# ASIIN Seal

# Accreditation Report

## Bachelor's and Master's Degree Programmes
***Mathematics***
***Artificial Intelligence Technologies***
***Nuclear Physics***

## PhD Programme
***Nuclear Physics***

Provided by
**Eurasian National University**

Version: September 23, 2022

# Table of Content

**A About the Accreditation Process ..... 3**

**B Characteristics of the Degree Programmes ..... 5**

**C Peer Report for the ASIIN Seal ..... 16**

1. The Degree Programme: Concept, content & implementation ..... 16
2. The degree programme: structures, methods and implementation ..... 25
3. Exams: System, concept and organisation ..... 31
4. Resources ..... 33
5. Transparency and documentation ..... 37
6. Quality management: quality assessment and development ..... 39

D Additional Criteria for Structured Doctoral Programmes ..... 42

**D Additional Documents ..... 47**

**E Comment of the Higher Education Institution (19.07.2021) ..... 48**

**F Summary: Peer recommendations (10.08.2021) ..... 49**

**G Comment of the Technical Committees ..... 52**

Technical Committee 04 – Informatics/Computer Science (10.09.2021) ..... 52
Technical Committee 12 – Mathematics (01.09.2021) ..... 52
Technical Committee 13 – Physics (06.01.2021) ..... 55

**H Decision of the Accreditation Commission (17.09.2021) ..... 56**

**I Fulfilment of Requirements (23.09.2022) ..... 59**

Analysis of the peers and the Technical Committees 12 - Mathematics and 13 – Physics (12.09.2022) ..... 59
Decision of the Accreditation Commission (23.09.2022) ..... 69

# A About the Accreditation Process

| **Name of the degree programme (in original language)** | **(Official) English translation of the name** | **Labels applied for** [1] | **Previous accreditation (issuing agency, validity)** | **Involved Technical Committees (TC)**[2] |
|---|---|---|---|---|
| 6B06112 Жасанды интеллект технологиялары/ 6B06112 Технологии искусственного интеллекта | 6B06112 Artificial intelligence technologies | ASIIN Seal | - | 04 |
| 7M06112 Жасанды интеллект технологиялары/ 7M06112 Технологии искусственного интеллекта | 7M06112 Artificial intelligence technologies | ASIIN Seal | - | 04 |
| 6B05401 Математика/ 6B05401 Математика | 6B05401 Mathematics | ASIIN Seal | ASIIN, 25.09.2015-30.09.2021 | 12 |
| 7M05401 Математика/ 7M05401 Математика | 7M05401 Mathematics | ASIIN Seal | ASIIN, 25.09.2015-30.09.2021 | 12 |
| 6B05305 Ядролық физика/6B05305 Ядерная физика | 6B05305 Nuclear Physics | ASIIN Seal | ASIIN, 25.09.2021-30.09.2021 | 13 |
| 7M05305 Ядролық физика/ 7M05305 Ядерная физика | 7M05305 Nuclear Physics | ASIIN Seal | ASIIN, 20.05.2015-30.09.2021 | 13 |
| 8D05305 Ядролық физика/ 8D05305 Ядерная физика | 8D05305 Nuclear Physics | ASIIN Seal | IAAR, 20.05.2016-19.05.2021 | 13 |
| **Date of the contract:** 10.02.2021<br><br>**Submission of the final version of the self-assessment report:** 10 February 2021<br><br>**Date of the online discussions:** 26-28 May 2021 | | | | |
| **Peer panel:**<br><br>Prof. Dr. Bettina Harriehausen-Mühlbauer, Darmstadt University of Applied Sciences | | | | |

[1] ASIIN Seal for degree programmes

[2] TC: Technical Committee for the following subject areas: TC 04 - Informatics/Computer Science; TC 11 - Geosciences; TC 12 - Mathematics; TC 13 - Physics.

| |
|---|
| Prof. Dr. Gerhard Lindner, Coburg University of Applied Sciences<br><br>Dr. Abay Nussipbekov, Suleyman Demirel University<br><br>Prof. Dr. Alexander Pott, Otto von Guericke University<br><br>Prof. Dr. Norbert Kroll, German Aerospace Center<br><br>Viktor Pyagay, International University of Information Technologies (Student) |
| **Representative of the ASIIN headquarter:** Arne Thielenhaus |
| **Responsible decision-making committee:** Accreditation Commission for Degree Programmes |
| **Criteria used:**<br><br>European Standards and Guidelines as of May 15, 2015<br><br>ASIIN General Criteria, as of December 10, 2015<br><br>Subject-Specific Criteria of Technical Committee 04 – Informatics/Computer Science as of March 29, 2018<br><br>Subject-Specific Criteria of Technical Committee 12 – Mathematics as of December 9, 2016<br><br>Subject-Specific Criteria of Technical Committee 13 – Physics as of March 20, 2020<br><br>ASIIN Additional Criteria for Structured Doctoral Programmes as of March 15, 2021 |

# B Characteristics of the Degree Programmes

| a) Name | Final degree (Kazakh/ Russian/ English translation) | b) Areas of Specialization | c) Corresponding level of the EQF | d) Mode of Study | e) Double/ Joint Degree | f) Duration | g) Credit points/unit | h) Intake rhythm & First time of offer |
|---|---|---|---|---|---|---|---|---|
| Artificial intelligence technologies Ba | Ақпараттық-коммуникациялық технологиялар бакалавры/ Бакалавр в области информационно-коммуникационных технологий/ Bachelor in Information and Communication Technologies | - | 6 | Full time | -- | 4 years/ 8 semester | 240 ECTS | Annually, 1st September 2021 |
| Artificial intelligence technologies Ma | Техника ғылымдарының магистрі/ Магистр технических наук/ Master of Engineering Science (M.Eng.) | - | 7 | Full time | -- | 2 years/ 4 semester | 120 ECTS | Annually, 1st September 2021 |
| Mathematics Ba | Жаратылыстану ғылымдары бакалавры/ Бакалавр естествознания/ Bachelor of Natural Science | - | 6 | Full time | -- | 4 years/ 8 semester | 240 ECTS | Annually, 1st September 2004 |
| Mathematics Ma | Жаратылыстану ғылымдарының магистрі/ Магистр естественных наук/ Master of Natural Science | - | 7 | Full time | -- | 2 years/ 4 semester | 120 ECTS | Annually, 1st September 2006 |
| Nuclear Physics Ba | Жаратылыстану ғылымдары бакалавры/ Бакалавр естествознания/ Bachelor of Natural Science | - | 6 | Full time | State University "Dubna" | 5 years/ 10 semester | 300 ECTS | Annually, 1st September 2004 |
| Nuclear Physics Ma | Жаратылыстану ғылымдарының магистрі/ Магистр естественных наук/ Master of Natural Science | - | 7 | Full time | State University "Dubna" | 2 years/ 4 semester | 120 ECTS | Annually, 1st September 2007 |
| Nuclear Physics PhD | Философия докторы (PhD)/ Доктор философии (PhD)/ Doctor of Philosophy (PhD) | - | 8 | Full time | | 3 years/ 6 semester | 180 ECTS | Annually, 1st September 2007 |

For the Bachelor's degree programme in **Nuclear Physics** the institution has presented the following profile in the official programme description:

| | |
|---|---|
| **Application area** | The educational program is designed to train personnel for work in the field of nuclear physics. |
| **Code and name of education program** | 6B05305 - Nuclear physics |
| **Regulatory and legal support** | Law "On Education" of the Republic of Kazakhstan<br>State General Education Standard on higher education (31.10.2018, №604)<br>Standard Rules for the Activities of Educational Organizations that Implement Study Programs of Higher and (or) Postgraduate Education (30.10.2018 №595)<br>Rules for the Organization of the Educational Process on the Credit Technology of Education (12.10.2018, №563)<br>Classifier of Areas of Training with Higher and Postgraduate Education (13.10.2018 №569) |
| **Profile Map of Education Program** | |
| **Objective of** Education Program | Preparation of qualified, competitive personnel with fundamental knowledge in the field of nuclear physics and practical skills in working at nuclear facilities capable of developing and implementing professional skills. |
| **Concept of education program** | Training of comprehensively educated personnel with fundamental and experimental knowledge in the field of nuclear physics. |
| **Graduate Qualification Characteristics** | |
| **Degree Awarded:** | Bachelor degree of Natural Science in the educational program «6B05305 - Nuclear physics» |
| **List of Specialist's Positions** | Engineer, laboratory assistant, specialist I, II category. Junior researcher. Engineer in biomedical equipment. Clinical physicist. Spectroscopist. The engineer on not destroying control. Engineer for technical diagnostics. Engineer-researcher in the field of product quality control. |
| **Area of Professional Activity** | Field of experimental, theoretical and applied physics, fields of neighboring natural and technical sciences, fields of educational programmes. |
| **Object of Professional Activity** | Scientific research institutes, laboratories, construction and project offices and firms, industrial enterprises and units of nuclear power complex, specialized educational organizations. |
| **Functions of Professional Activity** | To research problems in the field of nuclear physics, to perform projects and management in research, industry, to develop, perform and control the condition of industrial technological process at nuclear power complex enterprises, teaching physics in educational institutions in accordance with the objects of professional services.<br>Types of professional activity:<br>- organisation management;<br>- construction technology |

For the Master's degree programme in **Nuclear Physics** the institution has presented the following profile in the official programme description:

| | |
|---|---|
| **Application area** | The educational program is designed to prepare a master's degree in nuclear physics. |
| **The code and name of education program** | 7M05305–Nuclear physics |
| **The regulatory and legal support** | Law of the Republic of Kazakhstan dated February 18, 2011 № 407-IV "On science" (with amendments as of 01.04.2009.);<br>State General Education Standard on higher education (31.10.2018, № 604);<br>Standard Rules for the Activities of Educational Organizations that Implement Study Programs of Higher and (or) Postgraduate Education (30.10.2018 №595);<br>Rules for the Organization of the Educational Process on the Credit Technology of Education (12.10.2018, №563);<br>Classifier of Areas of Training with Higher and Postgraduate Education (13.10.2018 №569). |
| **Profile map of education program** | |
| **Objective of EP** | Preparation of specialists with in-depth theoretical knowledge and practical skills in the field of low-energy nuclear physics, capable of applying modern technology to the organization of research and teaching activities. |
| **The concept of education program** | The educational program regulates the goals, results, content, conditions and technologies for the implementation of the educational process, assessment of the quality of the graduate's training in this area of training, and includes materials that ensure the quality of student training and implementation of appropriate educational technology. |
| **Graduate Qualification Characteristics** | |
| **Awarded degree** | Master of Natural ScienceSciences on the education program "7M05305–Nuclear physics" |
| **List of a specialist's positions** | Engineer, researcher, expert, teacher. |
| **The area of professional activity** | The enterprise of the nuclear industry, research institutes, organizations of government bodies, the design of accelerator technology and the design of scientific research in the field of nuclear physics, educational organizations. |
| **The object of professional activity** | Nuclear industry enterprises, research institutes, public administration bodies, educational organizations. |
| **Functions of professional activity** | Conducting research in the field of nuclear physics, the organization of production activities in enterprises in accordance with the objects of professional activity, the implementation of educational activities in the field of education. |

For the PhD degree programme in **Nuclear Physics** the institution has presented the following profile in the official programme description:

| | |
|---|---|
| Application area | The educational program is intended for training in the specialty "Nuclear Physics" . |
| The code and name of education program | 8D05305 - Nuclear physics |

| | |
|---|---|
| The regulatory and legal support | Modular education program for specialty is prepared in accordance with the State Compulsory Standard for post-graduate education (PhD program) approved by the Government of the Republic of Kazakhstan dated 23 August 2012 №1080 and the state education plan approved by the Minister of Education and Science of the Republic of Kazakhstan dated 16 August 2013 №343 (Annex № 251).<br>The Law of the Republic of Kazakhstan "On Education" dated 27 July 2007 № 319-III (with amendments and additions as of December 28, 2017).<br>Methodical recommendations for the development of educational programs, including experimental and innovative educational programs. ENU, 2018. |
| **Profile map of education program** | |
| Objective of EP | Training of scientific and pedagogical staff of the new formation, capable of solving problems of improvement of society, education, science and research methods, possessing new directions of modern science. |
| The concept of education program | The education program regulates goals, results, content, conditions and technologies for the implementation of the educational process, assessment of the quality of the graduate's training in this area of training, and includes materials that ensure the quality of training for students and implementation of appropriate educational technology. |
| **Graduate Qualification Characteristics** | |
| Awarded degree: | Physic in Doctor of philosophy (PhD) name of education program «8D05305 - Nuclear physics » |
| List of a specialist's positions | Engineer, researcher, expert, teacher. |
| The area of professional activity | The enterprise of the nuclear industry, research institutes, organizations of government bodies, the design of accelerator technology and the design of scientific research in the field of nuclear physics, educational organizations. |
| The object of professional activity | Research institutes, nuclear centers, the nuclear industry and research laboratories, universities. |
| **Functions of professional activity** | Organizational management activities: to develop, implement and monitor the state of the production process at enterprises in accordance with the objects of professional services.<br>Pedagogical activity: teaching in universities. |

For the **Bachelor degree programme in Mathematics** the institution has presented the following profile in the official programme description:

| | |
|---|---|
| Applicationarea | The educational program is designed to ensure the quality of the training of mathematicians in the natural sciences and meet the needs of employers in the field of science, economics and education |
| The code and name of education program | 6B05401 – «Mathematics» |
| The regulatory and legalsupport | Law "On Education" of the Republic of Kazakhstan<br>Standard Rules for the Activities of Educational Organizations that Implement Study Programs of Higher and (or) Postgraduate Education (30.10.2018 №595) |

| | |
|---|---|
| | Rules for the Organization of the Educational Process on the Credit Technology of Education (12.10.2018, №563)<br>Classifier of Areas of Training with Higher and Postgraduate Education (13.10.2018 №569)<br>State General Education Standard on higher education (31.10.2018, №604)<br>Professional Standart "Educator", approved in Appendix № 133 of June 8, 2017 by the Order of the Chairman of the Board of the National Chamber of Entrepreneurs of the RK "Atameken" |
| **Profile map of education program** | |
| Objective of EP | Preparation of bachelors with basic knowledge and practical skills in the field of fundamental and applied mathematics to implement them in their professional activities |
| The concept of education program | The educational program regulates the goals, results, content, conditions and technologies for the implementation of the educational process, the assessment of the quality of graduate training in this area of training |
| **Graduate Qualification Characteristics** | |
| **Awarded degree** | Bachelor of Natural Science in the educational program "6B05401 - Mathematics" |
| List of a specialist's positions | Junior Researcher in the scientific and research organizations; mathematician-analyst, mathematician-actuarial in insurance companies, pension and investment funds, teacher of mathematics in secondary vocational schools, as well as in schools with a specialized bias(college, lyceum, gymnasium) |
| The area of professional activity | - fundamental mathematics;<br>- Applied Mathematics;<br>- actuarial mathematics;<br>- mathematical education. |
| The object of professional activity | - research organizations;<br>- Insurance companies;<br>- financial structures;<br>- educational organizations |
| Functions of professional activity | **Functions of research activities:**<br>- statement of mathematical models of processes and phenomena in the field of natural sciences, engineering, economics;<br>- the use of analytical and numerical methods using application packages and programs to solve problems;<br>- analysis and formulation in the form of statements with full evidence of the results obtained;<br>- approbation and publication of the results of research activities<br>**Functions of analytical activities:**<br>- statement of mathematical models of economic problems;<br>- application of methods of actuarial and financial mathematics, statistical methods using application packages and programs to solve the set tasks;<br>- analysis of the results and conclusion recommendations.<br>**Functions of pedagogical activities:**<br>- training and education in the field of education in accordance with the requirements of educational standards;<br>- the use of technologies appropriate to the age characteristics of students and reflecting the specificity of subject areas; |

| | |
|---|---|
| | - organization of interaction with public and educational organizations, children's groups and parents (legal representatives), participation in the self-government and management of the school team to solve the problems of professional activity;<br>- formation of the educational environment to ensure the quality of education, including the use of information technology;<br>- ensuring the protection of life and health of students during the educational process. |
| Types of profession-alactivity | - research;<br>- analytical;<br>- prognostic;<br>- pedagogical |

For the **Master degree programme in Mathematics** the institution has presented the following profile in the official programme description:

| | |
|---|---|
| **Application area** | The program is designed to prepare undergraduates in the field of mathematics. |
| **The code and name of education program** | 7M05401 – Mathematics |
| **The regulatory and legal support** | Law “On Education” of the Republic of Kazakhstan<br>State General Education Standard on higher education (31.10.2018, № 604)<br>Standard Rules for the Activities of Educational Organizations that Implement Study Programs of Higher and (or) Postgraduate Education (30.10.2018 №595)<br>Rules for the Organization of the Educational Process on the Credit Technology of Education (12.10.2018, №563)<br>Classifier of Areas of Training with Higher and Postgraduate Education (13.10.2018 №569)<br>Professional Standart “Educator”, approved in Appendix № 133 of June 8, 2017 by the Order of the Chairman of the Board of the National Chamber of Entrepreneurs of the RK “Atameken” |
| **Profile map of education program** | |
| **Objective of EP** | To prepare the Master ofScience in Mathematics, who have deeper systematic theoretical knowledge and practical skills on fundamental and actual directions of mathematicsfor their implementation in their professional activities. |
| **The concept of education program** | The educational program regulates the goals, results, content, conditions and technologies for the implementation of the educational process, assessment of the quality of the graduate’s training in this area of training, and includes materials that ensure the quality of student training and implementation of appropriate educational technology |
| **Graduate Qualification Characteristics** | |
| **Awarded degree** | Master of Sciences on the education program «7M05401 – Mathematics» |
| **List of a specialist’s positions** | - researcher, analyst, manager in organizations of education and science;<br>- teacher of mathematical disciplines in universities, research centers. |

| | |
|---|---|
| **The area of professional activity** | Sphere of education and science, scientific and production, social and economic. |
| **The object of professional activity** | The objects of the graduate's professional activity are: research institutes and training centers, departments of management, expertise, assessment, analysis of organizations in the fields of education, science and economics, universities. |
| **Functions of professional activity** | Functions of research and analytical activities:<br>– conducting fundamental and applied research using a mathematical apparatus;<br>– participation in conducting scientific events;<br>– approbation of research results;<br>– implementation of publishing activities;<br>– collection and processing of information;<br>– analysis and recommendations for improving the quality of professional activity.<br>Functions organizational and management activities:<br>– participation in the implementation of the goals and objectives of the organization;<br>– participation in the creation of communications networks, the collection, processing and direction of information;<br>– participation in organizing various events to improve the quality of professional activity.<br>Functions of pedagogical activity:<br>– study of opportunities, needs, achievements of students in the field of education;<br>– education and training in the field of education in accordance with the requirements of educational standards;<br>– use of technologies appropriate to the age-specific characteristics of students and reflecting the specifics of subject areas;<br>– organization of interaction with public and educational organizations, children's collectives and parents (legal representatives), participation in self-management and management of the school collective for solving the problems of professional activity;<br>– the formation of an educational environment to ensure the quality of education, including the use of information technology;<br>– ensuring the safety of life and health of students during the educational process; |

For the **Bachelor degree programme in Artificial Intelligence Technologies (AIT)** the institution has presented the following profile in the official programme description:

| | |
|---|---|
| **Application area** | .The present program establishes requirements to the content of education and level of training of bachelors in Information and Communication Technologies in the educational program «Artificial Intelligence Technologies» |
| **Code and name of education program** | 6B06112- « Artificial Intelligence Technologies» |

| | |
|---|---|
| **Regulatory and legal support** | Law of the Republic of Kazakhstan "on education" as amended on 26.11.19, № 273-VI<br>State mandatory standard of higher education (with changes from 05.05.2020)<br>Sectoral Qualifications Framework for Information Technology<br>Professional standard "Development of artificial intelligence applications" (National chamber of entrepreneurs of the Republic of Kazakhstan "Atameken" 24.12.2019 № 259 Appendix № 35)<br>Professional standard "Development of systems for processing and storing big data " (National chamber of entrepreneurs of the Republic of Kazakhstan "Atameken" 24.12.2019 № 259 Appendix № 42)<br>Standard Rules for the Activities of Educational Organizations that Implement Study Programs of Higher and (or) Postgraduate Education (30.10.2018 №595)<br>Rules for the Organization of the Educational Process on the Credit Technology of Education (12.10.2018 №563)<br>Classifier of Areas of Training with Higher and Postgraduate Education (13.10.2018 №569) |
| **Profile Map of Education Program** | |
| **Objective of** Education Program | Training Bachelors with fundamental knowledge in the field of Artificial Intelligence, who are able to develop and create intelligent computing systems in various fields. |
| **Concept of education program** | The education program regulates the objectives, results, content, conditions and technologies for the implementation of the educational process, assessment of the quality of graduate training in this area of training and includes materials that ensure the quality of training of students and implementation of appropriate educational technology. The EP has the following features: first, it provides coverage of the fundamental topics in computer science needed to evaluate artificial intelligence; second, it covers the core skills and knowledge required in the ICT industry as a whole; and third, it provides a unique ability to look at the world in a different way to identify and harness the capabilities of artificial intelligence for different industries to improve their competitiveness in the knowledge age. |
| **Graduate Qualification Characteristics** | |
| **Degree Awarded:** | Bachelor in Information and Communication Technologies in the educational program 6B06112- "Artificial Intelligence Technologies" |
| **List of Specialist's Positions** | - Programmer of artificial intelligence applications;<br>- Data Mining Specialist;<br>- Artificial intelligence specialist; |
| Area of Professional Activity | The area of professional activity of graduates who have mastered the undergraduate program includes the design and creation (modification) of artificial intelligence systems that mimic intelligence, including thinking patterns, cognitive and knowledge-based systems, problem solving and decision making. |
| **Object of Professional Activity** | The objects of professional activity of graduates who have mastered the bachelor's program are electronic language resources (ontologies, databases and knowledge bases), intelligent information technologies used in electronic systems for various purposes (search engines, machine translation systems, control systems, data analysis systems, expert systems, electronic language resources). |

| | |
|---|---|
| **Functions of Professional Activity** | Development and creation of intelligent computing systems in areas related to knowledge management; pattern recognition; self-learning systems; adaptive systems; advanced user interfaces that allow human-computer interaction to go beyond the traditional keyboard and mouse. |

For the **Master degree programme in Artificial Intelligence Technologies (AIT)** the institution has presented the following profile in the official programme description:

| | |
|---|---|
| **Application area** | The present program establishes requirements to the content of education and level of training of masters in Information and Communication Technologies in the educational program «Artificial Intelligence technologies» |
| **The code and name of education program** | 7M06112- «Artificial Intelligence technologies» |
| **The regulatory and legal support** | Law “On Education” of the Republic of Kazakhstan<br>State General Education Standard on higher education (31.10.2018, № 604)<br>The Law “On Science” of the Republic of Kazakhstan 18.02. 2011 No. 407-IV (with amendments and additions as of 28.10.2019)<br><br>Standard Rules for the Activities of Educational Organizations that Implement Study Programs of Higher and (or) Postgraduate Education (30.10.2018 №595)<br>Rules for the Organization of the Educational Process on the Credit Technology of Education (12.10.2018, №563)<br>Classifier of Areas of Training with Higher and Postgraduate Education (13.10.2018 №569)<br>Professional standard “Higher and postgraduate education” / Project (National Chamber of Entrepreneurs of the Republic of Kazakhstan “Atameken” Industry Qualifications Framework (OCR). Branch: information and communication technologies. Approved by Protocol No. 1 dated 12/20/2016. Meetings of the Sectoral Commission in the field of Informatization, Communications and Telecommunications<br><br>Professional standard "Development of big data processing and storage systems" Appendix № 42 to the Order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan "Atameken" dated 24.12.2019 №. 259<br><br>Professional standard "Development of artificial intelligence applications" Appendix № 35 to the order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan" Atameken ". 24.12.2019 № 259 |
| **Profile map of education program** | |
| **Objective of EP** | Preparation of masters with in-depth fundamental knowledge in the field of artificial intelligence, proficient in methods of modeling intelligence in real applications |

| | |
|---|---|
| **The concept of education program** | The educational program regulates the goals, expected learning outcomes, conditions and technologies for the implementation of the educational process, the content and structure of the postgraduate educational program. The program develops promising areas of artificial intelligence in the field of information technology, is designed to train masters and researchers who develop algorithms for the implementation of machine learning and text processing methods and create software tools for big data analysis and forecasting business processes in education, healthcare, industry, smart cities and other areas. |
| **Graduate Qualification Characteristics** | |
| **Awarded degree** | «Master of Engineering Science in the educational program «7M06112-Artificial Intelligence Technologies» |
| **List of a specialist's positions** | Artificial Intelligence specialist; machine learning specialist; specialist in computational linguistics; University professor |
| **The area of professional activity** | The area of professional activity of graduates is the field of scientific research of the artificial intelligence, higher education systems, enterprises of the IT industry, as well as enterprises and organizations that use systems, products, and IT services to implement their activities. |
| **The object of professional activity** | Research and development of methods and models for knowledge representation in intelligent systems; intelligent information search and processing in distributed environments and the Internet; big data processing and analysis, pattern recognition; solving fuzzy and complex problems; higher education systems and research. |
| **Functions of professional activity** | – Analyzing huge amounts of information.<br>– Preparation of data for use in neurosystems<br>– Logical design of systems for machine learning<br>– Drawing up algorithms for data analysis<br>– Processing of text information by means of computing means and technology<br>– Implementation of artificial intelligence systems<br>– Pilot operation of artificial intelligence systems and its implementation<br>– Organization of expert systems development processes<br>– Management of expert systems development processes<br>– Conducting scientific research related to the objects of professional activity |

# C Peer Report for the ASIIN Seal

## 1. The Degree Programme: Concept, content & implementation

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

**Evidence:**

- Programme descriptions
- University website
- Professional standard

**Preliminary assessment and analysis of the peers:**
The general intended learning outcomes and objectives of each programme are published in a binding fashion in the official programme descriptions, provided in a translated version by the University.

**For all programmes**, the submitted documents indicate that external experts also participated in providing feedback on the programmes. In some cases these were industry representatives, in others these were academic representatives from other higher education institutions. In addition, external professional standards and sectoral qualification frameworks were consulted to design the curricula. For the AIT programmes, for instance, inspiration was obtained from the professional standards for "Artificial Intelligence Application Development" developed by the National Chamber of Entrepreneurs of the Republic of Kazakhstan. It therefore appears that a variety of external inputs are taken into consideration in the continuous development of the programmes. As will be further discussed under criterion 6, there may be some benefit to increasing the exchange with local industry representatives

It is noted that the official descriptions, including learning outcomes, of the Bachelor, Master and PhD degree programmes in Nuclear Physics are available for download on the University website. However, it appears that this is not the case for the other programmes. For the AIT programmes, no course website exists yet. The University must ensure that the

learning outcomes of all study programmes are transparent and accessible to the stakeholders.

**Mathematics**

The overall learning outcomes for the Bachelor and Master programmes in Mathematics aim to prepare students for prognostic, analytical, pedagogical and research-related activities – research organisations, insurance and finance companies, as well as schools are included as sample employers.

Despite these listed employers, the programmes focus overwhelmingly on theoretical components, and most of the graduates appear to become teachers. The intended outcomes appear to be mostly in line with the subject-specific requirements (SSC) of the Technical Committee for Mathematics. The SSC suggest that Mathematical programmes focused on theory should allow students to pursue a minor – this is further discussed under criterion 1.3.

**Artificial Intelligence Technologies**

The overall learning outcomes for the Bachelor and Master programmes in Artificial Intelligence Technologies appear to be in line with the subject-specific requirements of the Technical Committee for Informatics. Both study programmes are new – their launch is planned for the Fall semester of 2021.

**Nuclear Physics**

The overall learning outcomes for the Bachelor, Master and PhD programmes in Nuclear Physics correspond to the subject-specific requirements of the Technical Committee for Physics. However, as indicated by the provided documentation, many of the graduates of these programmes – particularly the Bachelor programme - struggle to find employment. There is therefore a concern that the focus of the learning outcomes and programme contents are too narrow, and should be broadened. This is further discussed under criterion 1.3.

**Criterion 1.2 Name of the degree programme**

**Evidence:**

- SAR
- Diploma Supplements

**Preliminary assessment and analysis of the peers:**
For most of the programmes, it appears that the programme names effectively reflect the intended aims and learning outcomes of the programmes and the course language.

In the SAR, the University provides an extensive explanation of why "Artificial Intelligence Technologies" was favoured over "Artificial Intelligence" when naming the newly conceived programmes. According to the University, Artificial Intelligence Technologies (AIT) is a broader and more inclusive name, which is technologically more correct and also includes technologies such as data science. While the provided explanations are plausible, the name "Artificial Intelligence" could in fact be considered broader than "AIT" – the addition of the word "Technologies" suggests a narrower focus. "Artificial Intelligence" is moreover a globally accepted name for study programmes with similar intended learning outcomes. If the University wishes to communicate that the degree programmes are more practically-oriented, "Applied Artificial Intelligence" could also be a good choice.

Apart from this, the current contents of the programme indicate a strong focus on Natural Language Processing – the desired broad coverage of AI-related technologies is not achieved with the current curriculum. As a result, the most fitting name for the programmes may in fact be "Natural Language Processing Technologies" – a few such programmes also exist at other institutions.

**Criterion 1.3 Curriculum**

**Evidence:**

- SAR
- National Standard for Bachelor Programmes
- National Standard for Master and PhD programmes
- Objective-Module Matrices
- Module Descriptions
- Curricula

**Preliminary assessment and analysis of the peers:**
The curriculum of each programme is described in the translation of the official programme description. As all study programmes in Kazakhstan, the study programmes must contain certain general education modules defined by the state.

For the Bachelor programmes, for instance, required general education modules include Sports, Philosophy, Kazakh History, etc., and constitute 56 ECTS credits overall. In alignment with regulations, the programmes include two practice intervals.

In the Master's programmes, the general education component constitutes 35 ECTS credits. The programmes include Research Practice and Professional Practice intervals. PhD students must also complete general courses on academic research and writing and must also teach as part of the programme.

All programmes end with a final thesis, in alignment with national regulations.

For each study programme, the University has submitted matrices which give an overview of how the individual modules contribute to the overall learning outcomes. Following the review of the provided module descriptions, however, it is noted that in many cases, the University has not formulated module-specific learning outcomes. In many cases, the same outcomes are listed for a variety of modules. The University must ensure that the learning outcomes in each module description are module-specific.

**Mathematics**

With regards to the Mathematics curriculum, there appears to be a discrepancy between the envisioned areas of employment and the programme contents. On the one hand, it is understood that the programmes intend to concentrate on Mathematical theory – at the University, there is a separate Statistics study programme which focuses on actuarial Mathematics. However, the lack of applied Mathematics will make it more difficult for students to find employment in some of the proposed sectors, particularly Insurance and Finance. During the online discussions, some of the industry representatives echo this sentiment, stating that the educational process should be more applied.

The ASIIN SSC suggest that programmes in this category should allow students to dedicate at least 20% of the programme workload to an applied "minor" or other subject areas. The University notes that the Mathematics programme includes specialisations in Information Technology and in Information Security, each consisting of 15 ECTS credits. While these specialisations are surely helpful, they only compose a small percentage (<10%) of the total course workload. The University should consider expanding the specialisations in order to improve the employability of graduates in the envisioned sectors.

Structural issues are discussed under criterion 2.1.

**Nuclear Physics**

With regards to the Nuclear Physics curricula, it is noted that they are of a classical nature with a narrow focus. The programmes prepare students for a limited number of roles. The

provided documents indicate that a large proportion of Bachelor programme graduates struggle to find a job. Without a doubt, a broader focus would improve the employability of graduates. Additional subjects which could be featured more prominently in the curricula include advanced electronics, micro-controllers, data acquisition systems, control technology, lasers, and vacuum technology. During the discussions, the University agrees that a broader focus could improve graduates' employability. However, it notes that due to government standards, there is little room to adapt the curricula. Moreover, additional study programmes are planned to address these other areas. Graduates may therefore have the best chances if they search for work abroad.

It is noted that the PhD programme contains a compulsory module on scattering of complex particles in an optical model, which covers a special topic of nuclear reactions with heavy ions. Many of the thesis topics are related to other fields of nuclear physics, for instance radiation effects in solids or environmental radioactivity. For those theses, this module is not necessary, and the University may therefore consider changing this module into an elective. Overall, the PhD programme includes a limited number of electives. Additional modules could focus on Software such as COMSOL modules or nuclear engineering simulations, for instance. The University agrees that additional electives would be great, however, there are insufficient staff resources to teach additional electives. Staff resources are further discussed under criterion 4.1.

It is further noted that Chemistry is not a compulsory module and Linear Algebra appears to be missing from the Bachelor programme entirely, which may severely limit the students' comprehension of Nanosystems and Quantum Mechanics and furthermore limit the profile of the graduates. The expert panel believes that these subjects must be mandatory for Nuclear Physics students. The expert panel furthermore recommends the inclusion of more computational physics in the general physics modules.

While it is clear that structural as well as content requirements are imposed by national standards for Bachelor, Master and PhD programmes, it does not appear that these standards prohibit the addition of contents in the subject areas proposed above. A number of related sectoral qualification frameworks with a broad focus (ex: "Energy" or "Mining and Metallurgy") exist, but also do not impose restrictions on the types of contents which can be included in study programmes. The University is therefore asked to indicate all laws which impact or impose restrictions on the contents of the Bachelor, Master and PhD programmes in Nuclear Physics.

**Artificial Intelligence Technologies**

Based on the online discussions and provided information, the curricula of the AIT programmes appear to have a significant amount of contents related to Natural Language Processing (NLP). The programme coordinators indicate that the focus on NLP is explained by the expertise of the staff, and that the curriculum will be revisited on an annual basis to consider modifications and improvements.

While the NLP focus in itself is not negative, the curricula should ensure a broader treatment of AI technologies. These could include contents related to Machine Learning Engineering including DevOps, Models Lifecycle, and Maintenance during Production, as these are highly relevant for business applications. In addition, students should be taught how to obtain data from different recourses, and how to store and query non-structured data.

**Criterion 1.4 Admission requirements**

**Evidence:**

- SAR
- University Website

**Preliminary assessment and analysis of the peers:**
As indicated in the SAR, the admission requirements for the programmes are regulated in the Kazakhstan Government Decree dated 19.01.2012 No. 111 "Standard rules for admission to training in educational organizations that implement professional training programs of higher education".

The admissions process involves the taking of a computerised assessment, implemented by the National Test Centre, which is a part of the Ministry for Higher Education.

For Bachelor students, there is one general exam. For Master students, there are two exams: the first exam tests foreign language skills, the second is a “complex” exam related to the subject-area. For PhD students there are also subject-specific exams. All exams are organised by the National Test Centre for each discipline. PhD students must also submit a previously attained certificate (ex: IELTS) indicating sufficient English-language skills.

Prerequisites for the Master degrees and the PhD also include a certain amount of previous subject-specific coursework – if these prerequisites have not been fulfilled, the respective courses must be taken in addition and parallel to the regular coursework. For the Nuclear Physics Master programme, for instance, students must have previously completed courses in Experimental methods of Nuclear Physics and the Structure of the Atomic Nucleus.

All admission requirements and procedures – including those for foreign students - are indicated on the University's website and are transparent. While the institution has very little influence on the admissions process, the process appears to be structured in a way that supports the students in achieving the learning outcomes.

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

In its response statement, the University indicates that all the learning outcomes of all programmes are available online, and provides the related links. The peers are therefore satisfied that these are transparent.

Regarding the graduates of the Nuclear Physics Bachelor programme, it provides some statistics suggesting that, while a number of graduates do not find employment, those that are employed find employment in the Nuclear Physics field. The University furthermore explains that the Kazakh job market for graduates from this specialty is still small and developing. In this job market, graduates with Master's or PhD degrees are in greater demand than those with Bachelor degrees. The University also suggests that Nuclear Medicine is a growth area, which may create numerous job opportunities for future graduates. The University also notes that it provides employment for at least 50% of graduates in the context of the direction of personnel training during the year of graduation.

Based on the panel's recommendations, the University plans to provide a new atlas of specialties. The University plans to introduce the course of Chemistry in the Ba Nuclear Physics programme and Radiochemistry in the Master's program. For the PhD Nuclear Physics programme, the University plans to teach courses based on the topics of theses and the direction of research. For the Ba Programme the following additional changes are proposed:

1) The subject "Pedagogy" will be replaced with "Basics of computer physics" in order to increase computational physics.

2) The name of the discipline "Analytical Geometry" will be renamed as "Linear Algebra and Analytical Geometry". Analytical geometry is taught in such a way as to prepare students for the study of Linear Algebra using simple and accessible material. Linear Algebra is preceded by a large chapter on systems of linear equations and matrices.

3) In the seventh semester, the discipline "Theory and Methods of Teaching Physics" will be replaced with "Chemistry" and become a basic compulsory discipline. The discipline "Chemistry" in the elective course is to be replaced with "Angular momentum theory".

The peers are satisfied that these adjustments to the curricula will ensure that the SSC are met, and require their implementation. While these changes should contribute to the employability of graduates, the University could also take additional measures – if the local job market is small and still developing, it is recommended that the University implements courses which broaden the students' skill sets, so that they are able to work in related sectors, and / or increasing their opportunities to work abroad.

Considering the comments of the expert group, the University notes that graduates of the two Mathematics programmes generally work in one of four fields, including pedagogical activity. The provided data indicates that 11% of undergraduate graduates are employed as a mathematics teacher in secondary vocational institutions, and most graduates continue their studies at the Master level (on the average 61%).

To expand the areas of graduate activity, the University plans to conclude new cooperation agreements next year:

• Branch "Information Technology and Security" of the Republican State Enterprise on the Reinforced Conservancy of the Institute of Computer Science and Technology of the Ministry of Education and Science of the Republic of Kazakhstan

• Ministry of National Economy of the Republic of Kazakhstan

• JSC "Institute for Economic Research" under the Ministry of National Economy of the Republic of Kazakhstan.

Provided data indicates that a large number (59%) of graduates of the Master program are engaged in teaching. The University explains that this is due to the fact that over the past 5 years, the state has significantly increased the status of teachers and salaries. As a result, teaching activities have become attractive for many graduates of the magistracy. 29% of graduates of the master's programme work in the direction of research and analytical activities, employed in organizations such as the JSC National Centre for Civil Service Personnel Management, the Ministry of National Economy of the Republic of Kazakhstan, LLP "Digital Innovation & Transformation", STC "Sana-life ", etc.

In consideration of the expert panel's recommendations, and in order to expand the students' practical skills, new elective disciplines were added to the Ba Mathematics educational program:

1) Calculus of variations in economics;

2) Algorithms on graphs;

3) Operational calculus in mechanics.

The following elective disciplines were introduced in the Ma Mathematics educational program:

1) Application of Trigonometric Fourier Series and Fourier Transforms in Information Compression Problems

2) Topological vector spaces in problems of economics

3) Inequalities in functional spaces and their applications in signal filtering problems

4) Dynamic models of Financial Mathematics

5) Measure theory and forecasting the development of complex systems.

6) Maximum Regularity Approach to Equations of Quantum Mechanics

7) Multipliers of trigonometric Fourier series in optimal monitoring problems

8) Optimal computational aggregates of the numerical analysis with applications in computed tomography

9) Net spaces and their application

10) Optimal approximation of a thermal process with infinitely smooth initial conditions

11) Application of nonlinear analysis in finite-dimensional space in economic models

12) Application of Hardy-type weighted inequalities in physics to determine the oscillation properties of objects

The expert panel is pleased with these adjustments to the curricula, as they will allow the students to develop their knowledge of practical mathematical applications. Once the University has provided proof of their implementation, they will consider the SSC to be fulfilled.

With regards to the AIT programmes, the University indicates that renaming the programmes in line with the recommendations of the expert panel will be discussed at the next meeting of the Academic Committee for the Development of the Educational Programmes. The peers are satisfied with this plan.

Regarding the Ba AIT curriculum, the University indicates that only two disciplines (5 credits each) are related to natural language processing - Introduction to Natural Language Processing and Machine translation. A significant number of credits is allocated to the core competencies for all theoretical areas of AI and to specific competencies for developing intelligent applications: Programming in Python, Neural Networks, Machine learning, Deep learning, Data mining, Decision theory, Data analysis and optimization, Project management, Data Analysis Workshop, Intelligent control systems and cognitive systems.

The University furthermore plans to update the content of the programme annually, and to include elective courses reflecting other areas of AI, such as Digital Image Processing, Computer Vision, Pattern Recognition, Image Analysis and Video Analytics, Machine Learning DevOps Engineer, etc.

For the Ma AIT curriculum, the University agrees that there is a heavy focus on NLP, which is due to an international Erasmus+ educational project "Computational Linguistics at Central Asian Universities" (CLASS). The mandatory result of this project is the implementation of a Master's programme in Computer Linguistics or the integration of a specialization in Computer Linguistics in an existing study programme. Here, too, the University plans on annually updating the programme and adding new contents related to MLOps, Deep Learning for Computer Vision, Advanced CV, Biometric Recognition, People detection on images and video sequences.

The peers approve of the University's plans to introduce these additional contents in the AIT programme curricula and recommend their implementation.

Criterion partially fulfilled.

# 2. The degree programme: structures, methods and implementation

**Criterion 2.1 Structure and modules**

**Evidence:**

- SAR
- Programme descriptions
- Objective Module Matrices
- Module descriptions
- State Compulsory Standards of Higher Education
- Regulation on Outgoing Academic Mobility
- Online discussions

**Preliminary assessment and analysis of the peers:**

The structure of the degree programmes is heavily influenced by requirements imposed by Kazakh higher education law. In general, all Kazakh study programmes are composed of modules, and all semesters have a workload of 30 ECTS credit points. The structure of the degree programmes is determined by the State Compulsory Standards of Higher Education, which exist for Bachelor's, Master's and doctoral degrees.

In accordance with the standard, the Bachelor degree programme curricula are divided into general education disciplines (56 ECTS credits), basic professional disciplines (12 ECTS credits), and major or profile disciplines (60 ECTS credits). In addition, all Bachelor degree programmes have a final thesis with a workload of 12 ECTS credits. The workload for each of these components, including some of the related disciplines, is fixed by the state.

It should be noted that the workload allocated to the compulsory disciplines must not be completed within one semester: in ENU's case, for instance, the Physical Education requirements are spread across the first four semesters (2 ECTS credits per semester).

The structural and disciplinary requirements imposed by the state regulations nonetheless significantly restrict the University's curricular freedom in terms of content and organisation. The forced allocation of a large number of credits (56) to general disciplines prevents the University from dedicating more time to subject-specific contents. In other cases, it makes it more difficult for the University to teach important subject-specific contents at an earlier stage. During the discussions, the industry representatives similarly indicate that there is too great of a focus on general education courses.

All three Bachelor programmes also include – in accordance with the Kazakh educational standard - two practice intervals. The University indicates in the discussions that there are agreements with a number of organisations and companies, and that each student is guaranteed an internship spot. Support is also provided by a career centre. In all programmes, an individual course of study is furthermore facilitated by electives.

**Mobility opportunities**

The University offers students some mobility opportunities, primarily at Universities in Central Asia and Eastern Europe. There are funds available, both from the University as well as international programmes, to financially support student mobility. Rules pertaining to outgoing academic mobility are clearly stipulated. A list of outgoing student mobility experiences is provided by the University.

One apparent highlight is the double-degree option for Bachelor students in the Nuclear Physics programme, which takes place in cooperation with Dubna State University in Russia. High-performing students who partake in the double-degree option attend Dubna for the final year of the Bachelor programme. Dubna is a well-known institution in the field of Nuclear Physics and possesses advanced facilities and equipment for training students. One student who participated in this option and is present during the online discussions indicates that he was satisfied with the organisation and integration of the double-degree programme. While the double-degree cooperation agreement with Dubna also extends to the Master programme, there have thus far not been any double-degree exchanges on the Master level. The expert panel recommends that the University further develop international exchange opportunities and extend these to regions beyond Central Asia and Russia – this will also contribute to the University's internationalisation goals, stated by the University leadership.

While there are a few incoming students in the programmes, the number is very low. In most cohorts, there are no foreign students. It is noted that a number of modules in the programmes may have a large size (7 ECTS credits or more), which may make it more difficult for international students to obtain recognition for the modules upon returning at home. The University may therefore consider reducing the module sizes (ex: 5 ECTS), which could facilitate transferability.

With regards to language, Bachelor and Master degree programme students must take foreign-language courses. Most students choose English. In the module descriptions, it is indicated that some modules are offered in parallel in multiple languages (for example in Russian, Kazakh and English). These modules are offered in English if a minimum of five students indicate an interest. This offering of modules in multiple language is without doubt a positive characteristic of the programmes, even though it is also associated with a significant effort on the part of the University.

**Mathematics**

For the Bachelor programme, it is noted that Linear Algebra is not taught until the second year, although the international standard is for this to be taught in the first year. The university explains that this is because the compulsory disciplines imposed by the state already take up too many credit hours in the first two semesters. The expert panel notes that it may be possible to move a course from the first year into the second year and thereby create room for Linear Algebra. The University is asked to explain whether or not such a switch would be possible.

The expert panel notes that the "Theory of Groups" course in the Master programme appears to contain contents more reflective of a Bachelor level course, like Lagrange's theorem or groups of residue classes – this must be adjusted.

**Artificial Intelligence Technologies**

As mentioned under criteria 1.2 and 1.3, the contents of the individual modules of the AIT programme – as described in the module handbook - indicate a strong focus on NLP. While NLP can be considered a strength of the programme, there is a slight concern that there is an imbalance and that other areas of AIT, such as Computer Vision, are neglected.

In case the module descriptions do not provide an accurate or complete picture of the module contents and learning outcomes, the University should revise the module descriptions accordingly and resubmit them.

**Nuclear Physics**

It is noted that the Bachelor study programme includes a number of structural issues which force students to choose between two electives when in fact both appear to be important. This includes, for instance, the practicum in Optics and the theoretical course in Optics. Another example are the courses in Methods of Mathematical Physics and Special Seminar Work on Equations in Mathematical Physics – both are important in order to understand Quantum Mechanics, yet students can only take one.

From the online discussions, it is gathered that there are in some cases content overlaps between the modules, so that the most important aspects are taught regardless of the students' chosen elective. In other cases, it appears that students find ways to learn the missing information outside of the classroom. While the students' engagement is admirable, the curriculum must ensure that all students take the course contents which are necessary to achieve the learning outcomes – this appears to not be the case.

With regards to the literature indicated in the module descriptions, the University is encouraged to increase the amount of English literature, as this currently constitutes a very small proportion.

## Criterion 2.2 Work load and credits

**Evidence:**

- SAR

- Module descriptions

**Preliminary assessment and analysis of the peers:**
The University uses the European Credit Transfer System (ECTS). As an additional rule, all semesters must have a workload of exactly 30 ECTS credits.

Judging by the discussions with the students, the overall workload in the programme appears to be manageable: they do not report any structure-related peaks in workload, nor are there are signs that the students have difficulties completing the programmes in the prescribed time period.

The number of classroom hours and self-study hours are indicated in the module descriptions. During the online discussions, however, the peers learn that no measures exist to corroborate the self-study hours. To ensure that the estimates of self-study time are realistic, the University must implement methods to measure them (ex: via module-specific student surveys).

**Criterion 2.3 Teaching methodology**

**Evidence:**

- SAR
- Module descriptions

**Preliminary assessment and analysis of the peers:**
Based on the submitted module descriptions, it appears that the favoured teaching methods are primarily lectures and practical lab-work. During the online discussions, however, the teachers reveal that learning methods also include seminars, presentations, practice and internships.

During the pandemic the teaching staff adapted to the changed demands, provided online lectures and also conducted oral exams online.

The familiarisation of students with independent academic research and writing takes place via the required final thesis projects, which take place at the end of each programme, and related practice- and research courses.

In summary, the peer group judges the teaching methods and instruments to be suitable to support the students in achieving the learning outcomes. As previously mentioned, there is no indication that self-study hours have been corroborated, so any judgement concerning the balance between self-study and in-class hours is difficult.

**Criterion 2.4 Support and assistance**

**Evidence:**

- SAR
- Online discussions

**Preliminary assessment and analysis of the peers:**
The student feedback indicates that students are satisfied with the support provided in terms of (individual and group) mentoring, supervision and help offered in courses and research projects as well as in the laboratories and beyond. This also appears to extend to students participating in the double-degree option.

There are numerous support structures to help students find an internship placement and an employment (such as job/vacancy fairs, interactions with employers, meeting platforms, list of vacancies on website, list of contacts in the departments, link to Employment Centre of Kazakhstan, alumni connections, support for graduates).

The mentoring provided by curators (member of the teaching staff assisting the students with general concerns and in the educational process) is seen as useful. The students feel adequately supported by their curator who helps them applying for programmes, with documentation and any other student concerns.

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

In its response, the University indicates that it plans to expand its mobility activities under the UMAP programme, which will enable students to visit countries of the Pacific region. The University plans to reduce module size to 5 credit points to facilitate mobility, specifically the transfer and recognition of credits. The expert panel views these plans positively and recommends their implementation.

Taking into account the expert panel's comment regarding the discipline of Linear Algebra, Algebra 2 has been moved to the 3rd semester. One of the content sections of this discipline is Linear Algebra. The expert panel considers this acceptable, but encourages the University to move the module to the first year.

Regarding the structure of the Bachelor in Nuclear Physics programmes, the University submits new proposals. For the Nuclear Physics bachelor programme, there are no changes with respect to the attribution of modules to be compulsory or elective. Therefore, the structural problem outlined in the peer report that students will have to decide between

two elective modules, which both are necessary to achieve the learning outcomes, remains unsolved.

There is no indication in the response of ENU how the amount of English literature will become increased in the future. The peers encourage the inclusion of more English-language contents.

With regards to the peers' comment about the Theory of Groups course in the Master's programme, the revised module descriptions indicate that the contents have been adjusted in a satisfactory manner and reflect the desired level.

Regarding the measurement of the workload, the University's response suggests that self-study time is estimated, and that no feedback is collected from students to determine whether or not estimates are accurate. The University must therefore devise and implement a process for determining whether the estimated workloads for self-study time are accurate. This could for instance be via annual module-specific surveys, in which the students are asked to estimate the number of self-study hours.

Criterion partially fulfilled.

# 3. Exams: System, concept and organisation

**Criterion 3 Exams: System, concept and organisation**

**Evidence:**

- SAR
- Online discussions
- Assessment rules
- Regulations on conducting current and midterm assessment of learning achievements, midterm and final assessment of students in l.n. Gumilyov Eurasian National University
- Sample exams

**Preliminary assessment and analysis of the peers:**
The provided module descriptions indicate the type of examination formats utilised in the different modules. Exams are devised in line with the modular organisation of the curricu-

lum and cover the intended learning outcomes based on knowledge, skills and competencies. Continuous feedback is offered to students about their progress and areas of improvement.

Apart from computer exams and written exams, oral exams are a common examination format. This is enabled by the small class sizes. In Nuclear Physics, for instance, every course includes an oral exam. However, these exams are not purely oral - students have a few minutes to prepare something in writing and then present it. Overall, there appears to be an adequate balance in examination formats.

As indicated in the SAR, general assessment criteria have been established and can be found in the syllabus of each discipline, so that students have the opportunity to familiarize themselves with them at the beginning of the semester. Examination procedures are well documented, and transparently communicated to the students in due time before the exam take place (concerning time, place/mode, duration, form, assessment criteria etc.). During the discussions, the students report that grading of tests takes place quickly and that the number and spacing of exams is adequate.

The curricula of the degree programmes comprise a final thesis which demonstrated independent research work, reflection and analysis of the students and enables individual specialisations. The thesis can be written at an external collaboration partner, e.g. the former internship organisation/company of the student.

The expert panel also has the opportunity to review sample exams and final projects, and finds that these adequately reflect the intended level.

Rules for retaking exams are specified among the provided assessment rules, however, there is no mention of rules concerning disability compensation measures, illness or mitigating circumstances. These must be provided or formulated by the University.

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

The University submits a document in Russian concerning the treatment of students with special educational needs (SEN), and provides a translated summary in the response statement. According to this, the University recommends teachers to individualise the training and evaluation for students with special education needs.

While it is positive that the University allows the individualisation of evaluations according to student needs, the peers note that it is only a recommendation and therefore has no binding character. This is problematic, since there should be some consistency in the treatment of students with SEN. The provided information suggest that there are no rules and

processes in place which a) enable students to report and obtain recognition for their special educational needs and which b) provide these students with adequate and consistent support. SEN support measures should be designed to help students achieve the programme learning outcomes (which should be identical for all students). To provide an example, a support process could allow students with SEN to obtain a note from a dedicated office at the University, which they could in turn present to teachers, and which would allow them (for example) 25% more time for examinations. The expert panel requires that rules for supporting students with SEN be developed and implemented.

Criterion not fulfilled.

# 4. Resources

**Criterion 4.1 Staff**

**Evidence:**

- SAR
- Staff handbooks
- Online discussions

**Preliminary assessment and analysis of the peers:**
During the online discussions, it is revealed that the teaching staff teaches on average 16 ECTS credits per semester. Currently, most teachers can spend less than 10% of their time on research and spend approximately 90% on teaching. A small proportion of the teachers are considered “teacher-researchers” and can spend up to 30% of their time on research. Research sabbaticals spanning a whole semester currently do not take place, although some of the teaching staff indicate that they would be interested. Occasionally, teaching staff members conduct shorter visits at other institutions, which may last a few weeks. Apart from teaching, the teaching staff also dedicates time to helping students as advisors or curators – these additional hours go unpaid, because teachers are paid according to teaching hours. If a teaching staff member gets sick, the teaching hours are divided among colleagues, or, if necessary, a substitute is hired.

This willingness of the University staff to work extra hours to support students is admirable. Simultaneously, however, the limited time they can dedicate to research is unfortunate. The University leadership indicates that, as part of its 5-year plan, the number of “teacher-researchers” will be increased – this can be considered a step in the right direction.

**Nuclear Physics**

As indicated under criterion 2.1, the programme coordinators of the Nuclear Physics PhD programme note that additional staff resources would be needed in order to make additional electives possible. Since the overall focus of the Nuclear Physics programmes is narrow, the University should consider expanding the teaching staff resources to offer a greater variety of modules, for example from the field of Nuclear Medicine, which would also likely have a positive impact on the employability of graduates.

During the online discussions with the laboratory staff, it is furthermore revealed that there is a shortage of engineers who are able to maintain and fix laboratory equipment and facilities, and general lab staff. Lab assistants are currently responsible for multiple labs – there is some indication that this is a lot of work, and would be best distributed among a greater number of lab assistants. The expert panel therefore recommends that the University increases the number of support staff in the laboratories.

**Artificial Intelligence Technologies**

As mentioned under criterion 1.3, most of the teaching staff in the AIT programmes has expertise in computer linguistics and NLP. As a result, the expert panel is concerned that the many other areas of AIT cannot be effectively covered by the teaching staff. Additional staff with skills in these other areas may be necessary in order to offer a broader education.

**Mathematics**

Based on the review of the staff qualifications as indicated in the staff handbook, the expert panel is under the impression that the number of staff members with PhDs could be increased.

**Criterion 4.2 Staff development**

**Evidence:**

- SAR
- Lists of professional development and refresher courses

**Preliminary assessment and analysis of the peers:**
As indicated in the SAR, plans to develop staff are formed on an annual basis at the department level. The University submits evidence indicating the participation of the programme teaching staff in a variety of courses. As mentioned under 4.1, staff members may occasionally visit other institutions as a part of research projects or teaching exchanges. The expert panel is thus satisfied that there are sufficient opportunities for staff development.

## Criterion 4.3 Funds and equipment

**Evidence:**

- SAR
- Videos of facilities and equipment
- Online discussions

**Preliminary assessment and analysis of the peers:**
The University indicates that financing is obtained via tuition fees (from students who do not receive state grants) and state grants. Grants include both student scholarships as well as grants for larger projects. For instance, the Nuclear Physics study programmes have obtained additional financing by winning projects. According to the leadership, the University's research budget will increase to 10 million Euros by 2023. Overall, it seems that the funding is sufficient in order to sustain the programmes, and it is positively noted that additional funds are being made available to increase research capacity and activities.

During the discussions, the students report being satisfied with the available classroom, computer and library resources. Via their student ID, students also have access to a number of scientific databases such as Scopus.

The University provides videos of the laboratories and equipment available for the individual study programmes.

The University possesses very limited advanced equipment (ex: HPGe-Gammaspectrometer, Neutron Source and Detector) related to Nuclear Physics, however, it is revealed during the discussions that there is close cooperation with a number of partner institutions who provide access to these types of facilities. While the University provides copies of a number of partnership agreements related to the programmes, these are in Russian and can therefore not be analysed by most of the peers. The University is therefore asked to provide a brief explanation (or translation) of each of the partnership agreements. Regardless, it is also recommended that the University acquire specialized software for Computational Physics modules

While the teaching staff of the Nuclear Physics and AIT programmes would be happy to receive additional scientific equipment, they believe that the current facilities are sufficient for sustaining the programmes.

The expert panel notes that, for the AIT programmes, one or several Graphics Processing Units (GPUs) would be beneficial in order to train complex AI models. Access to Penn Treebank and Wolfram software, which are currently not available, would also be beneficial. The programme coordinators agree - the purchase of a GPU is planned for the coming year.

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

In its response, the University agrees that Nuclear Medicine may be a field which holds potential for the graduates of the Nuclear Physics programme. An Ma Medical Physics study programme was launched this year, which involves specialists in this field. The University suggests that it may expand the field of Nuclear Medicine and offer related modules to the Nuclear Physics students. This is appreciated by the peers. However, from the University's response, it remains unclear to what extent the specialists from this other programme will also teach in the Nuclear Physics programmes. The expert panel encourages the University to consider possible synergies between the new Medical Physics programme and the Nuclear Physics programmes, for example shared modules.

The University indicates that the new AIT department, which was opened in April 2021, will be composed of professors with research interests in computational linguistics, as well as associate professors with extensive research experience in computer vision, pattern- and image recognition. CVs are provided. In addition, the department will hold an open competition for additional positions related to various AI fields. Staff may to some extent be recruited from IT companies. On behalf of the government, the University also plans the joint creation of an Artificial Intelligence Centre, together with a number of University partners. The peers are satisfied that the current staff is able to adequately cover a sufficient breadth of AI topics, but recommend the implementation of the plans to hire additional staff from other AI specialties.

Regarding the qualifications of the Mathematics teachers, the University reports that there is an interest in increasing the number of PhD degrees among the programmes' teaching staff. The peers recommend this.

Regarding equipment for the Nuclear Physics programmes the University provides a list of new lab equipment which it plans to purchase this year, including for example Mössbauer and X-ray spectrometers. A copy of the public procurement plan is provided. The peers recommend the purchase of this additional equipment.

Regarding equipment for the AIT programmes, the University provides a purchase plan for workstations with a graphics processing unit. Purchases of additional equipment are

planned. The expert panel encourages the University follow through with the proposed GPU purchases.

The University does not respond to the comments regarding sabbaticals for teaching staff, or the comment that the laboratories could benefit from additional support staff. The expert panel maintains its recommendations to increase the number of support staff and to enable teaching staff to go on sabbaticals.

Criterion is partially fulfilled.

# 5. Transparency and documentation

**Criterion 5.1 Module descriptions**

**Evidence:**

- Module descriptions

**Preliminary assessment and analysis of the peers:**
The University submits module descriptions for all programmes. However, they are deficient in numerous ways: as previously mentioned, learning outcomes are in many cases not module specific and identical for a number of modules. In other cases, module contents are missing, or described in an extremely general manner. As previously mentioned, the staff also indicates that teaching methods are used which are not indicated in the module descriptions. The University should therefore thoroughly revise the module descriptions and ensure they are correct. Furthermore, the University must ensure that they are made available to students in the course language.

**Criterion 5.2 Diploma and Diploma Supplement**

**Evidence:**

- Sample diploma supplements and diplomas

**Preliminary assessment and analysis of the peers:**
The University submits sample diplomas and diploma supplements for the programmes. These also contain a “relative” grade, which allows readers to categorise the student’s individual performance.

## Criterion 5.3 Relevant rules

**Evidence:**

- University website

**Preliminary assessment and analysis of the peers:**

As indicated under the criteria 1.1, the intended learning outcomes are not made transparent for all the study programmes – this must be ensured by the university. The module descriptions must similarly be published and made available to stakeholders in the course language, once revised. While it appears that all other relevant rules and regulations are published on the University website, they are in some cases difficult to find – the University is therefore encouraged to reflect on how this aspect can be improved.

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

In its response statement, the University provides links to the module descriptions for the programmes in English. However, the peers discover that the descriptions for the Nuclear Physics programmes have not been revised. The University must therefore submit revised module descriptions for all Nuclear Physics programmes, which fully satisfy the ASIIN criterion 5.1. Furthermore, they note that the module descriptions for all seven programmes must be made available to students in the course language, i.e. Russian and / or Kazakh.

The expert panel is able to find the learning outcomes, module descriptions and other programme-related information on the website. The University indicates that programme-specific information is also available to students via their accounts on the University's "Platonus" system.

Criterion not fulfilled.

# 6. Quality management: quality assessment and development

**Criterion 6 Quality management: quality assessment and development**

**Evidence:**

- SAR
- Online discussions
- Sample surveys

**Preliminary assessment and analysis of the peers:**
As indicated in the SAR, the University conducts a variety of surveys with different stakeholders, including students, teachers, and employers – a list of surveys is provided. Sample results are also provided, indicating a general satisfaction among both students as well as teachers. It should be noted, however, that most of these results reflect the entire University, not only the specific programmes discussed in this report.

During the online discussions, the University explains that students receive two questionnaires per year. The results are discussed within the respective department, which subsequently implements measures to make improvements, as required. A few examples are given in the SAR and include, for instance, an increase in the amount of English-language contents, and increases in the number of electives. During the online discussions, the University explains that a Nuclear Physics teacher was replaced due to overly negative student feedback. The programme coordinators of the Mathematics programme indicate that no requests for changes were received.

Since the questionnaires take place at the very end of the semester, there is no time to discuss the results with students in class. It appears that the results are made available only to the department heads, not to the teachers, except in special cases.

While there are already a number of useful feedback measures in place, the expert panel notes that there are gaps in the feedback-loop. In order to address this issue, not only the department heads but also the teachers must receive the survey results, and teachers should discuss results with the students directly in order to receive additional feedback. In this manner, the students also recognise that their feedback is being heard and taken seriously, which in turn will encourage them to provide more feedback in the future. To make this possible, surveys could be scheduled earlier, before the end of the semester.

As noted under criterion 2.2, questionnaires should be adapted so that students are asked about the module-specific self-study workload – in this manner, the allocated time for self-study can thereby be corroborated. The simple use of a formula, which calculates the number of self-study hours based on in-class time, is not sufficient.

There is a significant amount of informal exchange between the University and some external organisations. Since the Vice-Director of the Institute of Nuclear Physics is an alumnus, there are particularly close ties. There are also close ties with Moscow State University and the Nuclear supervision body in Kazakhstan. During the discussion rounds, representatives from industry and partner institutions indicate that they have on a number of occasions provided ENU with feedback regarding the programmes – for the Nuclear Physics programme, for instance, this led to the introduction of additional contents in Medical Physics.

Unfortunately, no external representatives are present from the field of AIT. With the SAR, the University submits opinions provided by representatives from a local IT company. It therefore appears that at least one company was consulted in the development of the programme. In order to ensure the employability of the graduates, however, a variety of potential employer organisations should be consulted.

The Nuclear Physics programme appears to have particularly good connections to a number of external employers and institutions, however, these institutions may reflect too narrow of a spectrum and may not have the capacity to provide employment to all graduates of the programme. The expert panel therefore considers it important that other employers (ex: from the field of medicine) are more closely involved to increase the employment prospects of graduates.

Overall, it is noted that there are limited formal mechanisms for gathering feedback from external organisations and industry representatives – additional mechanisms may be necessary.

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

In its response statement, the University reports that, during the processing of evaluation results, negative comments concerning lesson quality are forwarded to the responsible deans, who may then discuss these with the responsible teachers. The University indicates that all faculty members can view the survey results and that the department discusses the results with all students. Regarding the timing, the evaluations take place after exams, to include this aspect in the evaluations. In this manner, students can be asked about the

quality of exams and the assessment of student knowledge. The University considers it impractical to conduct evaluations beforehand.

The expert panel understands the reasoning of the University regarding the timing of evaluations. However, while the University suggests that departments discuss survey results with students, thereby closing the feedback loop, it is unclear when or how often this takes place. The expert panel notes that a process must be in place, which ensures the systematic closure of the feedback loop.

The University indicates that feedback regarding the AIT programmes was collected from a number of organisations, not just one, as previously assumed. A total of five are mentioned. Some of the companies' feedback is provided along with the response statement. The expert panel is thus under the impression that a sufficient number of external organisations was consulted before the launch of the programme. However, it recommends the establishment of a formal process by which feedback from employers is gathered on an annual basis.

Criterion not fulfilled.

# D Additional Criteria for Structured Doctoral Programmes

## Criterion D 1 Research

**Evidence:**

- SAR
- Regulation of Doctoral Studies at ENU
- Sample dissertations

**Preliminary assessment and analysis of the peers:**
As described in the SAR, research work in the PhD in Nuclear Physics programme is carried out on the basis of the Regulation of Doctoral Studies. It includes drawing up a plan for the implementation of a doctoral dissertation, developing a plan for research-related focus, content, publications and internships in cooperation with a scientific supervisor and a foreign consultant. The latter provides guidance in terms of planning, methodology, registration, and presentation of research results.

For doctoral students, the intended proportion of research work is 68%, or 123 ECTS credits: of those, 97 ECTS credits are allocated to the dissertation, 20 ECTS credits to a foreign scientific internship, and 6 ECTS credits go to participation in conferences and scientific publications. The University indicates that the publication of research work in a journal with an impact factor is a mandatory component of the dissertation.

The expert panel also has the opportunity to review sample dissertations. Based on the provided evidence, the peers can see that the students demonstrate the ability to design and carry out an original research project at the forefront of the discipline. They are thereby able to contribute to the advancement of science and knowledge through original research and acquire advanced, cutting-edge knowledge of their research field. Recommendations for additional research areas are provided under criterion 1.3.

## Criterion D 2 Duration and Credits

**Evidence:**

- SAR
- Regulation of Doctoral Studies at ENU
- Sample dissertations

**Preliminary assessment and analysis of the peers:**
The structured doctoral programme in Nuclear Physics has a regular completion time of 3 years and 180 ECTS credits, including 25 credits of theoretical training, 20 credits of practice, 123 ECTS credits of research work, and 12 ECTS credits for the final assessment. The suggested programme length is appropriate. However, the provided information indicates that studies also require 4-6 years in a number of cases. ENU is asked to provide an explanation why this is the case, and to explain what measures it is implementing to reduce the number of students which exceed the regular study time. Furthermore, as with the other study programmes, the University should make efforts to corroborate the self-study time (see Criterion 2.2).

**Criterion D 3 Soft Skills and Mobility**

**Evidence:**

- SAR
- Regulation of Doctoral Studies at ENU
- Sample dissertations

**Preliminary assessment and analysis of the peers:**
With regards to soft skills, all PhD students are required to participate in a course on Academic Research and Writing, and must also be involved in pedagogical duties – the expert panel is however unclear what the pedagogical duties involve, and ask the University to provide a description. As indicated in the SAR, students in the PhD programme can participate in mobility as part of their dissertation-related research and can also attend advanced training courses. Mobility is financed by the national Ministry of Education and Science, via international exchange programmes and scholarships, or via the participant. A number of examples are provided where students participated in such courses at institutions in Kazakhstan, Central Asia and Europe. These experiences take place in the internship cycle of the programme. While the expert panel considers there to sufficient opportunities for career development and support, it believes (as with the other programmes) that the programme could benefit from more diverse mobility opportunities (see criterion 2.1).

**Criterion D 4 Supervision and Assessment**

**Evidence:**

- SAR
- Regulation of Doctoral Studies at ENU

**Preliminary assessment and analysis of the peers:**
Assessment- as well as other rules are provided in the Regulation for Doctoral Studies at ENU. Modules typically include mid-term and final exams. A transparent contractual framework of shared responsibilities between doctoral candidates, supervisors, and the institution is provided by the Regulation on Doctoral Studies. Following the discussions with the students, the expert panel is satisfied that adequate support and supervision is provided.

**Criterion D 5 Infrastructure**

**Evidence:**

- SAR
- Online discussions

**Preliminary assessment and analysis of the peers:**
As previously mentioned under criterion 4.3, the University itself does not possess advanced equipment, which can be used for PhD-level research. However, ENU works together with a number of research institutions (ex: Institute of Nuclear Physics) which provide access to this type of equipment. Following the discussions with the students, the expert panel is under the impression that the accessible equipment is adequate. ENU is asked to submit an English-language description of the cooperation agreements.

**Criterion D 6 Funding**

**Evidence:**

- SAR
- Regulation of Doctoral Studies at ENU
- Sample dissertations

**Preliminary assessment and analysis of the peers:**
As discussed under criterion 4.3, state grants are a primary source of funding, not only with regards to the direct education of students but also research projects. A number of such funded research projects involving students from the PhD programme are described in the SAR. Following the discussions, the expert panel is satisfied that there is an adequate and sustainable basis of funding for the programme.

**Criterion D 7 Quality Assurance**

**Evidence:**

- SAR
- Online discussions

**Preliminary assessment and analysis of the peers:**
As indicated in the SAR, students and teachers in the PhD programme also participate in surveys which aim to measure satisfaction. A sample survey is provided.

As indicated under criterion 6, the surveys should be adapted so that estimated self-study time can be corroborated. Furthermore, teachers should also have access to module-specific survey results and discuss these with their students.

**Final assessment of the peers after the comment of the Higher Education Institution regarding the additional criteria for structured doctoral programmes:**

In its response statement, the University provides some statistics concerning the periods in which students in the past cohorts have completed their studies. The peers are satisfied with the detailed information. It seems that most PhD students were able to finish the programme within the regular time and that problems with a publication in an indexed journal were responsible for a delay in some cases. The measures provided by the university to minimize such delays appear to be appropriate.

Concerning PhD students' pedagogical duties, the University provides a detailed description of intended learning outcomes and obligations of the involved parties. This reveals that students are assigned teaching posts where they should master the basic requirements of modern teaching and gain initial experience. The expert panel considers these to be in order.

With regards to mobility, the University adds that it has created an ambassador programme which supports students going abroad financially. The peers encourage the University to expand mobility options beyond Central Asia and Eastern Europe.

The University indicates that, while it wishes to expand its resources and equipment pool, the resources made available via partners are sufficient to provide training and enable scientific experiments. Among other agreements, English translations of cooperation agreements with the "Institute of Nuclear Physics", the "State University Dubna" and the "A.F.Tsyba Medical Radiological Research Center" in Obninsk were provided, which prove that doctoral studies of ENU PhD students can be performed at these institutions. These agreements ensure that ENU PhD students have access to advanced equipment, which is not available at ENU.

As indicated under criterion 6, the peers believe the feedback-loop must be systematically closed, and a process developed by which the estimated self-study hours of students are regularly corroborated.

Criteria partially fulfilled.

# D Additional Documents

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

D 1. (ASIIN 1.3) The University is asked to indicate all laws which impact or impose restrictions on the contents of the Bachelor, Master and PhD programmes in Nuclear Physics.

D 2. (ASIIN 2.1) Ba Mathematics - the expert panel notes that it may be possible to move a course from the first year into the second year and thereby create room for Linear Algebra. The University is asked to explain whether or not such a switch would be possible.

D 3. (ASIIN 4.3) The University is asked to provide a brief explanation (or translation) of each of the partnership agreements.

D 4. (ASIIN D2) Please provide an explanation of why many PhD students require more than the regular study time of 3 years to complete their studies, and explain which measures are being taken by the University to reduce the number of students exceeding the regular study time.

D 5. (ASIIN D3) Please provide a description of the pedagogical duties of the Nuclear Physics PhD students

# E Comment of the Higher Education Institution (19.07.2021)

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

- Report on the work based on the results of sociological research
- Assessment of satisfaction with learning conditions
- Agreement on the creation of an Artificial Intelligence Center
- Cooperation Agreements with Obninsk, INP Kazakhstan, Dubna
- Expert Opinions from the organisations SRC Factor and RG Damu
- Proposals for the Ba and PhD Nuclear Physics Programmes (Russian language)
- Module descriptions for all programmes in English

# F Summary: Peer recommendations (10.08.2021)

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

| **Degree Programme** | **ASIIN Seal** | **Maximum duration of accreditation** | **Subject-specific label** | **Maximum duration of accreditation** |
|---|---|---|---|---|
| Ba Nuclear Physics | With requirements for one year | 30.09.2028 | – | - |
| Ma Nuclear Physics | With requirements for one year | 30.09.2028 | – | - |
| PhD Nuclear Physics | With requirements for one year | 30.09.2027 | – | - |
| Ba Artificial Intelligence | With requirements for one year | 30.09.2027 | – | - |
| Ma Artificial Intelligence | With requirements for one year | 30.09.2027 | – | - |
| Ba Mathematics | With requirements for one year | 30.09.2028 | – | - |
| Ma Mathematics | With requirements for one year | 30.09.2028 | – | - |

## Requirements

**For all study programmes:**

A 1. (ASIIN 2.1) Devise and implement a process for determining whether the estimated workloads for self-study time are accurate.

A 2. (ASIIN 5.1) Module descriptions must be made available to stakeholders in the course language.

A 3. (ASIIN 3) Develop and implement specific rules regarding disability compensation measures, illness and / or mitigating circumstances.

A 4. (ASIIN 6) Ensure systematic closure of the feedback loop.

**For the Ba, Ma and PhD Nuclear Physics programmes:**

A 5. (ASIIN 5.1) The module descriptions must be revised so that they are in agreement with module contents and module-specific learning outcomes.

**For the Ba Nuclear Physics programmes:**

A 6. (ASIIN 2.1) Ensure that the programme structure enables all students to achieve all intended learning outcomes.

A 7. (ASIIN 2.1) Implement plans to ensure that a sufficient amount of Chemistry and Linear Algebra are among the compulsory course contents.

**For the Ba and Ma Mathematics programmes**

A 8. (ASIIN 1.3) Implement the plans to introduce electives with a focus on practical mathematical applications.

## Recommendations

**For all study programmes**

E 1. (ASIIN 2.1) It is recommended to expand the international exchange opportunities.

E 2. (ASIIN 4.1) It is recommended to give the teaching staff opportunities for sabbaticals.

E 3. (ASIIN 6) Implement additional formal processes for exchange with industry stakeholders to ensure agreement with labor market demands.

**For the Ba and Ma Mathematics programmes**

E 4. (ASIIN 4.1) It is recommended to increase the number of teaching staff with PhDs.

**For the Ba and Ma in AIT programmes**

E 5. (ASIIN 4.1) It is recommended to increase the number of AIT teaching staff.

**For the Ba, Ma and PhD in Nuclear Physics Programmes**

E 6. (ASIIN 1.3) It is recommended that the University implements courses which broaden the students' skill sets, so that they are able to work in related sectors.

E 7. (ASIIN 4.1) It is recommended to increase the number of lab staff and engineers.

E 8. (ASIIN 4.3) It is recommended to purchase additional advanced laboratory equipment according to the proposed procurement plan.

**For the PhD in Nuclear Physics**

E 9. (ASIIN 2.1) It is recommended to change compulsory modules in the PhD programme to electives.

# G Comment of the Technical Committees

## Technical Committee 04 – Informatics/Computer Science (10.09.2021)

*Assessment and analysis for the award of the ASIIN seal:*

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

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

| Degree Programme | ASIIN Seal | Maximum duration of accreditation | Subject-specific label | Maximum duration of accreditation |
|---|---|---|---|---|
| Ba Artificial Intelligence | With requirements for one year | 30.09.2027 | – | - |
| Ma Artificial Intelligence | With requirements for one year | 30.09.2027 | – | - |

## Technical Committee 12 – Mathematics (01.09.2021)

*Assessment and analysis for the award of the ASIIN seal:*

The Technical Committee discusses the procedure and agrees with the conditions and recommendations of the reviewers. However, it discusses an apparent contradiction which arises from the statements in the report and the curriculum. For example, the reviewers criticize in the report that Linear Algebra is not taught until the second year of study; a criticism that the Committee can understand and would require. However, in the curriculum submitted by the University, Linear Algebra is offered in the first semester.

The Technical Committee makes a tentative decision: the contradiction between the statements in the report and the curriculum should be reviewed and corrected if necessary. If Linear Algebra is indeed not taught until the second year of study, the facts shall be mandated as follows: "It must be ensured that linear algebra is already taught in the first semester."

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

| **Degree Programme** | **ASIIN Seal** | **Maximum duration of accreditation** | **Subject-specific label** | **Maximum duration of accreditation** |
|---|---|---|---|---|
| Ba Mathematics | With requirements for one year | 30.09.2028 | – | - |
| Ma Mathematics | With requirements for one year | 30.09.2028 | – | - |

## Requirements

**For all study programmes:**

A 1. (ASIIN 2.1) Devise and implement a process for determining whether the estimated workloads for self-study time are accurate.

A 2. (ASIIN 5.1) Module descriptions must be made available to stakeholders in the course language.

A 3. (ASIIN 3) Develop and implement specific rules regarding disability compensation measures, illness and / or mitigating circumstances.

A 4. (ASIIN 6) Ensure systematic closure of the feedback loop.

**For the Ba, Ma and PhD Nuclear Physics programmes:**

A 5. (ASIIN 5.1) The module descriptions must be revised so that they are in agreement with module contents and module-specific learning outcomes.

**For the Ba Nuclear Physics programmes:**

A 6. (ASIIN 2.1) Ensure that the programme structure enables all students to achieve all intended learning outcomes.

A 7. (ASIIN 2.1) Implement plans to ensure that a sufficient amount of Chemistry and Linear Algebra are among the compulsory course contents.

**For the Ba and Ma Mathematics programmes**

A 8. (ASIIN 1.3) Implement the plans to introduce electives with a focus on practical mathematical applications.

**For the Ba Mathematics programme**

A 9. (ASIIN 1.3) It must be ensured that Linear Algebra is taught in the first semester (TC 12).

## Recommendations

**For all study programmes**

E 1. (ASIIN 2.1) It is recommended to expand the international exchange opportunities.

E 2. (ASIIN 4.1) It is recommended to give the teaching staff opportunities for sabbaticals.

E 3. (ASIIN 6) Implement additional formal processes for exchange with industry stakeholders to ensure agreement with labor market demands.

**For the Ba and Ma Mathematics programmes**

E 4. (ASIIN 4.1) It is recommended to increase the number of teaching staff with PhDs.

**For the Ba and Ma in AIT programmes**

E 5. (ASIIN 4.1) It is recommended to increase the number of AIT teaching staff.

**For the Ba, Ma and PhD in Nuclear Physics Programmes**

E 6. (ASIIN 1.3) It is recommended that the University implements courses which broaden the students' skill sets, so that they are able to work in related sectors.

E 7. (ASIIN 4.1) It is recommended to increase the number of lab staff and engineers.

E 8. (ASIIN 4.3) It is recommended to purchase additional advanced laboratory equipment according to the proposed procurement plan.

**For the PhD in Nuclear Physics**

E 9. (ASIIN 2.1) It is recommended to change compulsory modules in the PhD programme to electives.

# Technical Committee 13 – Physics (06.01.2021)

*Assessment and analysis for the award of the ASIIN seal:*

The technical committee discusses the procedure and agrees with the assessment of the peers. However, it is mentioned in the report that the elective courses, particularly with regards to the PhD programme, could cover a wider range of nuclear physics. If the issue lies in a lack of teaching staff, the TC suggests to give students the opportunity to attend courses at other universities, possibly virtually. This should be added as a hint in the letter to the university.

The Technical Committee 13 – Physics recommends the award of the seals as follows:

| **Degree Programme** | **ASIIN Seal** | **Maximum duration of accreditation** | **Subject-specific label** | **Maximum duration of accreditation** |
|---|---|---|---|---|
| Ba Nuclear Physics | With requirements for one year | 30.09.2028 | – | - |
| Ma Nuclear Physics | With requirements for one year | 30.09.2028 | – | - |
| PhD Nuclear Physics | With requirements for one year | 30.09.2027 | – | - |

# H Decision of the Accreditation Commission (17.09.2021)

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

The Accreditation Commission discusses the procedure, in particular the peers' requirement to introduce practically-oriented contents in the Mathematics programmes. It considers this requirement appropriate. It notes that the elective disciplines proposed by the University in its response statement do not appear to comprise a set of individual modules, rather a collection of very specific mathematical topics. In the process of fulfilling the requirement, the University must therefore take care to combine these topics in a sensible fashion and form well-structured modules, which can then be offered as electives.

After further review, it is determined that the curriculum for the Ba Mathematics programme does in fact include Linear Algebra in the first semester. It appears that the confusion regarding this matter resulted from inconsistent terminology in the various translated curricula and module handbooks provided by the University (in some cases "Algebra" was used, in other cases "Linear Algebra". As a result, the Commission finds the additional requirement proposed by the TC 12 unnecessary. For the future, it urges the University to ensure accurate translation particularly of subject-specific contents.

In all other aspects, the Commission agrees with the findings of the peers' and the technical committees.

| **Degree Programme** | **ASIIN Seal** | **Maximum duration of accreditation** | **Subject-specific label** | **Maximum duration of accreditation** |
|---|---|---|---|---|
| Ba Nuclear Physics | With requirements for one year | 30.09.2028 | – | - |
| Ma Nuclear Physics | With requirements for one year | 30.09.2028 | – | - |
| PhD Nuclear Physics | With requirements for one year | 30.09.2026 | – | - |

| Degree Programme | ASIIN Seal | Maximum duration of accreditation | Subject-specific label | Maximum duration of accreditation |
|---|---|---|---|---|
| Ba Artificial Intelligence | With requirements for one year | 30.09.2026 | – | - |
| Ma Artificial Intelligence | With requirements for one year | 30.09.2026 | – | - |
| Ba Mathematics | With requirements for one year | 30.09.2028 | – | - |
| Ma Mathematics | With requirements for one year | 30.09.2028 | – | - |

## Requirements

**For all study programmes:**

A 1. (ASIIN 2.1) Devise and implement a process for determining whether the estimated workloads for self-study time are accurate.

A 2. (ASIIN 5.1) Module descriptions must be made available to stakeholders in the course language.

A 3. (ASIIN 3) Develop and implement specific rules regarding disability compensation measures, illness and / or mitigating circumstances.

A 4. (ASIIN 6) Ensure systematic closure of the feedback loop.

**For the Ba, Ma and PhD Nuclear Physics programmes:**

A 5. (ASIIN 5.1) The module descriptions must be revised so that they are in agreement with module contents and module-specific learning outcomes.

**For the Ba Nuclear Physics programmes:**

A 6. (ASIIN 2.1) Ensure that the programme structure enables all students to achieve all intended learning outcomes.

A 7. (ASIIN 2.1) Implement plans to ensure that a sufficient amount of Chemistry and Linear Algebra are among the compulsory course contents.

**For the Ba and Ma Mathematics programmes**

A 8. (ASIIN 1.3) Implement the plans to introduce electives with a focus on practical mathematical applications.

## Recommendations

**For all study programmes**

E 1. (ASIIN 2.1) It is recommended to expand the international exchange opportunities.

E 2. (ASIIN 4.1) It is recommended to give the teaching staff opportunities for sabbaticals.

E 3. (ASIIN 6) Implement additional formal processes for exchange with industry stakeholders to ensure agreement with labor market demands.

**For the Ba and Ma Mathematics programmes**

E 4. (ASIIN 4.1) It is recommended to increase the number of teaching staff with PhDs.

**For the Ba and Ma in AIT programmes**

E 5. (ASIIN 4.1) It is recommended to increase the number of AIT teaching staff.

**For the Ba, Ma and PhD in Nuclear Physics Programmes**

E 6. (ASIIN 1.3) It is recommended that the University implements courses which broaden the students' skill sets, so that they are able to work in related sectors.

E 7. (ASIIN 4.1) It is recommended to increase the number of lab staff and engineers.

E 8. (ASIIN 4.3) It is recommended to purchase additional advanced laboratory equipment according to the proposed procurement plan.

**For the PhD in Nuclear Physics**

E 9. (ASIIN 2.1) It is recommended to change compulsory modules in the PhD programme to electives.

# I Fulfilment of Requirements (23.09.2022)

## Analysis of the peers and the Technical Committees 12 - Mathematics and 13 – Physics (12.09.2022)

A 1. (ASIIN 2.1) Devise and implement a process for determining whether the estimated workloads for self-study time are accurate.

| **Initial Treatment** | |
|---|---|
| Peers | Fulfilled (3 votes)<br>Justification: In the order No. 1146 from 02.06.2022 approximate norms of time for different types of independent work of students are added to the academic policy of ENU<br>Partly fulfilled (1 vote)<br>Justification: The peer wants ENU to establish a loop to check-whether the estimates that they give in the presented documents are correct. The presented measures are a step in the right direction. |
| TC 04 | fulfilled<br>Vote: unanimous<br>Justification: The TC follows the majority of the peers and considers the requirement to be fulfilled. |
| TC 12 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the opinion of the majority of the peer panel. However, the TC adds a recommendation: It is recommended to implement a process for determining whether the estimated workloads for self-study time are accurate. |
| TC 13 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the justification of TC 12 and follows its assessment. |

A 2. (ASIIN 5.1) Module descriptions must be made available to stakeholders in the course language.

| **Initial Treatment** | |
|---|---|
| Peers | Fulfilled |

| | |
|---|---|
| | Justification: Module descriptions in English, Russian and Kazakh have been uploaded to the ENU website. |
| TC 04 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the opinion of the peer panel. |
| TC 12 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the opinion of the peer panel. |
| TC 13 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the opinion of the peer panel. |

A 3. (ASIIN 3) Develop and implement specific rules regarding disability compensation measures, illness and / or mitigating circumstances.

| **Initial Treatment** | |
|---|---|
| Peers | Fulfilled<br>Justification:<br>With order Nr. 1147 from 02.06.2022 a corresponding paragraph has been added to the regulations of exams and other assessments. |
| TC 04 | fulfilled<br>Vote: unanimous<br>Justification: The TC follows the assessment of the peers without any changes. |
| TC 12 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the opinion of the peer panel. |
| TC 13 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the opinion of the peer panel. |

A 4. (ASIIN 6) Ensure systematic closure of the feedback loop.

| **Initial Treatment** | |
|---|---|
| Peers | Fulfilled (3 votes)<br>Justification: With the second edition of the Survey Guide from 04.07.2022 the feedback loop becomes closed now.<br><br>Not completely fulfilled (1 vote)<br>Justification: New measures have been introduced but it still remains unclear where the loop is closing, i.e. where the feedback |

| | |
|---|---|
| | is being returned to the students who were involved in the evaluation process. The survey guide stipulates that students are informed about the measures derived, but not about the results of the surveys. |
| TC 04 | fulfilled<br>Vote: unanimous<br>Justification: The TC follows the majority of the peers and considers the requirement to be fulfilled. |
| TC 12 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the opinion of the majority of the peer panel. However, the TC adds a recommendation: It is recommended to regularly review the systematic closure of the feedback loop. |
| TC 13 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the justification of TC 12 and follows its assessment. |

**For the Ba, Ma and PhD Nuclear Physics programmes:**

A 5. (ASIIN 5.1) The module descriptions must be revised so that they are in agreement with module contents and module-specific learning outcomes.

| **Initial Treatment** | |
|---|---|
| Peers | Fulfilled (1 vote)<br>Justification: The module descriptions of the corresponding programmes have been revised.<br>Fulfilled for PhD Nuclear Phyics Programme;<br>Not completely fulfilled for BaMa Nucelar Physics Programmes (3 votes)<br>Justification:<br><br>**<u>For the Ba Nuclear Physics Programme:</u>**<br>In some of the module descriptions the module contents and/or the reading lists do not fit to the module title and module-specific learning outcomes:<br><br><u>Module 19: The theory of probability</u> |

| | |
|---|---|
| | The reading list is the same as that of Module 20 (Analytic geometry and linear algebra) and does not fit to the content of Module 19.<br><br><u>Module 23: Methods of mathematical physics</u><br><u>Module 24: Equations of mathematical physics</u><br>Both Modules have identical reading lists. The description of the contents of both Modules is not specific enough to judge whether there is any difference between these Modules.<br><br><u>Module 29: Electricity and magnetism</u><br><u>Module 30: Physics of electrical and magnetic phenomena</u><br>The learning outcomes, contents and reading lists of both Modules are identical.<br><br><u>Module 43: General chemistry</u><br>The content and the reading list do not fit to the title of this module (see A7)<br><br><u>Module 57: Physical bases of nuclear medicine</u><br><u>Module 58: The use of nuclear facilities in medicine</u><br>These two modules have the same reading list as Module 59: Basics physics of nanosystems.<br>The following reading list fits to Module 59, but not to Module 57 and 58:<br>1. Nanotechnology in the next decade. Forecast research directions. Collected under red. M.K.Roko, R.S.Uilyamsa and P.Alivisatosa, Wiley, New York, 2002 2. Ch.Pul, F.Ouens, Nanotechnology (2nd ed.), M., Technosphere, 2005, 334 pp. 3. N.Koboyasi, Introduction to nanotechnology, M., BINOM. Knowledge Laboratory, 2005 4. A.I.Gusev, nanomaterials, nanostructures, nanotechnology, M., FIZMATLIT, 2005, 416 V.Mironov "Fundamentals of the scanning probe microscopy," M. Technosphere, 2005, 144 5. A.A.Abramyan and other basics of applied nanotechnology. Moscow, 2007. 6. Y.Imri, Introduction to mesoscopic physics, M., FIZMATLIT, 2002, 304 pages 7. VO Nesterenko "Atomic Clusters as a new area of application of the ideas and methods of nuclear physics", Nuclei, 23 (6), 1665 (1992).<br><br><u>Module 63: Radiation safety</u><br>Neither the learning outcome nor the content or the reading list are in accordance with the Module title. There is no relationship with radiation safety.<br>Learning outcome: |

| | |
|---|---|
| | the ability to apply the knowledge of the theoretical and experimental fundamentals of nuclear physics and nuclear technologies, nuclear physics research methods, planning methods, organization and maintenance of research and production, scientific and pedagogical, production and technical, experimental and design work in the field of nuclear physics technologies and nuclear energy.<br>Content:<br>Nuclear power is currently developing very rapidly. Nuclear power generating units of VVER-1000 rightly considered one of the safest and most reliable in the world. For the coming years is scheduled commissioning of several new units and, moreover, extended life of existing units at all plants. In this regard, now there is clear lack of qualified specialists This discipline is necessary future nuclear physicist yes and all other physicists, as it is the base for all other branches of physics and fundamental discipline for the entire technology in general.<br>Reading list:<br>1. Nuclear Physics. V.2. Nuclear reactions: a tutorial / MA Zhusupov; A.V.Yushkov.- Almaty: Kazakh University, 2007.- 246 p. 2. Berkovskii VB, Gavrilin Yu, GM Gulko, Il'ichev SV Kryuchkov VP, Likhtarev IA, Nosovskii AV Collection techniques yes retrospective recovery doses of the accident at the Chernobyl nuclear power plant. - Kiev, 1995. 3. Borovoy AA, Vasil'chenko VN, Nosovskii AV, AA Popov, VG Sherbina The concept of radiation monitoring software "Chernobyl NPP" and the basic technical requirements for the system of Kazakhstan. - Chernobyl, 1993. 4. Rocket engines and power plants based on gas-phase nuclear reactor [Text] = Rocket engines and powerplants based on gas-core nuclear reactor / AS Koroteev, AB Stranger, VM Martishin; Ed. AS Koroteeva.- Moscow: Machinery, 2002.- 432p.<br><br><u>Module 51: Hydrogen energy and nanostructured materials</u><br>Neither the learning outcome nor the content or the reading list are in accordance with the Module title. There is almost no relationship with hydrogen energy or nanostructured materials.<br>Learning outcomes:<br>the ability to apply the knowledge of the theoretical and experimental fundamentals of nuclear physics and nuclear technologies, nuclear physics research methods, planning methods, organization and maintenance of research and production, scientific and pedagogical, production and technical, experimental and design work in the field of nuclear physics technologies and nuclear energy.<br>Content: |

| | |
|---|---|
| | Fundamentals of Solid-State Physics. The structure and symmetry of solids. Band theory of semiconductors and dielectrics. Semiconductors. Specific properties of semiconductor materials. Model representations of the conductivity mechanism of intrinsic and extrinsic semiconductors. Elementary theory of electrical conductivity of semiconductors. Lattice defects. Physical phenomena in solids. Contact phenomena. Thermoelectric phenomena. Optical properties of semiconductors. Reflectance spectrum and the absorption spectrum. Selfabsorption in the direct and indirect transitions. Exciton absorption. Lowdimensional systems. Nanostructured materials.<br>Reading list:<br>1. Ashcroft NV, ND Mermin Solid-state body- M .: Mir, 1990.- V.1. - 409. 2. Tsvelik AM Quantum field theory in condensed matter physics. - M .: FIZMATLIT, 2002.- 320 p. 3. Kvasov NT Physics of Condensed state.- Minsk BSUIR, 2003. - 80 p. 4. Troyan VI et al. Physical basis of research techniques of nanostructures and solid surface. Moscow Engineering Physics Institute, 2008. - 260 p. 5. Gasumyants VE, Lykov SN et al. Size quantization. Part 2: Optical and transport properties of semiconductor nanostructures. Uch-s manual., 2010-242 with. 6. Voronov VK, Podoplelov AV, Sagdeev RZ Physics at the turn of the millennium. Physical Basis of Nanotechnology. -M .: LIBROKOM, 2011. - 432 p.<br><br><u>Module 52: Radiation solid state physics</u><br>The learning outcomes, the content and the reading list are identical with those of Module 51, but they also do not fit to the title of the module.<br><br><u>Module 53: Elementary particle physics</u><br>The reading list is missing. There are many textbooks on this topic available.<br><br><u>Module 68: Heavy Ion Physics and Module 69: Exotic Nuclei</u><br>These two modules have the same learning outcome, content and reading list.<br>Content:<br>Features of the interaction of heavy ions with nuclei classification reactions. Coulomb excitation of nuclear levels. Elastic scattering of heavy ions on nuclei. Of the direct interaction. Fusion reaction and fission. Beams of radioactive nuclei. Nuclear Astrophysics. Applied Nuclear Physics. Nuclear Methods and Astrophysics.Synthesis of new elements. Development of accelerator technology heavy ions. Cyclotron, DC -60, synchrotron. |

| | |
|---|---|
| | Module 70: Physical Principles of Applied Nuclear Physics<br>The reading list is missing. There are many textbooks on this topic available.<br><br>**For the Ma Nuclear Physics programme:**<br>The phenomenon of Modules with different titles but identical learning outcomes and contents appears in the Master programme as well for the following Modules:<br><br>Semester 1:<br>Module 4 (Nuclear fission) and Module 5 (Alpha-, beta- and gamma-decays of nuclei).<br>Module 6 (Neutrons and gamma quanta) and Module 7 (Statistical model and thermodynamical properties of nuclei).<br>Module 8 (Detecting equipment of nuclear physical experiment) and Module 9 (Electronics of nuclear physical experiment).<br><br>Semester 2:<br>Module 13 (Cosmic Ray Physics) and Module 14 (Nucleosynthesis).<br>Module 15 (Physical principles of radiation diagnostics and therapy) and Module 16 (Physical principles of radionuclide diagnostics and therapy).<br><br>Semester 3:<br>Module 19 (Methods of nuclear physical experiments) and Module 20 (Devices and techniques of nuclear experiments).<br>Module 21 (Statement of nuclear physics experiments in the study of exotic nuclei and correlation) and Module 22 (Accumulation and processing of experimental data in nuclear physics).<br>Module 23 (Physics and theory of nuclear reactors) and Module 24 (Mechanism of interaction of light ions of low energies with atomic nuclei).<br><br>It seems that in each semester there are two or three pairs of identical electives, but with different titles. Since the difference between the modules within one module pair is not clear, it is proposed to merge these two modules respectively.<br><br>There is only one responsible teacher for all modules within the Master programme (A.A. Temerbaev).<br><br>Reading lists are missing – there is a reference to the library catalogue, but specific textbooks are not outlined. |

| | |
|---|---|
| | **PhD Nuclear Physics Programme**<br>The module descriptions are in agreement with module contents and module-specific learning outcomes. |
| TC 13 | not for all programmes fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the detailed assessment submitted by one of the peers and considers the requirement to be fulfilled for the PhD programme and not fulfilled for the Ba and Ma programme. |

**For the Ba Nuclear Physics programmes:**

A 6. (ASIIN 2.1) Ensure that the programme structure enables all students to achieve all intended learning outcomes.

| **Initial Treatment** | |
|---|---|
| Peers | Not completely fulfilled<br>Justification:<br>**Module 32 "Optics" and Module 33 "Wave optics"** (each one of two electives in Sem. 4) have the same learning outcomes and contents according to the Module Handbook:<br><br>Learning outcomes:<br>To be familiar with the basic laws of optics and be able to solve the typical problems and analyze the results of experiments<br><br>Content:<br>During the study of this Module, students form a physical approach to the surrounding natural world, which has no fundamental, normal, contradictory in terms of logic conclusions; familiar with the concepts of the basic optical phenomena and processes in nature from the point of view of classical physics. Basic understanding of optics and the history of their development, electromagnetic waves, photometry, coherence, methods for producing coherent beams, interference optical phenomena multibeam interferometry method zones Fresnel diffraction, Fraunhofer diffraction, diffraction grating diffraction spatial structures, holography, the basics of geometrical optics, optical system, the interaction of electromagnetic waves with matter, light polarization, propagation of electromagnetic waves in an anisotropic field, interference of polarized rays, artificial anisotropy, rotation of the plane of polarization, dispersion of light, light absorption, light scattering, thermal radiation, the effect of |

| | |
|---|---|
| | light, the photoelectric effect, the propagation of light in moving media, optical lasers, quantum electronics, nonlinear optics.<br><br>The only difference is the module name. This suggests that the student have no real choice, the module is compulsory. In this was it is ensured that the students acquire adequate knowledge in optics, but on the expenses of a real choice between different modules.<br><br>This phenomenon has been discovered with other electives as well, such as<br><br>**Module 68: Heavy Ion Physics and Module 69: Exotic Nuclei**<br>**Module 23: Methods of mathematical physics and Module 24: Equations of mathematical physics**<br>**Module 29: Electricity and magnetism and Module 30: Physics of electrical and magnetic phenomena**<br><br>Those questionable pairs of elective Modules may pretend more choice possibilities for students than really exist. On the other hand, they ensure that all students will achieve the essential competences envisaged in this study programme. |
| TC 13 | Not completely fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the opinion of the peer panel. |

A 7. (ASIIN 2.1) Implement plans to ensure that a sufficient amount of Chemistry and Linear Algebra are among the compulsory course contents.

| **Initial Treatment** | |
|---|---|
| Peers | Fulfilled.<br>Justification: Chemistry is now a compulsory course. Linear algebra as a part of the module “Analytic geometry and linear algebra” is an elective course (competing with “Theory of Probability”). But this is acceptable – at least a part of student will have the chance to learn the methods of linear algebra (e.g. matrix calculus, systems of linear equations).<br><br>There is another problem with the course “General chemistry”: Module content and reading list do not fit to learning outcomes: Learning outcomes: |

| | |
|---|---|
| | This Module forms the basic concepts of the structure of the atom, chemical bonding, thermodynamics and kinetics of chemical reactions, the theory of solutions, coordination theory, and basic concepts in general chemistry. In addition, they determine the dependence of the properties of elements, the properties of simple and complex substances on the electronic structure of atoms and the type of chemical bonds in compounds.<br>Content:<br>Basics of nanotechnology. History of the development of nanotechnology. Types of nanostructures. Nanostructure formation technology. Methods of study of nanostructures. Basic properties of nanostructures. The application of nanotechnology in the art. Protection of human health and environment. Prospects of nanotechnology. Physics of Nanosystems. Atomic nuclei and their comparison with nanosystems. Electronic Nanosystems. Bose-Einstein condensate. Optical gratings. Variety of nanostructures. Nanoparticles for biomedical applications. A brief overview of theoretical models.<br>Reading list:<br>1. Nanotechnology in the next decade. Forecast research directions. Collected under red. M.K.Roko, R.S.Uilyamsa and P.Alivisatosa, Wiley, New York, 2002 2. Ch.Pul, F.Ouens, Nanotechnology (2nd ed.), M., Technosphere, 2005, 334 pp. 3. N.Koboyasi, Introduction to nanotechnology, M., BINOM. Knowledge Laboratory, 2005 4. A.I.Gusev, nanomaterials, nanostructures, nanotechnology, M., FIZMATLIT, 2005, 416 5. V.Mironov "Fundamentals of the scanning probe microscopy," M. Technosphere, 2005, 144 6. A.A.Abramyan and other basics of applied nanotechnology. Moscow, 2007. 7. Y.Imri, Introduction to mesoscopic physics, M., FIZMATLIT, 2002, 304 pages 8. VO Nesterenko "Atomic Clusters as a new area of application of the ideas and methods of nuclear physics", Nuclei, 23 (6), 1665 (1992).<br>It is recommended to change the description of content and the reading list! |
| TC 13 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the opinion of the peer panel. |

**For the Ba and Ma Mathematics programmes**

A 9. (ASIIN 1.3) Implement the plans to introduce electives with a focus on practical mathematical applications.

| **Initial Treatment** | |
|---|---|
| Peers | Fulfilled<br>Justification: With the implementation of additional elective modules related to practical applications the requirement is fulfilled. |
| TC 12 | fulfilled<br>Vote: unanimous<br>Justification: The TC agrees with the opinion of the peer panel. |

# Decision of the Accreditation Commission (23.09.2022)

The accreditation commission discusses the procedure and follows the assessment of the peers and the technical committees 04, 12 and 13.

The Accreditation Commission decides to award the following seals:

| **Degree programme** | **ASIIN-label** | **Subject-specific label** | **Accreditation until max.** |
|---|---|---|---|
| Ba Artificial Intelligence Technologies | All requirements fulfilled | | 30.09.2026 |
| Ma Artificial Intelligence Technologies | All requirements fulfilled | | 30.09.2026 |
| Ba Mathematics | All requirements fulfilled | | 30.09.2028 |
| Ma Mathematics | All requirements fulfilled | | 30.09.2028 |
| Ba Nuclear Physics | A5., A 6. Not fulfilled | | Prolongation |
| Ma Nuclear Physics | A5. Not fulfilled | | Prolongation |
| PhD Nuclear Physics | All requirements fulfilled | | 30.09.2026 |