number theory	E	5	2	1
	Cryptography	E	5	2	1
Semester 7					
MAT 370	Methods of Scientific research	C	5	2	1
MCM 1014	Internship 3-4	C	5	2-1	0

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MCM 1009	Distributed Big Data Systems	E	5	2	1
	UXUI design	E	5	2	1
	Topics in combinatorics	E	5	2	1
MCM 1010	Mathematical modelling of economic processes	E	5	2	1
	Differential geometry and topology	E	5	2	1
	Project Management	E	5	2	1
MCM 1011	Artificial Intelligence	E	5	2	1
	3D modeling	E	5	2	1
	Database Management Systems 1	E	5	2	1
MCM 1012	Variation theory and methods of optimization	E	5	2	1
	Abstract Algebra	E	5	2	1
BETA	Industrial project 1-4	E	20		
Semester 8					
MCM 1014	Pregradual practice	C	12	0	8
MAT 412	Diploma preparation	C	6	4	0
MCM 1013	State exams	E	12	0	8
	Graduation thesis	E	12	0	8

According to self-assessment report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the master program Mathematics

PLO1	Solve advanced problems in the theory of classical and modern mathematics and construct proofs of results in the field achieved by laboratory works, practical classes, exams based on problem-solving and writing a Master's thesis.
PLO2	Analyze theoretical and applied problems and utilize necessary mathematical techniques to develop solutions, conduct an independent inquiry

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	and develop creative work evidenced by a Master's thesis and research publications.
PLO3	Demonstrate ability to critically analyze global problems arising in Mathematics, reason quantitatively and create effective solutions by solving theoretical and (or) applied problems.
PLO4	Develop and maintain theory and problem-solving skills with a deep understanding of their area of specialization by learning elective courses, writing a Master's thesis and research publications.
PLO5	Communicate mathematical ideas to a mathematics audience both in writing and oral form achieved by participation in scientific conferences.
PLO6	Able to plan the development of the personality and managerial resource of the leader, mastery of psychological techniques and modern communication technologies of business communication, neutralize the negative impact of interpersonal relationships and intergroup communication, know replica clichés of speech etiquette, reflecting the country's culture and regional geographic information from authentic sources, enriching social experience, conduct conversation in situations of professional communication; skills of professional communication in a foreign language, raising and developing one's intellectual level, designing the educational process in conditions of socialization of a person; compliance with professional and ethical standards accepted in international practice achieved by learning compulsory courses.

The following **curriculum** is presented:

Module Code	Module name	C/UC/E	ECTS	Theory, hrs	Practice, hrs
Semester 1					
MAT 517	Advanced probability and statistics	C	5	2	1
MAT 521	Algebraic structures	C	5	2	1
MAT 599	Research Tools and Methods	C	5	2	1
MSC 1000	Research work for the Master's Degree including an internship and a Master's Thesis 1	C	5	0	3

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MDE 1000	History and Philosophy of Science	C	5	2	1
MDE 1000	Psychology of Management	C	5	2	1
Semester 2					
MAT 518	Measure theory and real analysis	C	5	2	1
MSC 1000	Research work for the Master's Degree including an internship and a Master's Thesis 2	C	5	0	3
PRC 1000	Pedagogical Practice	C	2	0	2
MDE 1000	Higher School Pedagogy	C	3	1	1
	Foreign Language (professional)	C	5	0	3
MSC 1001	Numerical Analysis and Scientific Computing	E	5	2	1
	Applied mathematical programming	E	5	2	1
MSC 1002	Noncommutative hypoelliptic analysis	E	5	2	1
	Machine Learning	E	5	2	1
Semester 3					
MSC 1000	Research work for the Master's Degree including an internship and a Master's Thesis 3	C	5	0	3
MSC 1003	Selected topics of differential equations	E	5	2	1
	Geometric and functional inequalities on Lie groups	E	5	2	1
MSC 1004	Contemporary number theory	E	5	2	1
	Fundamental solutions of equations of mathematical physics	E	5	2	1
MSC 1005	Representation Theory	E	5	2	1
	Data Collection, Wrangling, Analysis and Visualization	E	5	2	1
MSC 1006	Operator equations	E	5	2	1

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	Methods of mathematical modeling and computational technology	E	5	2	1
	Combinatorial enumeration	E	5	2	1
Semester 4					
MSC 1000	Research work for the Master's Degree including an internship and a Master's Thesis 4	C	9	0	6
PRC 1000	Research Practice	C	9	0	6

According to self-assessment report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the doctoral program *Mathematics*,

PLO1	Produce, communicate and defend an original contribution to knowledge, as evidenced by the writing and defense of a thesis involving significant original research.
PLO2	Communicate mathematical ideas, results, context, and background effectively and professionally in written and oral form achieved by doing homework, exams based on problem-solving, writing scientific papers, doing presentations and giving talks at scientific seminars, conferences.
PLO3	Demonstrate advanced knowledge and understanding of their area of specialization and reproduce proofs of classical results in the field by learning theoretical courses.
PLO4	Create, implement, and disseminate knowledge in mathematics by producing high quality and original research.
PLO5	Demonstrate abilities in the critical analysis and quantitative reasoning of global problems arising in Mathematics by the writing and defense of a thesis.
PLO6	Plan and conduct lessons in advanced mathematics, create an effective learning environment for university students, and give appropriate assessment and feedback by passing a pedagogical practice.

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The following **curriculum** is presented:

Module Code	Module name	C/UC/ E	ECTS	Theory, hrs	Practice, hrs
Semester 1					
MAT 700	Research Methods	C	5	2	1
PHD 1000	Implementation of the Doctoral Dissertation 1	C	15	4	7
PHD 1001	Methods of mathematical modeling and computational technology	E	5	2	1
	Hypoelliptic functional inequalities	E	5	2	1
	Topics in Algebra	E	5	2	1
Semester 2					
MAT 704	Academic Writing	C	5	2	1
PRC 1000	Pedagogical practice in Higher Education	C	10	0	7
PHD 1000	Implementation of the Doctoral Dissertation 2	C	10	0	7
PHD 1002	Measure theory and real analysis	E	5	2	1
	Numerical Analysis and Scientific Computing	E	5	2	1
Semester 3					
PHD 1000	Implementation of the Doctoral Dissertation 3 (Research proposal defense)	C	10	0	8
	Scientific research work of the doctoral student 1	C	10	0	7
PRC 1000	Scientific & Research Practice	C	10	0	7
Semester 4					
PHD 1000	Implementation of the Doctoral Dissertation 4	C	15	0	10
	Scientific research work of the doctoral student 2	C	15	0	10
Semester 5					

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PHD 1000	Implementation of the Doctoral Dissertation 5	C	15	0	10
	Scientific research work of the doctoral student 3	C	10	0	7
	Scientific research work of the doctoral student 9	C	5	0	3
Semester 6					
PHD 1000	Implementation of the Doctoral Dissertation 6	C	10	0	7
	Scientific research work of the doctoral student 4	C	10	0	5
MAT 997	Formalization and defense of doctor's degree dissertation	C	12	0	8