

## APPLICATION

Study field "Physics, Material Science, Mathematics, and Statistics" for  
assessment

Study field	<i>Physics, Material Science, Mathematics, and Statistics</i>
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# **Self-evaluation report**

Study field "Physics, Material Science, Mathematics, and  
Statistics"

Daugavpils University

<b>Self-evaluation report</b> .....	2
<b>Study field</b> .....	4
1. Information on the Higher Education Institution/College .....	4
2.1. Management of the Study Field .....	14
2.2. Efficiency of the Internal Quality Assurance System .....	27
2.3. Resources and Provision of the Study Field .....	37
2.4. Scientific Research and Artistic Creation .....	49
2.5. Cooperation and Internationalisation .....	55
2.6. Implementation of the Recommendations Received During the Previous Assessment Procedures .....	59
<b>Annexes</b> .....	62
<b>Other annexes</b> .....	64
<b>Mathematics (51460)</b> .....	65
<b>Study programme</b> .....	68
3.1. Indicators Describing the Study Programme .....	68
3.2. The Content of Studies and Implementation Thereof .....	72
3.3. Resources and Provision of the Study Programme .....	79
3.4. Teaching Staff .....	81
<b>Annexes</b> .....	85
<b>Solid State Physics (51443)</b> .....	86
<b>Study programme</b> .....	89
3.1. Indicators Describing the Study Programme .....	89
3.2. The Content of Studies and Implementation Thereof .....	95
3.3. Resources and Provision of the Study Programme .....	103
3.4. Teaching Staff .....	106
<b>Annexes</b> .....	111
<b>Physics (45443)</b> .....	112
<b>Study programme</b> .....	116
3.1. Indicators Describing the Study Programme .....	116
3.2. The Content of Studies and Implementation Thereof .....	122
3.3. Resources and Provision of the Study Programme .....	130
3.4. Teaching Staff .....	131
<b>Annexes</b> .....	136

# 1. Information on the Higher Education Institution/College

## 1.1. Basic information on the higher education institution/ college and its strategic development fields,.

### Brief characteristics of Daugavpils University

Daugavpils University (henceforth - DU) is a significant centre of science and education in Daugavpils and East Latvia. DU is a modern science-based university that offers high quality education, prepares highly qualified specialists and professionals, greatly contributes to science innovation and transfer of scientific ideas to broader public and national economy. DU is the only university in Latgale that performs the functions of the driving force for the development of the region of East Latvia and its adjacent territories, it concentrates major intellectual and technical resources in the region. DU has gained international recognition by joining the European University Association, European International Studies Association, European Union Universities of Small States Association, and European Science Events Association.

### Daugavpils University mission and vision

**DU mission:** to contribute to the development of sustainable future society by implementing scientific research on an international level and ensuring high quality education in the fields of natural, engineering, education, health, humanities and social sciences, thus promoting the sustainable development of Latgale region and the whole country.

**DU vision:** In 2030 DU is a modern scientific university that offers high quality education and conducts important scientific work. The quality of the University work and its reputation in Latvia and all over the world has provided the basis for its growth and stability. DU has become a driving force of the educational, scientific, innovation and business development in Eastern Latvia. DU functions as an excellence centre in the fields of mathematics, physics, nano-materials, material engineering, biology, regional studies, literature, art, and education science. DU accumulates, preserves, and maintains regional knowledge and contributes greatly to the regional development.

### Main objectives of DU activity:

1. to act as a regional university in the spheres of natural sciences, humanities, education and social sciences creating opportunities for diversified high quality studies and research;
2. to provide high quality study programmes and conduct research in compliance with the dynamics of labour market demands and needs of the community;
3. to create opportunities for enhancing the professional mobility of the population by developing further education;
4. to develop personality capable of analytical thinking, critical perception, and creative processing of information, who can, due to the acquired education, contribute to the development of the state and region of Latvia and the welfare of the population;
5. to preserve and develop Latvian national identity and culture legacy, simultaneously entering international integration;
6. to implement interior quality provision systems that build policy and procedures for the provision of the higher education quality.

### DU strategic areas of specialization

According to the order of the Cabinet of Ministers of June 21, 2022 no. 449 "On strategic

specialization of state universities" (<https://likumi.lv/ta/id/333471-par-valsts-augstskolu-strategisko-specializaciju> - available in Latvian), three areas of strategic specialization are defined in DU:

- natural sciences;
- social Sciences;
- humanities and artistic sciences.

DU, implementing its studies and research activities in accordance with the areas of strategic specialization defined for it in paragraph 1 of this order, implements interdisciplinary studies, research and innovations, as well as cooperation with the business sector.

The university has the right to implement study programs and research activities also outside the initial areas of strategic specialization specified in this order, in accordance with Article 4 of the Law on Universities.

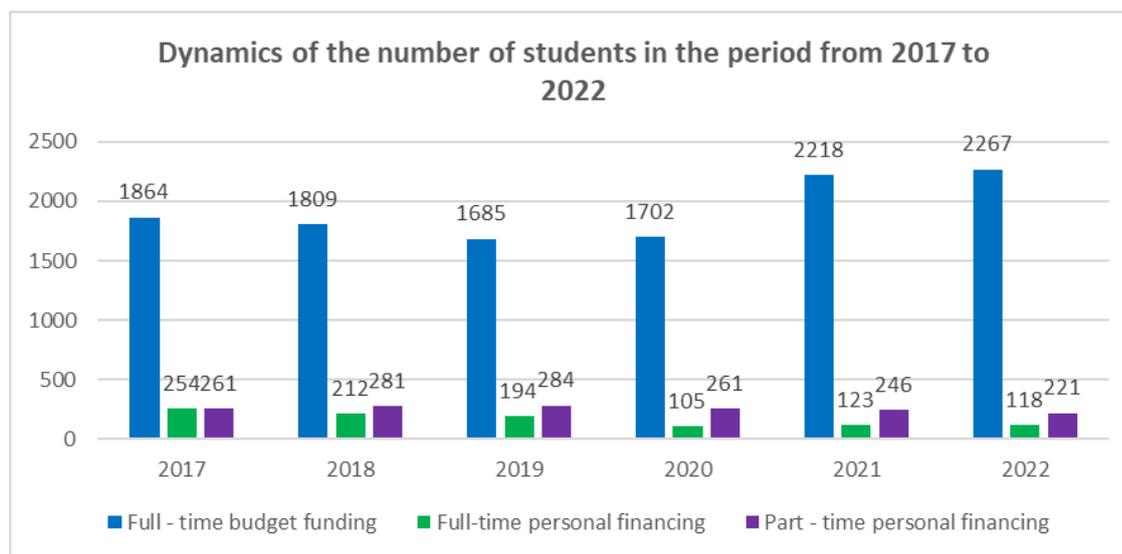
### **Implemented study directions and the number of study programmes within them**

**Study process at DU is implemented in 16 study directions:** "Education, pedagogy, and sports" (7 study programmes), "Art" (5 study programmes), "History and philosophy " (3 study programmes), "Language and culture studies, native language studies and language programmes " (5 study programmes), "Translation" (1 study programme), "Psychology" (3 study programmes), "Economics" (3 study programmes), "Management, administration, and real estate management" (3 study programmes), "Law" (3 study programmes), "Life sciences" (3 study programmes), "Chemistry, Chemical Technologies and Biotechnologies" (2 study programmes), "Physics, material science, mathematics, and statistics" (3 study programmes), "Information technologies, computer technology, electronics, telecommunications, computer management, and computer science" (3 study programmes), "Health care" (2 study programme), "Environment protection" (2 study programmes), " Internal Security and Civil Protection " (3 study programmes).

### **The dynamics of student number at Daugavpils University in the period of assessment**

In accordance with the Ministry of Education and Science "Survey of higher education in Latvia in 2021" (<https://www.izm.gov.lv/lv/media/18744/download?attachment> - available in Latvian), DU occupies 5th place among Latvian higher education institutions as to the number of students. DU provides higher education not only to East Latvia region represented by the majority of DU students but to other regions of Latvia and labour market of foreign countries.

Assessment of the dynamics of the student number in the time period from 2017 to 2022 (Figure 1) leads to a conclusion that the number of students at DU has remained steady and even increased in 2021, despite the long-term decline and emigration of the population in Latgale and Latvia. According to the informative material "Summary: Economic and labor market trends", in the following years the number of the population of Latvia will keep diminishing (<https://prognozes.em.gov.lv/en>). The main reasons of this process include aging of the society, durably low birth rate and emigration of the population (<https://www.em.gov.lv/lv/media/598/download> - available in Latvian). Due to economic reasons, more and more secondary school leavers choose to study or get employed outside Latvia, therefore state funded budget places are not filled and the fall of the number of students concerns almost all higher education institutions.



**Figure 1.** Dynamics of the number of students in the period from 2017 to 2021. Displayed data for October 1 of the respective year.

In order to attract students in the current conditions, Daugavpils University is developing new competitive study programmes, for example, in 2021, one of such study programmes was the professional Bachelor's study programme "Nursing", in turn, in 2022 – professional Master's study programme "Economic security".

Enlarging of the number of foreign students is one of the priority goals of DU. For the purpose of internationalization of studies, 26 study programmes are offered in English. In the time period from 2016 to 2022, there were 615 students from abroad at DU. Most of foreign students at DU are citizens of Russia, Uzbekistan, Kazakhstan, Tajikistan, Belarus, China, USA, Israel, Finland, Italy, Ukraine, Philippines and Indonesia. 3 – 4 times a year DU representative participate in higher education exhibitions in Belarus, Uzbekistan, Kazakhstan, as well as cooperate with higher education institutions and education institutions in foreign countries to inform of the current offer of study programmes, establish contacts with foreign universities for elaboration of joint programmes, to facilitate the attracting of foreign students and the academic staff.

### **Daugavpils University development strategy major goals and activity directions**

DU development goals are envisaged by "Daugavpils University development strategy for 2015-2020" (henceforth – Strategy, the summary of the strategy in English: <https://du.lv/wp-content/uploads/2022/09/DU-Strategy-summary-1.pdf>).

Based on letter No. 4-10e/21/99 "On Development Strategies of Institutions" issued by the Ministry of Education and Science on 11.01.2021, for the implementation of nationally mutually harmonized education and science policy and successful implementation of the ongoing reforms, by the decision of the DU Senate (Protocol No.1 of the DU Senate meeting of January 25, 2021) the period of "Daugavpils University Development Strategy 2015-2020" has been extended until the start of a new approved strategy (2023).

**Strategy general goal is** developing Daugavpils University as academic traditions based, modern, and competitive study, scientific, and innovation centre.

### **Strategy determines the medium-term goals:**

1. To provide high quality education that corresponds with future challenges and is based on theoretical knowledge and acquiring of research skills, preparing internationally competitive

specialists, developing their abilities and encouraging life-long learning.

2. To develop scientific and creative work on an international level, deepening integration of scientific research in the study process, facilitating technology transfer and development of innovations and contributing to public understanding of the science.
3. To increase the role of Daugavpils University as a consolidator of scientific educational institutions in Eastern Latvia and a driving force of the development, as well as to promote the reputation of the University in Latvia and all over the world.
4. To ensure united and efficient work of organisational structure and to introduce a quality management system.
5. To develop a modern, environmentally friendly infrastructure, safe and supporting working environment.

**1.2. Description of the management structure of the higher education institution/ college, the main institutions involved in the decision-making process, their composition (percentage depending on the position, for instance, the academic staff, administrative staff members, students), and the powers of these institutions.**

DU is a derived public person. DU is state founded and acts as an autonomous self-governing institution. Decision about reorganization or liquidation of DU is made by the Cabinet of Ministers on the proposal of the Minister of education and science.

DU self-governing is based on the rights and opportunities of the staff to engage in academic and scientific, administrative, and economic decision-making. DU acts on the basis of the Constitution of the Republic of Latvia, Law on Education, Law on Scientific Activity, Law on Higher Education Institutions, DU Constitution, and other laws and regulations.

**DU major decision-making institutions are: Daugavpils University Council, Constitutional Assembly, Senate, rector, Academic Court of Arbitration.**

In 2022, the **Daugavpils University Council** was approved – the highest decision-making body of the University, which is responsible for the sustainable development, strategic and financial supervision of the University, as well as supervises the activities of the Rector of the University and ensures the University's activities in accordance with the goals set in its development strategy. The Council is established in the composition of 7 (seven) members, of which 3 (three) members of the Council are nominated by the University Senate, 3 (three) are nominated by the Cabinet of Ministers of the Republic of Latvia, and 1 (one) by the President of the Republic of Latvia. The Council operates in accordance with the regulations of the Daugavpils University Council (available in Latvian only: [https://du.lv/wp-content/uploads/2022/09/Padomes-nolikums\\_25.08.2022..pdf](https://du.lv/wp-content/uploads/2022/09/Padomes-nolikums_25.08.2022..pdf)).

**DU Constitutional Assembly** (Satversmes sapulce) is the academic, general staff and student representative body of DU, which is elected for three years by secret ballot, from professors and other academic staff - 35 representatives (70%), students - 10 representatives (20%), and general staff - 5 representatives (10%). The Constitutional Assembly decides on the adoption, amendment, or repeal of the Constitution (Satversme); The Constitutional Assembly adopts and makes amendments to the Regulation of the Senate, elects the Senate, calls off the members of the Senate; elects the rector to the position and can initiate the removal of the rector from the position, listens to the rector's report; elects the Academic Arbitration Court and approves its regulation. The Constituent Assembly has the right to accept for examination and decision also other conceptual issues of operation and development of Daugavpils University.

**DU Senate** is a collegial higher academic decision-making body, which is responsible for the excellence, development and compliance of DU with internationally recognized quality standards of education, research, creative activity. The Senate regulates the academic, creative, and scientific spheres of DU. The Senate operates in accordance with the procedures established in the DU Constitution and the regulations approved by the Senate. Within the autonomy of the university, the Senate protects and ensures the academic freedom of the academic staff and students. The Senate is elected by the Constituent Assembly for three years. The Senate consists of 15 members - 11 representatives from the academic staff of DU elected by the Constitutional Assembly, 3 student representatives elected by the student self-government and approved by the Senate, as well as the rector in accordance with the position held and in accordance with the Act on Higher Education Institutions. The students represented in the Senate of DU have the delaying veto right in matters related to the interests of the students.

The highest official of DU is the **rector**. Candidates for the post of rector are selected within an open international competition by the university Council and elected by DU Constitutional Assembly. The rector administrates the university and is responsible for the achievement of the goals set in the university development strategy, as well as efficient and lawful use of the university's financial resources in accordance with the law, other regulatory enactments, as well as the university's Constitution, the decisions of the Council and the Senate. The rector carries out representative functions of the university, performs other activities to ensure successful operation of the university and represents the university in cooperation with other institutions and private individuals, within the scope of rector's competence bearing responsibility for the compliance of the university's activities with the Act of HEI and other regulatory acts.

**The Academic Arbitration Court** examines applications by DU students and academic staff regarding restrictions or violations of academic freedom and rights stipulated in the DU Constitution; examines disputes between DU officials, as well as administrative institutions of DU structural units, which are in a subordinate relationship; examines, in the cases specified in the Act on HEI, submissions on challenging administrative acts or actual actions and makes relevant decisions on them, as well as performs other tasks provided for in the DU Constitution. The Academic Arbitration Court is elected for three years in the composition of seven people, including four representatives from among the academic staff by secret ballot by the Constitutional Assembly, three student representatives by the student self-government.

**Council of Studies** is a management authority that supervises issues of study planning, organizing, and coordinating, provides the necessary conditions for the academic work at faculties and departments. Council of Studies includes vice rector for studies, faculty deans, and the head of the Department of Studies. Main duties of the Council of Studies are coordinating the elaboration and execution of bachelor, master, and professional study programmes, elaboration of the scheme of studies, its analysis and determining the main directions of its improvement and development, organizing the investigation and implementation of foreign countries' experience.

**Council of Science** is an institution of representation of branches and sub-branches of science that coordinates the scientific work at the university. Main functions of DU Council of Science are supervising the elaboration and implementation of DU strategy, science development process, allocation of funds for science, execution of promotion, and the work of professor councils. DU Council of Science consists of vice rector for science, head of the Department of Science, representatives delegated from each scientific institute council, a representative from professors delegated by faculty in case the faculty has no institute or no institute council, DU Young Scientist Association representative.

**Faculty council** supervises the study, scientific and/or artistic work and economic activity of the

faculty. The configuration of council corresponds to the requirements of the promotion council in the respective branch or sub-branch of science and no less than a half of its members must be professors, associate professors, senior researchers, and experts approved by Latvian Council of Science. The council is formed of the chairperson of the council, deputy chairperson of the council, and council members. The council includes the dean; deputy dean/s and/or education methodologist; heads of departments, institutes, centres and other faculty structural units; it may include study programme directors, representatives of the academic staff from the structural units; student representatives that are delegated by the faculty student self-governance (20% of the council members).

**Study direction council** is formed upon the recommendation of DU Council of Studies and approved by DU Senate. The members of the Study direction council are approved by DU Council of Studies. Study direction council includes study direction programme directors, the academic staff, students (at least one representative from 1st level professional education programme, bachelor, master, and doctoral study programmes) and representatives of employers. Functions of the council are: to elaborate the study programme/s of the study direction; execute the direction study programme self-assessment and implementation analysis; analyze students' academic performance; analyze the academic work of the academic staff involved in the study direction; facilitate the integration of scientific work in the study programme.

### **1.3. Description of the mechanism for the implementation of the quality policy and the procedures for the assurance of the quality of higher education. Description of the stakeholders involved in the development and improvement of the quality assurance system and their role in these processes.**

Quality ensuring policy is part of Daugavpils University development strategy for 2015-2020.

DU study quality management system observes the compliance with ISO 9001:2017 quality standard. Compliance with this standard testifies to the fact that DU tends for the quality of its education services by maintaining the quality management system (QMS), periodically passing accreditation and verifying the efficiency of the system. QMS testifies that DU makes an effort to make out the preferences of the potential students, tends to maintain constantly good quality of studies and governance and ensure systematic and transparent processes as well as incessantly improve cooperation with cooperation partners and community.

The envisaged outcomes of DU implemented ESF project "Daugavpils University governance and management competence improvement" (No. 8.2.3.0/18/A/010) are - adjust DU study and governance quality systems and receive ISO 9001 certificate that is an internationally recognized organization quality mark.

DU Council of Studies and DU Centre of Study Quality Assessment (henceforth - CSQA) introduces quality provision systems on the basis of "DU study internal quality assurance policy" (see "Other Annexes", <https://du.lv/en/about-us/documents/> - available in Latvian). The policy has been elaborated in accordance with *The Standards and guidelines for quality assurance in the European Higher Education Area* (ESG) and observing legal acts of the Republic of Latvia (Law on Higher Education Institutions, Higher education standards, etc.), DU normative acts and "Daugavpils University development strategy for 2015 - 2020".

To ensure the improvement of the existing normative documents and procedures at DU and

compliance with the student centered and sustainable higher education, especially assessing and updating quality policy implementation mechanisms, the study quality system is being updated within ESF project “Daugavpils University governance and management competence improvement” (No. 8.2.3.0/18/A/010). Within the framework of the project, in 2021, the new normative acts for the internal study quality assurance were drawn up, which were approved by rector's ordinance, for example, “DU Study Internal Quality Assurance Policy”, “DU Study Quality Policy and Study Quality Monitoring Strategies (see “Other Annexes””, “Procedures for Ensuring the Effectiveness of DU Study Internal Quality Assurance System” (see “Other Annexes”), etc. (see “Other Annexes”), which are aligned with the content of the newly developed "DU Quality Policy" and "Quality Management System Manual". All these documents are available from the DU internal network in Latvian.

### **Mechanisms of the study process quality provision**

Study quality maintaining aims at monitoring and improving the study programme implementation and facilitating prerequisites for reaching study programme outcomes. Quality monitoring is constant: during enrolment, recruiting the academic staff, improving the study programmes, reviewing the activity of structural units and their heads according to the academic and research work outcomes.

Higher education internal and external quality provision proceeds in cooperation between DU and the Ministry of Education and Science (in distribution of State budget funded places, execution of conceptual decisions), Higher Education Council (dealing with strategic issues, drawing statements), and Academic Information Centre (study programme licensing, study direction assessment, recognition of students' prior education).

### **The main forms of quality assessment are as follows:**

External assessment - licencing, accreditation, and assessment of independent experts. It is ensured by the quality ensuring agency listed in the European higher education quality ensuring register (in Latvia - Higher Education Quality Agency). It is coordinated by heads of study directions along with CSQA and vice-rector for studies.

Internal assessment - constantly performed by DU study direction councils elaborating self-assessment reports. Internal assessment is implemented and coordinated by DU CSQA approved by the Senate. In accordance with DU study internal quality ensuring policy there is systematic assessment of study directions and programmes in order to make sure how the programme objectives and study outcomes are reached, the compliance of the programme with the current developments of national economy and labour market demands.

### **The internal quality of studies is ensured by the following measures:**

<b>Quality ensuring instrument</b>	<b>Implementation procedure</b>
<b><i>Strategic planning of the process of studies</i></b>	Implemented by the study programme director in cooperation with the academic staff and members of the study direction council; Analyzing the shortcomings, risks, development opportunities of the study direction and study programmes wherein.

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**Examining the issues related to the process of studies**

Study direction councils assess the process of studies within a programme, its outcomes, and proposes to the head of the study direction and study programme directors measures for the programme improvement and integration of recent ideas in the study content and process. The respective structural units discuss the submitted proposals and initiate changes in the study course amount, their content and calendar arrangements in semesters. Each semester, departments, taking into consideration the results of student surveys, formal indicators of students' academic performance as well as the professional indicators of the academic staff members in respective spheres (participation in conferences, research and other projects, applied projects, publications, etc.), analyze in detail the content of each course and the quality of its delivery. After that proposals as to changes in the study courses or study programme are discussed in faculty councils and after their support are addressed to DU Council of Studies that examines the justification of changes proposed. In case of a positive decision taken by the Council of Studies, the changes are implemented.

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**Surveys**

At the end of each academic year surveys of students (<https://aptaujas.du.lv/index.php/253299/lang-lv>), employers (<https://aptaujas.du.lv/index.php/544412> - available in Latvian), and alumni (<https://aptaujas.du.lv/index.php/764263/lang-lv> - available in Latvian) are carried out. Based on the survey results, the study programme content is reviewed and improved within study direction councils executed by study programme directors. All justified opinions, proposals, and reprimands are examined by the study programme director, in case of necessity discussing the issues in study direction councils. CSQA upon necessity carry out express surveys in order to clarify students' opinion on current issues concerning the process of studies.

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**Self-assessment of the study direction and preparation of the self-assessment report**

The head of the study direction organizes meetings of the study direction council in order to discuss the main trends of programme development and management. For examining debatable issues (assessment of examinations, ignoring the regulations of DU by students and/or academic staff members, etc.) student representatives are invited. Once a year the head of the study direction along with programme directors prepare the self-assessment report of the study direction on the previous academic year that is examined by CSQA and approved by the Council of Studies and the Senate.

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**E-study environment improvement**

DU e-study environment Moodle is used to provide information on the courses acquired during the semester. For each course students have access to the following information: study course description, criteria of assessment, materials for student independent work, etc.

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**Characteristics of the parties involved in the elaboration and improvement of quality ensuring system and their role.**

Efficient results are reached by means of understanding and support of the administration, purposeful DU strategy and policy implemented by successful participation of the academic staff as well as full partnership, resource saving approach, and process governance.

<b>Party involved</b>	<b>Characteristics of the role</b>
<b><i>DU administration</i></b>	<ul style="list-style-type: none"> <li>- elaborates DU development strategy and implements its objectives;</li> <li>- facilitates the development and professional growth of the staff, elaborates and implements various motivation and support mechanisms (e.g. research activity facilitation, involvement in ERASMUS+ programmes for experience exchange and good practice);</li> <li>- cooperates with deans, heads of study directions, provides support for the solution of governance and financial issues.</li> </ul>
<b><i>Academic and research staff</i></b>	<ul style="list-style-type: none"> <li>- ensures high quality studies;</li> <li>- performs scientific research and integrates it into the study content;</li> <li>- participates in professional updating events, international mobility and experience exchange activities;</li> <li>- cooperates with external experts, employers, alumni, facilitates their involvement in the study direction improvement.</li> </ul>
<b><i>Administrative staff</i></b>	<ul style="list-style-type: none"> <li>- ensures high quality study programme governance;</li> <li>- provides support for students and the academic staff involved in study programmes;</li> <li>- tends to the updating of the material and technical base for studies.</li> </ul>
<b><i>Employers, social partners, and external experts</i></b>	<ul style="list-style-type: none"> <li>- provide the expertise for the study programme content and proposals for the improvement of the study content and methods;</li> <li>- provide opportunities for practical placement and internship, facilitating working environment-based study principles in professional study programmes.</li> </ul>
<b><i>Alumni</i></b>	<ul style="list-style-type: none"> <li>- use the acquired knowledge, skills, and competences in their professional activity;</li> <li>- provide proposals for the improvement of the study content.</li> </ul>
<b><i>Students</i></b>	<ul style="list-style-type: none"> <li>- provide feedback for the study quality improvement.</li> </ul>

**1.4. Fill in the table on the compliance of the internal quality assurance system of the higher education institution/ college with the provisions of Section 5, Paragraph 2(1) of the Law on Higher Education Institutions by providing a justification for the given statement. In addition, it is also possible to refer to the respective chapter of the Self-Assessment Report, where the provided information serves as justification.**

1.	The higher education institution/ college has established a policy and procedures for assuring the quality of higher education.	Complies DU is being implemented “DU study internal quality ensuring policy” (see “Other Annexes”, <a href="https://du.lv/en/about-us/documents/">https://du.lv/en/about-us/documents/</a> ) that facilitate and ensure the quality of higher education. To ensure the improvement of the existing normative documents and procedures at DU and compliance with the student centered and sustainable higher education, especially assessing and updating quality policy implementation mechanisms, the study quality system is being updated within ESF project “Daugavpils University governance and management competence improvement” (No. 8.2.3.0/18/A/010) (see section 1.3).
2.	A mechanism for the creation and internal approval of the study programmes of the higher education institution/ college, as well as the supervision of their performance and periodic inspection thereof, has been developed.	Complies In accordance with the “Regulation on Studies at Daugavpils University” ( <a href="https://du.lv/wp-content/uploads/2022/06/ENG-NOLIKUMS_PAR_STUDIJAM_D_U_2018-1-1.pdf">https://du.lv/wp-content/uploads/2022/06/ENG-NOLIKUMS_PAR_STUDIJAM_D_U_2018-1-1.pdf</a> ) and “Regulations on Opening and Managing Daugavpils University Study Directions and Study Programmes” ( <a href="https://du.lv/en/about-us/documents/">https://du.lv/en/about-us/documents/</a> ) there are established mechanisms for the development, internal approving of study programmes, their monitoring and periodic examination.
3.	The criteria, conditions, and procedures for the evaluation of students’ results, which enable reassurance of the achievement of the intended learning outcomes, have been developed and made public.	Complies “Regulation on Studies at Daugavpils University” and study course descriptions of each study programme state the criteria, conditions, and procedures of the assessment of students’ academic performance that attests to reaching the envisaged outcomes of studies. The Regulation and study course descriptions are freely available to students. Students have an opportunity of giving proposals for the criteria, conditions, and procedures of the assessment of students’ academic performance in surveys.
4.	Internal procedures and mechanisms for assuring the qualifications of the academic staff and the work quality have been developed.	Complies DU has elaborated internal normative acts and mechanisms that regulate the ensuring of the qualification and work quality of the academic staff: “Regulation on elections to academic positions in Daugavpils University” and “Procedure of assessing the scientific activity of Daugavpils University academic staff” (available from the DU internal network: <a href="https://veidlapas.du.lv/kartibas/">https://veidlapas.du.lv/kartibas/</a> ). Self-assessment reports include the results of surveys and measures of implementing students’ proposals and averting criticism.

5.	The higher education institution/ college ensures the collection and analysis of the information on the study achievements of the students, employment of the graduates, satisfaction of the students with the study programme, efficiency of the work of the academic staff, the study funds available, and the disbursements thereof, as well as the key performance indicators of the higher education institution/ college.	Complies Surveys of students, alumni, and employers are organized every year. CSQA carries out express surveys to learn students' opinion on current issues related to the process of studies and academic staff work efficiency. There is regular cooperation with the Student Council, exchange of opinions, examination of proposals. Program directors collect, analyze and discuss information about student progress in Study direction Councils. Necessary changes in study programs are reviewed and accepted by the Study Council. Every year, the scientific efficiency of the academic staff is evaluated by the Council of Science.
6.	The higher education institution/ college shall ensure continuous improvement, development, and efficient performance of the study field whilst implementing their quality assurance systems.	Complies DU study quality management system observes the compliance with ISO 9001:2017 quality standard. Compliance with this standard testifies to the fact that DU tends for the quality of its education services by maintaining the quality management system (QMS), periodically passing accreditation and verifying the efficiency of the system. QMS testifies that DU makes an effort to make out the preferences of the potential students, tends to maintain constantly good quality of studies and governance and ensure systematic and transparent processes as well as incessantly improve cooperation with cooperation partners and community.

## 2.1. Management of the Study Field

### 2.1.1. Aims of the study field and their compliance with the scope of activities of the higher education institution/ college, the strategic development fields, as well as the development needs of the society and the national economy. The assessment of the interrelation of the study field and the study programmes included in it.

The study direction “Physics, material science, mathematics and statistics” implemented at DU is an essential constituent part of DU's strategic specialization direction in the field of natural sciences, in accordance with Cabinet of Ministers Order No. 449 of 21 June 2022 "On strategic specialization of state HEI" [1].

The study direction “Physics, material science, mathematics and statistics” is implemented and its development is planned based on DU Strategy of Development for 2015-2020, which on January 25,

2021 with the decision No. 6/1 was extended until the launch of a new approved strategy. The implementation of the study programmes included in the study direction will contribute to the achievement of the mid-term goals included in the DU strategy: *“To provide high quality education that meets future challenges and is based on the acquisition of theoretical knowledge and research skills, preparing professionals who are competitive on the international labor market, developing their abilities and motivating for lifelong learning”*, as well as *“To develop internationally recognized scientific and creative activity, deepening the integration of scientific research in the study process, engaging in international, national and branch research programmes, promoting technology transfer and the development of innovations and promoting public understanding of science”*.

The DU field of study "Physics, material science, mathematics and statistics" is implemented only at the master's and doctorate levels. The direction includes the academic master's study program "Physics", the doctoral study program "Solid State Physics" and the doctoral study program "Mathematics".

Study programs "Solid State Physics" and "Physics" are interconnected. After completing the academic master's study program "Physics", acquiring the necessary knowledge, skills and competences and obtaining a master's degree in physics, you can continue your studies in the doctoral study program "Solid State Physics". They have agreed research directions.

The main common goal of the field of study is to prepare highly qualified, internationally competitive physics and mathematics specialists in the course of the implementation of higher-level programs, who are able to independently plan and conduct innovative research and contribute to the growth of the prosperity of the Republic of Latvia and the European Union.

Tasks of the field of study:

- to provide students with a scientific basis for professional activity, providing an opportunity to supplement the knowledge and skills acquired in the bachelor's or bachelor's and master's programs in the chosen specialization of physics or mathematics.
- to deepen students' scientific research skills and competence in the analysis of researched problems in order to prepare students for further scientific research work.
- to develop students' critical and creative thinking, reasoning and decision-making abilities, skills to use the acquired knowledge and competences in physics, mathematics and interdisciplinary research.
- to ensure effective and controllable achievement of planned program results.

The aim and objectives of the study direction are coordinated with the new trends in the education system in the European Union, with the requirements described in the regulatory documents, the DU Constitution and with the priority research directions determined in the Daugavpils University Development Strategy. In the current version, the study programmes are intended to provide students with a scientific basis for their professional activity, developing the abilities of scientific analysis, critical and creative thinking, reasoning and decision-making abilities, skills to use acquired knowledge and competences in physics, mathematics and interdisciplinary research, as well as to prepare for future scientific research work.

[1] Cabinet of Ministers Order No. 449 of 21 June 2022 "On strategic specialization of state HEI". Available only in Latvian: <https://likumi.lv/ta/id/333471-par-valsts-augstskolu-strategisko-specializaciju> [viewed 28.05.2023]

**2.1.2. SWOT analysis of the study field with regard to the set aims by providing explanations on how the higher education institution/ college expects to eliminate/ improve weaknesses, prevent threats, and avail themselves of the given opportunities, etc. The assessment of the plan for the development of the study field for the next six years and the procedure of the elaboration thereof. In case there is no development plan elaborated or the aims/ objectives are set for a shorter period of time, information on the elaboration of the plan for the development of the study field for the next assessment period shall be provided.**

Based on the analysis of the formal indicators of the study programme implementation and taking into consideration the results of student surveys, as well as assessing the trend and dynamics of the development of external factors, the study direction council has carried out a SWOT analysis (see Table 2.1.2.1) and has highlighted strengths, weaknesses, opportunities and potential threats in the implementation of the study direction in order to prognosticate the future development of study programmes and ensure their improvement.

**Table 2.1.2.1. SWOT analysis of the study direction “Physics, material science, mathematics and statistics”**

Strengths	Weaknesses
<i>Study direction</i>	

- 
- Clear goal, objectives, and strategy of the study direction;
  - good material and technical base, modern equipment for conducting research in solid state physics, wide opportunities to use the Internet, library electronic database "Alice", etc.;
  - accumulated extensive research experience in solid state physics and the qualitative theory of boundary value problems of ordinary differential equations, acquired competences for the implementation of discoveries in production technologies;
  - licensed joint academic master's study program "Physics" with LU;
  - DU is the only institution outside of Riga that provides doctoral studies in physics and mathematics;
  - The majority of programme graduates work in Latvian state and private businesses;
  - The academic staff involved in the study direction implementation possess high capacity of attracting project funding;
  - The academic staff involved in the study direction implementation have high scientific qualification.
- The uncompetitive remuneration of the academic staff lowers the competitiveness of state financed HEI on labour market and makes a negative impact on the motivation of professionals involved in the study direction;
  - Insufficient state financing for scientific institutions reduces students' opportunities to engage in research;
  - insufficient scientific cooperation with foreign study programs and scientific research institutions, including in creation of joint study programs;
  - high workload of academic staff in various projects, and in the Institute of Life Sciences and Technologies of DU;
  - insufficient participation of students in international projects;
  - there are no cooperation agreements for the application of research results in production technologies
- 

*Study process*

- Opportunity to obtain in-depth knowledge and familiarize with latest ideas in the chosen physics or mathematics specialization;
- Integration of studies and research work;
- High level material and technical base and provision with qualified academic staff members;
- Use of diversified study forms and methods;
- Students are involved in the research activities of the structural units, their research is approbated in the academic environment;
- Broad opportunities of using international peer-reviewed scientific data bases.
- Provided opportunity to study for people with special needs

- there are no foreign guest lecturers in the study programs implemented in the field of study;
- there are no exchange students and foreign students in the field of study,
- Insufficiently used opportunities of distant and e-studies;

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### *Students*

- High motivation for studying in the selected speciality;
- Good contact with the academic staff of the study programmes;
- Engaging in the assessment of the study direction quality and content updating;
- Students' interest in presenting their research results and approbating them in scientific forums and conferences.

- part of the doctoral students is exmatriculated as having completed the doctoral study program, but not having defended the doctoral thesis, as a result of which state funds are used irrationally, which in turn may affect financing of the program;
- no activity in using opportunities of international exchange programs;
- Low engagement in the university academic and public life, lack of academic and students' traditions.

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### *Academic staff*

- High academic qualification in compliance with the requirements of Act on HEI;
- Mutual cooperation, observing principles of good collegiate and tolerance;
- Improving academic and professional competences involving in research projects, publishing research results and presenting them to the academic community at international conferences;
- Good contact with students;
- Ability to assess and admit flaws in the study courses taught and search for ways of improving the quality of studies.

- high average age of academic staff;
- academic staff do not use creative leaves to improve their qualifications;
- insufficient use of international academic and scientific exchange programs.

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*Other factors*

- there is a close connection between the lecturer and the student, which allows for the use of an individual approach and controllable achievement of the planned program results (because the academic groups have a small number of students);
- doctoral students often have connections with potential employers, this increases the students' interest in obtaining a doctoral degree.

- Exclusively project-based infrastructure and especially human resource development aggravates the opportunity of planning the process of academic and research work.

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**Opportunities**

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**Threats**

---

*Study direction*

- 
- introduction of new study programs;
  - Attracting EU financial instrument and structural fund resources for improving the study environment and quality of studies;
  - Expanding the cooperation with other European universities;
  - Broader involvement of academic staff members and students in exchange programs, e.g. Erasmus+, etc.;
  - Study course provision in foreign languages, involving students from abroad;
  - Involving highly qualified visiting lecturers and professors;
  - Opening of new academic staff and support staff positions, election of new academic staff members along with programme development, creation of new study programmes and expansion of the scientific infrastructure.
- According to the "Daugavpils University Study Program Development and Consolidation Plan" from 2023/2024. st.y. DU will only have the professional bachelor's study program "Teacher" (Mathematics), but there are no academic bachelor's study programs in mathematics and physics, so there are no self-prepared personnel who can choose the field of study;
  - risk that the number of students will not only increase, but may decrease, taking into account the poor demographic situation in the country and potential outflow of students to foreign countries;
  - In Latvia, there are few companies that need research in the field of high technology, this makes it difficult to attract funds for conducting research and reduces public recognition of the field of study;
  - students' inability to cover the costs related to their studies due to the decrease in solvency of the population in the country as a whole and in Latgale region;
  - decrease in the competitiveness of academic staff remuneration, as it is more profitable for scientists to work in other fields;
  - unpredictability of the future due to the effects of the Covid-19 pandemic and the security situation in the world.

Evaluating the current stage of implementation of the field of study "Physics, material science, mathematics and statistics", we believe that it has possibilities of existence and development. Popularization of the field of study, as well as presentation of research results of students and teaching staff of the direction, should be strengthened throughout Latvia. In order to ensure further development of the field of study, it is necessary to set a series of achievable performance indicators for the period from 2023-2029:

- Prepare for licensing bachelor study programs in mathematics and physics;
- Commencement of implementation of AMSP Physics in English, which would allow to attract foreign students, including ERASMUS+ exchange students, would facilitate involvement of guest lecturers in the implementation of the study program.
- The number of people who have obtained a Doctor of Science (*D.*) degree in natural sciences on average at least 1 per year;
- at least half of the doctoral study program graduates and doctoral degree applicants of the study field (ex-matriculated, having completed the doctoral study program) have participated in the implementation of DU internal research projects or ESF or ERDF projects.

Summary of the study direction further development plan is available in appendix-2.1.2. *Summary of the study direction development plan\_EN*. The study direction development plan was approved by the study direction council, based on the discussions of the study direction council members,

evaluating the existing opportunities.

**2.1.3. The structure of the management of the study field and the relevant study programmes, and the analysis and assessment of the efficiency thereof, including the assessment of the role of the head of the study field and the heads of the study programmes, their responsibilities, and the cooperation with other heads of the study programmes, as well as the assessment of the support by the administrative and technical staff of the higher education institution/ college provided within the study field.**

An essential prerequisite of the implementation of the study direction and its programmes is provision of programme management and its inner quality control system and its functioning at DU. The study process quality and management provision system is aimed at securing compliance of the programme content to the current requirements in the higher education and labour market demands in Latvia and EU.

Assessment of the quality of study programmes and the study process at DU is carried out in order to control the execution of study programmes in accordance with accreditation documents, improve its content, and plan its development. On the whole, this system is aimed at achieving the goals set for the study program and fulfilling the objectives set. Quality control is organized at the University level and is carried out at all stages, i.e. matriculating students, hiring academic staff, evaluating and improving the content of the study programme, evaluating the functioning of structural units and their heads according to the results of scientific and academic work.

In addition to external evaluation provided by the University in cooperation with the Ministry of Education and Science of the Republic of Latvia, an internal quality assurance system operates continuously and systematically. The internal control of the quality of studies is constantly carried out by the study direction council Faculty of Natural Sciences and Mathematics (FNCM) Department of Physics and Mathematics and Institute of Life Sciences and Technologies, this work is coordinated and managed by the Centre of Study Quality Assessment Center (CSQA) approved by the DU Senate, the Department of Studies of DU and the Council of Studies.

The management of the study direction "Physics, material science, mathematics and statistics" is carried out in accordance with the "Regulations on opening and management of study directions and study programmes of Daugavpils University"[1]. The study process is organized in accordance with the DU Constitution[2], Act on HEI[3], and other regulatory documents. The scheme of the management structure of the study direction "Physics, material science, mathematics and statistics" can be found in the appendix (2.1.3\_Structure of the management of the study direction\_EN).

The study direction council assesses the progress and results of the study process and recommends measures to improve the programs and integrate the latest knowledge into the study content and process. The study direction council approves proposals for changes in the amount of study courses, their content and calendar arrangement by semesters, taking into account the results of student surveys, student academic performance, as well as indicators of the professional performance of lecturers. Proposals for changes in study courses or study programmes submitted by the study direction council are discussed at the Faculty of Natural Sciences and Mathematics Council and forwarded to the DU Council of Studies.

The head of the study direction, in cooperation with programme directors, organizes and

coordinates the study process in the study programmes included in the study direction, constantly monitoring the quality of studies. The head of the study direction is responsible for conceptual changes in the study direction, convenes meetings of the study direction council if necessary, prepares the annual study direction self-evaluation report in cooperation with study programme directors, collects and analyzes the information to be included in it.

The director of the study programme cooperates with the directors of other programmes and the academic staff to ensure the continuity of the study process and mutual connections. At the end of each academic year, programme directors plan the workload for the next academic year and send requests to respective structural units. The heads of the relevant structural units are responsible for appointing an academic staff member to teach the relevant study course. Directors of study programmes communicate with students, make improvements in study programmes, coordinating them with the head of the study direction. If necessary, topical issues are considered by the study direction council and the faculty council.

The preparation of the annual programme self-evaluation report in the internal quality control system should be emphasized. Namely, at the end of each academic year, a programme report is drawn and after its discussion and approval at the study direction council and the Faculty of Natural Sciences and Mathematics council, it is submitted to the CSQA and after approval by the DU Senate, it is published and is available from the DU internal network.

It should be added the the DU Student Service Center (SSC) operates at DU and its main task is to inform DU students about current issues, as well as to provide consultations and services. Key features of SSC are as follows:

- issue certificates to students (to the bank, the State Revenue Service and other institutions, as well as certificates about study leaves, elaboration and defense of bachelor and Master's theses, etc.);
- issue the signed study contracts to students;
- advise students on issues related to the study process, extracurricular activities and dormitories;
- participate in organizing informative events (career days, educational exhibitions, etc.);
- listen to, collect students' proposals and submit them to the appropriate structural units.

The work of the SSC provides great support for the organization of the study process within the field of study.

Each structure has its own tasks, together they complement each other, supporting study program directors and students. Therefore, we rate the support provided within the study direction of administrative and technical personnel of DU as good.

[1] "Daugavpils University study direction and study programme opening and management regulations" (in Latvian). Available: [https://du.lv/wp-content/uploads/2021/12/3\\_DU\\_Studiju-virzienu-un-studiju-programmu-atversanas-un-parv-nolikums.pdf](https://du.lv/wp-content/uploads/2021/12/3_DU_Studiju-virzienu-un-studiju-programmu-atversanas-un-parv-nolikums.pdf) [viewed 20.02.2023]

[2] DU Constitution (in Latvian). Available: [https://du.lv/wp-content/uploads/2022/09/DU-Satversme\\_17.06.2022.pdf](https://du.lv/wp-content/uploads/2022/09/DU-Satversme_17.06.2022.pdf) [viewed 20.02.2023]

[3] Act of HEI (in Latvian). Available: <https://likumi.lv/ta/id/37967-augstskolu-likums> [viewed 20.02.2023]

**2.1.4. Description and assessment of the requirements and the system for the admission of students by specifying, inter alia, the regulatory framework of the admission procedures and requirements. The assessment of options for the students to have their study period, professional experience, and the previously acquired formal and non-formal education recognised within the study field by providing specific examples of the application of these procedures.**

Admission to the AMSP "Physics" of DU study direction "Physics, material science, mathematics and statistics" takes place in accordance with "Daugavpils University admission rules for full-time and part-time higher level studies", while admission to DSP "Solid State Physics" and "Mathematics" takes place in accordance with the "Daugavpils University admission rules for full-time and part-time doctoral studies". Admission rules are approved annually by the DU Senate. The admission rules are updated every academic year in accordance with the Act on Higher Education Institutions, the Cabinet of Ministers' regulations of October 10, 2006 No. 846 "Rules on requirements, criteria and procedures for admission to study programmes" and the decision of the DU Council of Studies. Admission rules at DU have been developed for different levels of studies, "Admission rules for full-time studies for foreigners" are available separately. Detailed information on admission, as well as links to admission rules, are available on the DU website[1].

The admission process is additionally regulated by "Full and part-time study opportunities", "DU admission rules", registration fee, tuition fee in programmes, number of study places for admission that are approved by the decision of the DU Senate before its start. The Senate approves the deadlines for the competition and announces admission.

"DU Admission Rules" and "Study Opportunities" determine the requirements for persons who are willing to study at DU, mutual rights and obligations between the university and this person in the admission process, provide information about the study programmes and study forms of a specific academic year, about additional requirements for applicants' prior education, readiness, or special suitability for specific studies, on the evaluation criteria of the competition. Admission to DU study programmes comprises registration of applicants for studies, the procedure of the competition for study places, the announcement of the results of the competition, signing of the study agreement, and registration in the list of students (matriculation).

Admission to DU study programmes is ensured by the Secretariat of the DU Admission Commission.

The admission commission determines and approves the results of the competition. The Admissions Commission can also approve and redistribute admission places. The responsibilities of the Admissions Commission and the Secretariat of the Admissions Commission are defined in the document "Mutual obligations and rights of a person and DU in the admission process"[2].

The decision of the DU Admission Commission on the results of the competition can be appealed in accordance with the "Procedure in which a person can challenge and appeal decisions related to admission to a study programme at Daugavpils University" developed by DU[3]. The DU admission procedure and information about it are implemented efficiently and transparently. During the admission, information boards are placed in the DU hall on the ground floor, consultations are provided in person, by phone, and via e-mail; it should be added that most of the potential students communicate about admission issues using DU accounts on social networks.

Assessment of the implementation of admission requirements - the admission commission strictly follows the admission requirements, guided by regulatory documents.

There are no examples of the possibility of recognizing previously obtained formal and informal education within the field of study, but such possibilities exist. DU has developed and operates the "Regulations on recognition of competences acquired outside of formal education or professional experience and study results achieved in previous education at Daugavpils University"[4]. Experience acquired outside of formal education (participation in seminars, trainings, professional development courses, etc.) is most often equated.

DU has concluded an agreement with the University of Latvia (LU), which confirms that, based on the cooperation of the parties in the field of studies and scientific research, in the event that the doctoral study program "Computer Science and Mathematics" (mathematics) (51460) of the LU field of study "Information technologies, computer engineering, electronics, telecommunications, computer management and computer science" is terminated, DU undertakes to provide opportunities to continue studies in the DU field of study "Physics, Materials Science, Mathematics and Statistics " doctoral program "Mathematics" (51460) , and vice versa - upon termination of DU study programs implementation, its students are admitted to the mentioned LU field of study. On the other hand, if the doctoral study program "Natural Sciences" 51421 of the field of study "Living Nature Science" in the LU is terminated, the DU undertakes to provide opportunities for continuation of studies in the doctoral study program *Solid State Physics* (51443), and vice versa - when implementation of the study program of the DU is terminated, its students will be admitted to the mentioned LU studies. DU and LU have concluded an agreement with Riga Technical University (RTU), which confirms that if the DU and LU studies in the field of "Physics, Materials Science, Mathematics and Statistics" and the joint academic master's study program "Physics" are discontinued, RTU undertakes to ensure continuation of studies opportunities in their study program "Medical Engineering and Physics" (47526).

[1] DU admission rules (Interantional Students). Available: <https://du.lv/en/studies/admission/> [viewed 20.02.2023]

[2] "Mutual obligations and rights of a person and DU in the admission process"(in Latvian). Available: <https://du.lv/gribu-studet/uznemsana/> [viewed 20.02.2023]

[3] "Procedure in which a person can challenge and appeal decisions related to admission to a study programme at Daugavpils University"(in Latvian). Available: [https://du.lv/wp-content/uploads/2021/12/kartiba\\_uznemsanas\\_apstridesana.pdf](https://du.lv/wp-content/uploads/2021/12/kartiba_uznemsanas_apstridesana.pdf) [viewed 20.02.2023]

[4] "REGULATION ON THE RECOGNITION OF COMPETENCES ACQUIRED OUTSIDE THE FORMAL EDUCATION AND THROUGH PROFESSIONAL EXPERIENCE AND LEARNING OUTCOMES ACHIEVED IN PRIOR LEARNING BY DAUGAVPILS UNIVERSITY". Available: [https://du.lv/wp-content/uploads/2022/06/ENG\\_Regulations-for-the-recognition-of-study-results-2.pdf](https://du.lv/wp-content/uploads/2022/06/ENG_Regulations-for-the-recognition-of-study-results-2.pdf) [viewed 24.11.2023]

**2.1.5. Assessment of the methods and procedures for the evaluation of students' achievements, as well as the principles of their selection and the analysis of the compliance of the evaluation methods and procedures with the aims of the study programmes and the needs of the students.**

In compliance with the Standards and guidelines for quality assurance in the European higher education area (standard 1.3) adopted in 2015, higher education institutions must ensure that the study programmes are implemented in the way as to encourage students to actively participate in the the study process development, and that the assessment of student academic performance complies with this approach. Assessment in the study programmes of the "Physics, material science, mathematics and statistics" study direction is carried out based on the following principles:

- the assessment criteria are clear and understandable, are previously published and available for public;
- instructors are familiar with testing and examination methods;
- assessment gives students an opportunity to show to what extent they have achieved the expected learning outcomes;
- students receive feedback, which, if necessary, provides advice related to the learning process;
- assessment is consistent, fair, suitable for all students and is implemented in accordance with legislation and approved procedures;
- there is a procedure for examining student appeals.

Depending on the teaching form and methods, the instructor chooses the assessment forms and criteria. Results obtained from the study courses require the student to demonstrate not only knowledge, but also skills and competence. As in the exact sciences, seminars, laboratory works, as well as independent work play an important role. During acquisition of practical skills and competences, formative assessment is used, which is implemented by the teacher and the student in close partnership. Attention is also paid to reflection - self-evaluation of one's work. Feedback, which is the most important part of formative assessment, usually takes the form of verbal or written comments. As part of formative assessment, students understand the mistakes made or receive confirmation that there are no mistakes in order to make a decision on the next steps of the learning process. It contributes to the stabilization and self-actualization of students' acquisition of professional skills. In addition to formative assessment, lecturers use summative assessment. Summative grading is used to post midterm grades. At the end of the study course, there is a test with a grade or an exam. The final exam is oral, written, in the form of an achievement test. Students can familiarize themselves with the evaluation criteria, conditions and binding procedures in the course descriptions of the study program.

The principles and criteria of evaluation are described in the description of each study course, which is available in the E-environment of the DU. Upon commencing work with students in the auditorium, the teaching staff shall acquaint students with the requirements of the study course and with the knowledge and skills assessment system.

In order to analyse the conformity of assessment methods and procedures with the achievement of the aims of study programmes and students' needs, the results of student surveys, formal indicators of student success are regularly described, the content of each study course and the quality of its teaching are examined in detail. If discrepancies in the assessment methods are detected, then the necessary amendments in the content of study courses or in the organisation of the study process are considered, if necessary, examining issues in the Study Direction Council. After that, proposals for changes in study courses or study programme are discussed in the Council of the Faculty of Humanities, and after its approval, they are directed to the DU Council for Studies, which evaluate the relevance and necessity of changes. In case of a positive decision of the Council

for Studies, the changes are approved. All the mentioned DU's activities form a systematic approach to achieving the results of the study programs.

Study outcome assessment is described in detail in "Regulations on Studies at Daugavpils University"[1].

[1] Regulations on Studies at Daugavpils University. Available: [https://du.lv/wp-content/uploads/2022/06/ENG-NOLIKUMS\\_PAR\\_STUDIJAM\\_DU\\_2018-1-1.pdf](https://du.lv/wp-content/uploads/2022/06/ENG-NOLIKUMS_PAR_STUDIJAM_DU_2018-1-1.pdf) [viewed 20.02.2023]

**2.1.6. Description and assessment of the academic integrity principles, the mechanisms for compliance with these principles, and the way in which the stakeholders are informed. Specify the plagiarism detection tools used by providing examples of the use of these tools and mechanisms.**

"Code of Ethics for Employees and Students of Daugavpils University"[1] defines ethical guidelines for DU employees and students. The Code determines that students shall support and maintain academic and professional integrity, shall not allow plagiarism, other disintegrated use of intellectual property or fraud, while the academic staff shall assess students' paper in a timely, integrate and fair manner, support and maintain academic and professional integrity without creating conditions enhancing academic fraud, shall follow the process of student work development, shall not allow plagiarism and other disintegrate use of intellectual property or other forms of fraud.

In implementing the principles of academic integrity, DU complies with the "General Guidelines of Academic Integrity"[2], which contributes to the development of a common understanding of issues of integrity in science and entrepreneurship. Study programmes of the study direction shall observe the principles of academic integrity in compliance with the "Regulations on Studies at Daugavpils University"[3]. For example, if students use unauthorised aids in the examination or signs of plagiarism are detected in the final paper, they shall be suspended from the examination as having not passed the examination and an appropriate entry in the examination report shall be made.

DU is defined the "Procedure for submission of final works for plagiarism control at Daugavpils University"

(<https://du.lv/wp-content/uploads/2022/09/Procedure-of-thesis-submission-for-plagiarism-control.pdf>), which provides for mandatory submission and storage of electronic versions of the final examination papers in the Daugavpils University informative system and provides an opportunity to compare students' final papers with the set of papers defended in previous years. All DU final examination papers, incl. bachelor's and master 's theses of the students in the field of study "Physics, material science, mathematics and statistics " from 2017-2022 (AMSP "Physics"), are examined prior to the defence using plagiarism control system PLAG LV (plag.lv). If signs of plagiarism have been detected in the process of comparing the final papers, the Expert Commission established by the Dean of the Faculty and approved by the Order shall evaluate the paper and decide on the detection of plagiarism in the paper. The expert commission shall, within three working days, examine the report and submit proposals regarding the student's responsibility to the Dean of the faculty.

The content of the courses implemented in the "Physics, material science, mathematics and

statistics" DSP "Mathematics" and DSP "Solid State Physics" does not include topics related to the basic principles of academic honesty. Because students are informed about the principles of academic honesty and the consequences of their violation when publishing the results of their research and using works of other authors to justify obtained results. It is in this process that an intentional or unintentional violation of the principles of academic integrity is possible. The thesis supervisor plays an important role in promoting compliance with the principles of academic honesty. Doctoral students are legally liable persons and, like all citizens of the state, they are subject to the laws of the Republic of Latvia that regulate copyright. Questions about plagiarism are regulated by the Copyright Law, the Law on Universities, the Law on Scientific Activities and Section 148 of the Criminal Law, as well as in certain cases by the Civil Law. It should also be noted that the students have already written bachelor's and master's theses, where they were informed about the principles of scientific ethics and academic honesty.

Adherence to the principles of academic honesty is strictly monitored in the process of development, evaluation and defending doctoral theses of DSP "Solid State Physics" and DSP "Mathematics". Promotion process at Daugavpils University takes place in accordance with the "Regulations on Daugavpils University Promotion Boards"[4] . Evaluation of the promotion opportunities and the promotion process provided to the students of the doctoral study program is given in more detail in section 3.2.5. respectively for each program - DSP "Solid Physics" and DSP "Mathematics".

[1] Daugavpils University academic staff and student ethic code (only in Latvian). Available: <https://du.lv/wp-content/uploads/2021/12/Etikas-kodekss.pdf> [viewed 20.02.2023]

[2] "General guidelines of academic integrity" (only in Latvian). Available: <https://ebooks.rtu.lv/product/akademiska-godiguma-terminu-vardnica-akademiska-godiguma-vispar-ejas-vadlinijas/> [viewed 20.02.2023]

[3] Regulations on Studies at Daugavpils University. Available: [https://du.lv/wp-content/uploads/2022/06/ENG-NOLIKUMS\\_PAR\\_STUDIJAM\\_DU\\_2018-1-1.pdf](https://du.lv/wp-content/uploads/2022/06/ENG-NOLIKUMS_PAR_STUDIJAM_DU_2018-1-1.pdf) [viewed 20.02.2023]

[4] "Regulations on Daugavpils University promotion councils" (only in Latvian) <https://du.lv/wp-content/uploads/2021/05/Nolikums-par-DU-Promocijas-padomem-1.pdf> [assessed 30.04.2023]

## **2.2. Efficiency of the Internal Quality Assurance System**

**2.2.1. Assessment of the efficiency of the internal quality assurance system within the study field by specifying the measures undertaken to achieve the aims and outcomes of the study programmes and to ensure continuous improvement, development, and efficient performance of the study field and the relevant study programmes.**

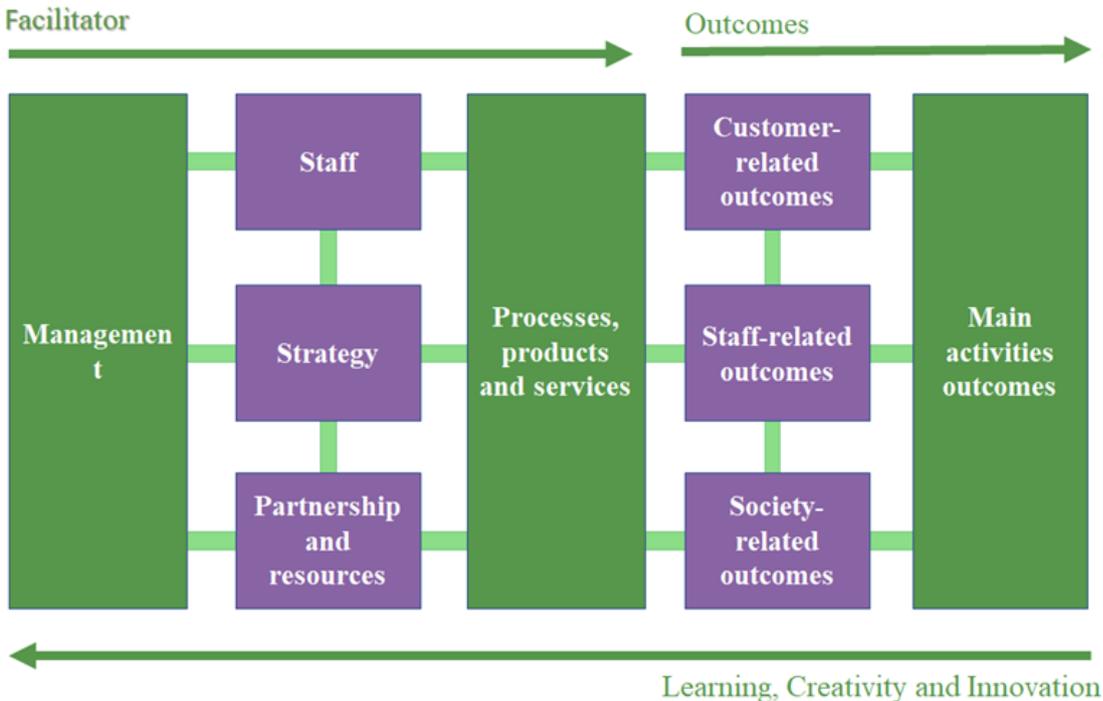
### ***Internal quality provision system efficiency assessment within the study direction***

An important role in the implementation of the study process is played by the management of direction and the quality assurance system, as the functioning of the DU Council for Studies and DU

Study Quality Assessment Centre (hereinafter – SQAC). The aim of ensuring the quality and management system of the study process is to guarantee the conformity of the content of the programmes with the higher education standard, the quality of science, as well as the labour market demands in Latvia and the European Union. Evaluation of the quality of studies is carried out with the aim to control the implementation of study programmes and plan development in order to fully achieve the aims set in the programme and to fulfil the defined objectives. Quality control is carried out continuously: in admitting students, recruiting academic staff, evaluating and improving study programmes, evaluating the activities of structural units, their managers and staff according to the efficiency of science and the results of academic work.

DU has developed a structured quality management system model that sets guidelines for achieving excellence. This model of excellence is binding on every DU employee. It includes nine criteria (see Figure 2.2.1.1). Five of them cover contributing factors, the other four cover outcomes and results. Contributing factors (facilitating criteria) reflect what DU does and how it is done, while outcome (result) criteria reflect the achievements obtained.

The results are achieved thanks to the contributing factors, whereas the contributing factors are improved retrospectively based on the results achieved. Effective results can be achieved with the management's understanding and support, purposefully directed DU strategy and policy, which in turn is implemented with the successful participation of the staff, as well as with the help of a full-fledged partnership, a resource-saving approach and effective management of all the processes. The arrows shown in the figure show the dynamic improvement nature of the model of excellence – the importance of creativity, innovation and education in the improvement of promoters, which in turn ensures the achievement of better results. The model of excellence makes it possible to understand the cause-and-effect relationships between the activities that DU implements and the results it achieves (DU development strategy).



**Figure 2.2.1.1.** Quality management system model that sets guidelines for achieving excellence in DU

The study quality assurance center carries out interconnected control and improvement measures, thus creating trust in the activities of DU and higher education in general.

To implement inner quality assurance system of studies effectively within the study direction “Physics, material science, mathematics and statistics” the following activities are performed:

- Internal quality control of the field of study "Physics, material science, mathematics and statistics" is carried out by the board of the field of study. Discussion and evaluation of the development plan of the course and measures to improve the quality of studies take place at the end of the study year at the meeting of the council of the course of study.
- Once during an academic year the head of the study direction “Physics, material science, mathematics and statistics” in cooperation with the programme directors prepare a study direction self-evaluation report on the previous academic year.
- Lecturers regularly review the descriptions of study courses, update the content of the course, supplement it with the latest literature.
- In order to improve the skills of remote work, the academic staff of the study field “Physics, material science, mathematics and statistics” regularly participates in training courses, e.g., to ensure an effective use of the possibilities of the e-learning environment Moodle. Within the framework of the ESF project “Reduction of Fragmentation of Study Programmes of Strengthening of Shared Use of Resources at Daugavpils University”, Nr. 8.2.1.0/18/A/019, for lecturers there were organized seminars for the development and integration of the study course materials necessary to support a study process.
- There is a regular strengthening of the integration of the study process and research work, considering it an essential part of the quality assurance system.
- The personal profiles of DUIS contain information about the courses to be acquired during the semester. In each course the student has access to the descriptions of the study course.
- Academic staff of the field of study "Physics, material science, mathematics and statistics" participate in professional development courses.

**Table 2.2.1.1. Activities to promote the motivation of teaching staff at DU**

Teaching staff activities	Motivation
Lecturers are given the opportunity to improve and increase their knowledge and professionalism with ERASMUS + etc. mobility programs	Gains experience abroad by doing internships and giving lectures at foreign universities / organizations.
Participation in conferences, development of scientific publications, organization of scientific communication activities, work on artistic creation projects, etc.	Lecturers are allocated funding for the scientific activities of the next period for the scientific achievement of the previous period. At the end of each calendar year, DU lecturers in the Science Department submit a report on achievements in scientific work, work projects, participation in scientific seminars and conferences, publications in accordance with The procedure for evaluating the scientific activity of Daugavpils University academic staff (available from the DU internal network).
Preparation and publication of scientific articles included in the Web of Science and SCOPUS indexed editions.	Lecturers are reimbursed for expenses related to the preparation of the publication (editing of scientific texts in English (proofreading) and publication fees).

Hirsch index increase.	The DU academic staff receives remuneration for the citation Hirsch index in the SCOPUS and / or Web of Science databases within the funding available in the DU budget.
Reimbursement of expenses for scientific business trips	DU pays for business trips related to participation in scientific events and scientific research.
DU organizes Daugavpils University research project competition	As a result of the DU research project competition, funding is provided for topical and high-quality projects to promote the research growth of DU academic, scientific staff and students.

Within the ESF project *“Daugavpils University strategic specialization academic staff professional Competence Strengthening”* (No.8.2.2.0/18/A/ 022) and the project *“Daugavpils University study direction “Education, Pedagogy and Sports” capacity building of the academic staff in the fields of strategic specialization”* (No.8.2.2.0/18/I/005) DU academic staff, including lecturers of the study field “Health Care”, have the opportunity to improve their language skills in English language training programmes at B2 and C1 levels.

Lecturers improve their knowledge of foreign languages free of charge, learn current issues in teaching methodologies and participate in training in the use of e-resources.

It should be noted that the staff involved in the implementation of the study course used several motivation promotion activities. Participation in scientific conferences and the number of published scientific publications are increasing. In 2021, three lecturers improved their English language skills at B2 and C1 levels during 132 hours free of charge (assoc. prof. I. Jermačenko, chairwoman of the field of study board assoc. prof. A. Sondore, researcher I. Mihailova). Other training courses should be mentioned, in which academic staff of the field of study "Physics, material science, mathematics and statistics" and the chairwoman of the field of study council participated. Studies during 16 academic hours in 2023, within the framework of the Ministry of Education and Science project of further education program "Using the tool for assessing the competences of students' transitions in the formulation and evaluation of study results". In 2021, within the specialized course "Interaction and communication skills" in the amount of 12 academic hours (leader Zane Daudziņa), organized by the academic staff of ESF project No. 8.2.2.0/18/I/005 "Daugavpils University field of study "Education, pedagogy and sports" strengthening the academic staff capacity in strategic specialization areas". In the context of the ESF project "Education, Pedagogy, and Sports" seminar "Leadership ABC" was conducted within the framework of strategic specialization area No. 8.2.2.0/18/I/005. In the year 2020, the European Social Fund project No. 8.2.3.0/18/A/010 "Enhancement of Management and Leadership Competencies at Daugavpils University" offered the following courses: training course "Coaching", training course "English Language Proficiency", training course "Change Management Process", training course "Team Building Competence Development", training course "Leadership Competence Development", training course "Innovations in Educational Content", and training course "Personnel Management Competence Development". In the year 2019, within the European Social Fund project No. 8.2.3.0/18/A/010

"Enhancement of Management and Leadership Competencies at Daugavpils University", was offered training course "Development of Communication Competences", within European Social Fund Project No. 8.2.3.0/18/A/010 "Enhancement of Management and Leadership Competencies at Daugavpils University", training course "Financial Management".

Students' participation of in the doctoral programs of Daugavpils University research projects competition as well as involvement in research projects (not only DU internal projects) increase, thus promoting research growth of doctoral students and positively affecting quality of studies in the field of study "Physics, materials science, mathematics and statistics".

The above confirms effectiveness of internal quality assurance system within the field of study.

**2.2.2. Analysis and assessment of the system and the procedures for the development and review of the study programmes by providing specific examples of the review of the study programmes, the aims, and regularity, as well as the stakeholders and their responsibilities. If, during the reporting period, new study programmes have been developed within the study field, describe the procedures of their development (including the process of the approval of study programmes).**

The principles of the opening and management of new study directions and study programmes are determined by the "Daugavpils University Regulations on the Opening and Management of Study Directions and Study Programmes"[1]. The purpose of the regulations on the opening and management of DU study directions and study programmes is to determine the principles, content and implementation requirements for the opening and management of DU study directions and study programmes, in accordance with Act on HEI and other binding regulatory acts of the Republic of Latvia, DU Constitution and other binding DU regulatory documents. The regulations determine the procedure for opening, management, development and quality assurance of DU study directions and study programmes, the procedure for closing study directions and study programmes, the principles of the study direction council, as well as the duties, rights, and qualification requirements for the head of study direction and study programme directors. The development of a new study programme is initiated in accordance with the DU strategy or other strategic and study process regulatory documents at least one academic year before starting the study programme implementation.

During the reporting period, a great deal of work was done in cooperation with the representatives of the field of study "Physics, Materials Science, Mathematics and Statistics" of the University of Latvia (LU) in order to prepare a licensing report. In 25.10.2021, an expert opinion was received that the experts recommend licensing the joint academic master's study program "Physics". The study program "Physics" was created on the basis of the Cooperation Agreement concluded between the LU and DU on May 31, 2019, regarding the implementation of European Social Fund co-financed project "Creation of study programs that promote the development of Latvian national economy at the University of Latvia" agreement no. 8.2.1.0/18/A/015. It was created on the basis of physics master's programs, merging existing programs in both universities (LU and DU) and further evolving and preventing fragmentation of physics master's education in Latvia. It is expected that the joint study program will promote specialists with a strong specialization in a certain sub-field of physics. Along with the teaching staff, students and employers were also involved in the creation, evaluation and approval of the study program. In modifying and developing the content of the study program and individual study courses, university performance indicators related to students,

teaching staff, graduates and the study program were analyzed and taken into account. In the context of the study program, performance indicators of the university were analyzed, which characterize matriculation, the number of students and graduates, dropouts, student mobility, composition of teaching staff, graduate employment and employer satisfaction, study program profitability and industry trends.

Specialization of DU AMSP "Physics" is the physics of technologies. Students will gain current knowledge about nanotechnology, nanomaterials, optics and lasers, robotics, operating principles of vacuum equipment and research methods. The program includes practice in laboratories, during which the skills of working with scientific and industrial equipment, planning and conducting experiments will be acquired, student will participate in the process of actual research in physics.

[1] "Daugavpils University Regulations on the Opening and Management of Study Directions and Study Programmes" (in Latvian). Available: [https://du.lv/wp-content/uploads/2021/12/3\\_DU\\_Studiju-virzienu-un-studiju-programmu-atversanas-un-parv-nolikums.pdf](https://du.lv/wp-content/uploads/2021/12/3_DU_Studiju-virzienu-un-studiju-programmu-atversanas-un-parv-nolikums.pdf) [viewed 20.02.2023]

**2.2.3. Description of the procedures and/or systems according to which the students are expected to submit complaints and proposals (except for the surveys to be conducted among the students). Specify whether and how the students have access to the information on the possibilities to submit complaints and proposals and how the outcomes of the examination of the complaints and proposals and the improvements of the study field and the relevant study programmes are communicated by providing the respective examples.**

Submitting and considering the complaints and proposals from students is an essential component of the study quality system. To ensure the improvement of the quality of studies, it is necessary to analyze the processes, collect clear survey of the causes for the complaints submitted and provide feedback to the person who submitted the complaint or proposal.

#### **The procedures and systems of submitting complaints and proposals from students**

Students have the right to submit complaints and proposals to the study programme director, the head of the major department, dean, vice-rectors, and rector. Complaints and proposals, depending on their degree of significance, are accepted orally, in writing, and electronically.

Complaints and proposals are accepted from individuals or collectively, openly (with identified submitter) and anonymously. Drafting the submissions and their acceptance at DU is executed in accordance with the procedures set in "The Law on Submissions"[1]. Submissions concerning possible violations of the norms of "DU Code of Ethics"[2] including action or conduct outside DU, if that affected the prestige of DU, may be made by DU academic, administrative, and general staff, students. On behalf of students submission may be made by the Student Council that may represent the student in the course of examining the complaint.

Submissions from students and the academic staff concerning the infringements and violations of the academic freedom and rights that are stated in the Constitution are examined by DU Academic Court or Arbitration.

#### **Submitting open complaints and proposals**

DU students may submit open complaints and proposals in a free form or in accordance with the procedures stated in DU interior normative acts.

### **Submitting anonymous complaints and proposals**

The following tools for submitting complaints are available at DU:

- CSQA section available on the DU website, where anyone can submit a complaint / proposal to CSQA anonymously[3]
- Questionnaire of trust designed by the Student Council [4] (*available in Latvian only*)

Anonymous complaints are received electronically, after examination and content analysis of the complaint CSQA leads negotiations with the involved parties and in case of necessity conducts the monitoring of the study quality. In the prior practice, in examination of anonymous complaints CSQA closely cooperated with the Student Council, examining the situation and taking steps for the improvement of the study quality, because, in accordance with “The Regulation of Daugavpils University Student Council”(accessible in Latvian), the Student Council has the right to request and receive information from any structural unit of DU concerning all matters in its competence that concern students’ interests.

In order to examine complaints related to enrolment, “Order whereby a person may dispute and appeal decisions related to enrolment to a study programme at Daugavpils University” is in force at DU, in accordance with which a person may dispute the decision of the Enrolment commission on the results of the competition by submitting an application to DU rector in seven working days’ time after the publication of the competition results.

In accordance with “The Regulation on Studies at Daugavpils University”[5] , students have the right to submit to the faculty dean a motivated appellation about the results of examination within one working day after their announcement. Appellation is examined in three working days’ time by a commission formed on the dean’s decision by the participation of the examiner and the head of the respective department.

### **Information accessibility**

All interior administrative acts, in accordance with which students may submit complaints and proposals are publicly available from DU website. Students may receive information by addressing the study programme director, dean, CSQA, and the Student Council.

### **Feedback in examining complaints and proposals**

CSQA coordinates the examination of students’ complaints and proposals and, if needed, organizes express surveys, executes study quality monitoring by attending classes and talking with students and the academic staff in order to ensure full bodied analysis of the conflict or problem.

During the implementation of the remote study process in 2019/2020 spring semester, there was organized a survey of DU students on the quality of the implementation of the remote learning process, as a result of which the offer of the library services was improved, as well as the methods and tools for organizing remote learning were diversified for all the university students.

At the beginning of the remote study process, when the work had to be urgently reorganized, the lecturers of the field of study "Physics, material science, mathematics and statistics" had access to introductory training to learn and start using in the process of study such modern IT solutions as Zoom and Webex. Of course, during the implementation of remote study

process in 2019/2020 academic year, 2020/2021 academic year, and 2021/2022 academic year the head of the field of study and lecturers regularly communicated with students of all levels, monitoring the progress of the study process in the study programs of the field. If necessary, for example, classes were organized in the park for the students of the field of study "Physics, material science, mathematics and statistics", observing epidemiological safety measures.

Since 2013, CSQA has received oral and written complaints about the study quality (e.g. discrepancy between the requirements for crediting indicated in the study course description and the forms of examination of students' knowledge and skills in the study process, proposals for the timetable, communication problems, etc.). All complaints and proposals are always discussed with the involved parties. In the examination of complaints and proposals there participates study programme director and, if needed, also the head of the study direction and vice-rector for studies. After the situation analysis, possible solutions are found, students are always informed about the implementation of the complaints and/or proposals, CSQA provides consultations in the matters of study quality.

It is worth noting that the University regularly (once a month) holds meetings of the management and the head of the CSQA with the Student Council, where students' problems, complaints and recommendations for improving the quality of studies are identified and discussed.

[1] "The Law on Submissions". Available: <https://likumi.lv/ta/en/en/id/164501-law-on-submissions> [viewed 20.02.2023]

[2] „DU code of ethics”(in Latvian). Available: <https://du.lv/wp-content/uploads/2021/12/Etikas-kodekss.pdf> [viewed 20.02.2023]

[3] Study Quality Assessment Centre. Available: <https://du.lv/en/about-us/study-quality-assessment-centre/> [viewed 20.02.2023]

[4] Trust questionnaire drawn by the Student Council. Available: <https://du.lv/en/students-council/> [viewed 20.02.2023]

[5] "Regulations on Studies at Daugavpils University". Available: [https://du.lv/wp-content/uploads/2022/06/ENG-NOLIKUMS\\_PAR\\_STUDIJAM\\_DU\\_2018-1-1.pdf](https://du.lv/wp-content/uploads/2022/06/ENG-NOLIKUMS_PAR_STUDIJAM_DU_2018-1-1.pdf) [viewed 20.02.2023]

**2.2.4. Provide information on the mechanism for collecting the statistical data, as developed by the higher education institution/ college. Specify the type of data to be collected, the regularity of collection, and the way the information is used to improve the study field. Describe the mechanism for obtaining and providing feedback, including with regard to the work with the students, graduates, and employers.**

When collecting physical person data, DU collects and processes person data for concrete, clear, and lawful reasons and exclusively according to the procedure and amount stated in the normative acts.

DU operates informative system DUIS, that holds statistical data and information on study programmes, students, and academic staff members. The system is accessible from DU inner network. Data are entered into DUIS by study programme directors, faculty records managers; they are summarized and verified by the Department of Studies. At the end of each month the data from DUIS system are exported to State Education Information System (SEIS). Data export is executed in accordance with the regulations of the Cabinet of Ministers No. 276 of 25 June 2019 “Terms of State Education Information System”[1]. SEIS data export entails person data of DU students, information of students’ status (matriculated and ex-matriculated student number, their status changes, e.g. semester of studies, students being in an academic withdraw, etc.) and other binding information.

One of the main instruments contributing to the improvement of the study directions is student survey that is announced by the Centre of Study Quality Assessment 3 times a year – for the first year students 2 months after beginning the studies, after the winter graduation, and after summer graduation. In particular study programmes student surveys are organized at the end of each semester. Based on the data and information provided in the surveys, in case of need CSQA carries out lecture auditing and individual student group surveys as well as organizes interviews with the academic staff concerning the measures of the study quality improvement.

The data gained in surveys are collected in DU survey system (Open Source Project LimeSurvey), data are analyzed and their results are reflected in the study direction self-assessment reports.

DU organizes also alumni and employer surveys. Alumni survey[2] data contain the information on the trends of alumni’s employment, assessment of the acquired study programmes and proposals for their improvement. Employer surveys [3] are executed and their data are summarized by the study programme directors. Their aim is obtaining proposals for the improvement and development of DU study content. Appendix 2.2.4\_employer survey analysis\_DSP\_EN contains analysis of survey at the end of 2022/2023 st. y. It will be used to improve the field of study, with the aim to improve project development skills of students in DSP programs.

The analysis and interpretation of the data systematically obtained are used for the improvement of the study direction. The data of students and employers’ surveys ensure the compliance of the aims and tasks of the study direction programmes with the requirements of the market and society, allowing for tracking and evaluating the quality of each study course, its compliance with the aims and tasks of the programme.

Great attention is paid to students’ satisfaction with the quality of delivery of the study programmes and study courses. The results of the surveys are discussed at the meetings of the council of the study direction. The information obtained is passed on to the director and the teaching staff implementing the study programme. Evaluating the quality of the programmes of the study direction and certain study courses provides for taking a decision regarding necessary changes in the content of the study courses or in the organisation of the study process.

### **Mechanism of receiving and providing feedback (working with students, alumni, employers)**

For the study programme elaboration to be compatible with the labour market demands, special significance is attributed to the feedback received from students and alumni. Students and alumni assess the proceeding of the study programme as well as the applicability of the acquired knowledge, skills, and competences in professional activity, thus the feedback becomes a valuable element of the study process improvement.

The SQAC at the end of each academic year organizes a student survey the results whereof provide information on the assessment of the study quality and related aspects. Student survey is available in e-environment. Alumni and employer survey questionnaires are elaborated as well. The results of

student surveys are taken into account when planning the next academic year, assessing the pedagogical and professional competences of the lecturers, the availability of the study materials and sources, the involvement of foreign teaching staff, and other related issues.

Graduate student and employer surveys are conducted by representative sampling. Employers are surveyed after internships, the survey of employers not involved in internship provision takes place every two years on average. Questionnaires or interviews of graduates are organized both immediately after graduation and several times after graduation (after six months, a year, three years). After processing the obtained data and reviewing the results, changes are introduced into the content of the study programme. The director of the study programme informs all involved parties (students, teaching staff, employers, graduates) about the changes introduced, thus providing feedback. Student representatives participate in the direction councils and in the development of solutions to the comments provided in the surveys. Student, alumni, and employer survey results are used to review and improve the study programme content. The study programme director reacts to all justified opinions, proposals, and reprimands expressed in the survey questionnaires, and upon necessity they are discussed by the study direction council.

However, in case of DSP, students (who are often lecturers at DU or other universities themselves) consider evaluation of their thesis supervisor and colleagues to be unethical, because with a small number of students in a given study year, the survey is actually no longer anonymous. Doctoral students believe that discussion of problems in a separate seminar is more useful than filling out a formal survey questionnaire. In fact, they showed that this action form of research and improvement is ineffective in doctoral studies with a small number of students. Analysis of the completed by AMSP "Physics" students survey, which confirms that implementation of the newly created program is going well, see in appendix 2.2.4. *student survey analysis\_AMSP\_Physics* (note that there is only one student from DU in the program, so it is a subjective analysis).

[1] Regulations of the Cabinet of Ministers of 25 June 2019 No. 276 "Rules of State Education Information System"(in Latvian). Available: <https://likumi.lv/ta/id/307796> [viewed 20.02.2023]

[2] Graduate survey (in Latvian). Available: <https://aptaujas.du.lv/index.php/764263/lang-lv> [viewed 20.02.2023]

[3] Employer survey (in Latvian). Available: <https://aptaujas.du.lv/index.php/544412> [viewed 20.02.2023]

**2.2.5. Specify the websites (e.g., the homepage) on which the information on the study field and the relevant study programmes is published (in all languages in which the study programmes are implemented) by indicating the persons responsible for the compliance of the information available on the website with the information published in the official registers (State Education Information System (VIIS), E-platform).**

All necessary information on studies, the faculty, study direction and study programmes in Latvian and English is available on DU website and is accessible to students. DU website section "Studies"[1] contains information about DU faculties, implemented study programmes, opportunities of auditing study courses, as well as further education opportunities provided by DU life long education centre. DU website section "Study programmes"[2] contains information on all study programmes implemented at DU, including AMSP "Physics" (physics of technology)[3], DSP

“Mathematics”[4] and DSP “Solid State Physics”[5]. The website provides information about admission requirements for each study programme, study courses to learn (including study course descriptions in Latvian and English), opportunities after graduating as well as contact information of the study programme director.

The International and Public Relations Department is responsible for the compliance of the information on the DU study fields available on the DU website with the information available in the official registers. In turn, the Study Department is responsible for regular and timely provision of information about students (SEIS).

[1] DU Studies. Available: <https://du.lv/en/studies/> [viewed 20.02.2023]

[2] DU Study programmes. Available: <https://du.lv/en/studies/study-programmes/> [viewed 20.02.2023]

[3] Information about AMSP "Physics". Available: <https://du.lv/en/studies/study-programmes/academic-master-study-programmes/physics/> [viewed 30.04.2023]

[4] Information about DSP “Mathematics”. Available: <https://du.lv/en/studies/study-programmes/doctoral-study-programmes/mathematics/> [viewed 30.04.2023]

[5] Information about DSP “Solid State Physics”. Available: <https://du.lv/en/studies/study-programmes/doctoral-study-programmes/solid-state-physics/> [viewed 30.04.2023]

## 2.3. Resources and Provision of the Study Field

**2.3.1. Provide information on the system developed by the higher education institution/ college for determining and redistribution of the financial resources required for the implementation of the study field and the relevant study programmes. Provide data on the available funding for the scientific research and/or artistic creation activities, its sources and its use for the development of the study field.**

The study direction “Physics, material science, mathematics and statistics” is funded from the state budget financing for studies (subsidy) and tuition fees. In addition to the development of the program, funding is attracted from Latvian and European projects (see Appendix 3.4.4. *Participation in projects DSP Mathematics* and 3.4.4. *Participation in projects DSP Solid State Physics*) and science-based funding, the amount of which depends on scientific performance.

The cost calculation for one student in the programmes of the study direction was made at the Department of Finance and Accounting of DU, including the salary fund and the employer’s SSIA, the costs of business trips, materials, energy resources and inventory costs, the costs of purchasing books, equipment and investments, as well as the costs for social security of students.

The source of funding for study programs in the field of study "Physics, material science, mathematics and statistics" for the period 2017-2022 was state budget funds. For the scientific

development of the field of study "Physics, materials science, mathematics and statistics" at DU funds for the development of the science base are allocated from the Ministry of Education and Culture. The study field obtains the funds intended for the development of science on the basis of the scientific achievements and indicators of the lecturers for the previous year, which are evaluated by the DU Department of Science. The assessment of the efficiency of the scientific work of the academic staff of DU is carried out in accordance with the "Procedure for evaluating the effectiveness of the scientific work of the academic staff of the University of Daugavpils" (available from the internal network of DU).

DU academic staff (assistants, lecturers, docents, associate professors, professors, research assistants, researchers, leading researchers) have the right to receive within the available DU budget financing royalties for scientific publications indexed in the Web of Science and/or SCOPUS databases, and scientific monographs. Payment for scientific publications is made in accordance with the "Procedure in which scientific publications and monographs of academic staff of Daugavpils University are paid" developed by DU (available from the internal network of DU).

DU academic staff (assistants, lecturers, assistant professors, associate professors, professors, research assistants, researchers and leading researchers) within the available DU budget financing have the right to receive remuneration for the citation characterizing Hirsch index in SCOPUS and/or Web of Science (hereinafter referred to as WoS) databases. The amount of compensation is calculated according to the "Procedure in which the academic staff of Daugavpils University receives remuneration for the Hirsch index".

DU academic staff have the opportunity to participate in the annual Daugavpils University research project competition and receive funding for the implementation of scientific research [1]. The general goals of the research project competition are to ensure the development of DU's scientific activity and scientific excellence; promote the research growth of DU academic, scientific staff and students; promote the practical applicability of research results, cooperation with the private sector and attraction of additional external funding; to form innovative interdisciplinary research groups for the implementation of current research topics. The right to submit individual or research group projects to the competition is granted to representatives of the academic and scientific staff working on the basis of an employment contract: professors, associate professors, docents, leading researchers, researchers, lecturers, assistants, research assistants, doctoral students and applicants for a doctoral degree. The total funding amount of the project competition for the current year is determined by the DU Budget Commission. The allocated project tender fund for 2023 was EUR 51,000.00. The maximum allowable amount of funding for one research project is EUR 3000.00.

Students of DU study programmes are eligible for applying to student research project competition [2]. The general goals of the research project competition are to ensure the development of DU's scientific activity and scientific excellence; promote the research growth of DU students; promote the practical applicability of scientific results, cooperation with the private sector and attraction of additional external funding; to form innovative interdisciplinary research groups for the implementation of current research topics; involve DU bachelor and Master students in scientific activity; promote the increase in the number of publications indexed in the Web of Science and/or SCOPUS databases at DU. The right to submit projects to the student research project competition is granted to academically successful students in DU bachelor and Master study programmes who are enrolled in the respective level study programme for the first time. If the student terminates studies, the scholarship payment is stopped starting from the following month. During the implementation of the project, it is planned to publish at least one publication in editions indexed in the Web of Science and/or SCOPUS databases. For the project implementation, bachelor and Master students receive a scholarship of EUR 200.00 per month for annual 10 months duration.

The maximum available amount of funding for one research project and the total amount of funding for the project competition for the given year are determined by the DU Budget Commission. The project tender fund in 2023 was EUR 24,000.00, while the maximum allowable amount of funding for one research project was EUR 2,000.00.

Funding for the improvement of the educational material and technical base (additional improvement of auditoriums and laboratories, purchase of educational literature and modern research equipment, purchase of visual aids and software, etc.) is mainly provided from various projects (e.g. ERDF, ESF).

[1] DU research project competition for 2023 (in Latvian). Available: <https://du.lv/aktualitates/daugavpils-universitate-izsludinats-ieksejo-petniecibas-projektu-konkurss-2023-gadam/> [viewed 20.02.2023]

[2] DU student research project competition for 2023 (in Latvian). Available: <https://du.lv/aktualitates/daugavpils-universitate-izsludinats-studejoso-petniecibas-projektu-konkurs-2023-gadam/> [viewed 20.02.2023]

**2.3.2. Provide information on the infrastructure and the material and technical provisions required for the implementation of the study field and the relevant study programmes. Specify whether the required provision is available to the higher education institution/college, available to the students, and the teaching staff.**

DU has purposefully invested in the modernization of the study and research infrastructure, as a result of which students have access to modern teaching and research laboratories equipped with the necessary laboratory and field research equipment to ensure the study and the research process. Infrastructure modernization projects implemented by DU, within the framework of which the study and research opportunities for the students of the study direction “Physics, material science, mathematics and statistics” have been improved, are the following ones:

- ERDF project “Development of research infrastructure in the fields of smart specialization and strengthening of institutional capacity at Daugavpils University” (agreement No. 1.1.1.4/17/I/008”, project implementation time: 2017 - 2020, DU total costs: 3,069,684, 21 EUR). Within the framework of the project, infrastructure has been developed by purchasing new equipment in the priority development areas defined in the internationally recognized research programmes: mathematics, physics, nanomaterials, materials engineering, biology.
- ERDF project “Improvement of the quality of Daugavpils University study programmes and ensuring the environment accessibility” (agreement No. 2010/0115/3DP/3.1.2.1.1/09/IPIA/VIAA/021, project implementation time: 2010 - 2015, DU total cost: EUR 16 715 991). Within the framework of the project, the auditoriums of the study building at 1 Parādes Street were renovated and adapted for people with functional disorders, their energy efficiency was increased, as well as the equipment, tools, facilities and information technologies were modernized. The building of the DU Life Sciences and Technology was attached to the existing building of DU; it has study and scientific laboratories that are fitted up with modern equipment within the project. Within the project, in all the modernized premises, access to people with various functional disorders is provided.

All DU students are provided not only with modern study environment, but also with modern living infrastructure – renovated dormitories, a sports complex with a swimming pool, etc. The study and the research processes are provided in sufficient quantities with the necessary photocopying equipment, visual presentation equipment, video filming and video reproduction equipment, modern photo equipment and audio equipment. The students and the lecturers have constant access to the Internet and the Internet connection of the local DU network, e-study environment Moodle, as well as the possibility of using e-mail and teleconferences, various online platforms, e.g. ZOOM.

Implementation of the study programs included in the field of study "Physics, Materials Science, Mathematics and Statistics" is supported by several structural units of DU - Institute of Life Sciences and Technologies (DZTI) (Department of Biotechnology, Department of Ecology, Department of Technology (incl. Center for Innovative Microscopy and Center for Mathematical Research), Department of Biosystematics and Department of Applied Chemistry), FNSM.

The most important of the available infrastructure and laboratory equipment is given in Appendix 2.3.2. *Infrastructure and material technical provision\_EN*. It shows that DU has the necessary equipment for learning the skills of practical and research work. For example, there are auditoriums equipped for video conferences, with an interactive whiteboard, and specialized laboratories with equipment for practical work. Let's list the most important equipment of the Technology Department of DZTI, which is most closely related to the implementation of both physics programs and the field of specialization "Technological Physics":

- A metalworking machine equipped with laser technology;
- Electron scanning microscope FESEM MAIA3 TRIGLAV, TESCAN;
- Electron scanning microscope VEGA II LMU, TESCAN;
- Confocal laser scanning microscope Leica TCSP-5;
- Fs laser system;
- X-ray diffractometer RIGAKU Smart Lab;
- Vacuum equipment for obtaining nanostructured coatings Nanosys500 MANTIS, LAB 18 KJ LESKER;
- *Spectrophotometer SHIMATZU;*
- *Electrochemical station ZANHER ZENNIUM;*
- Atomic force microscope Park – equipped with a range of different measurement modes;
- Holographic equipment.

**2.3.3. Provide information on the system and procedures for the improvement and purchase of the methodological and informative provision. Description and assessment of the availability of the library and the databases to the students (including in digital environment) and their compliance with the needs of the study field by specifying whether the opening times of the library are appropriate for the students, as well as the number/area of the premises, their suitability for individual studies and research work, the services provided by the library, the available literature for the implementation of the study field, the databases available for the students in the respective field, the statistical data on their use, the procedures for the replenishment of the library stock, as well as the procedures and possibilities for the subscription to the databases.**

Replenishment of the library collection and subscription of databases take place at the request of the lecturers of the faculties. Applications for the purchase of books are regularly (every academic year) reviewed and approved by the DU Budget Commission, thus implementing a mechanism for purchasing the latest publications for the DU library. The library does not digitize the collection, but the final theses of the DU students are uploaded to the library's information system. The library regularly informs the faculties about the latest literature, database trials and subscription options, so that the faculty lecturers and students can get acquainted with new offers.

The students have access to the services offered by the DU Library - the library's electronic catalogue, ordering, reserving and renewing books on the Internet, automated service provide to the user, Self-service system for receiving and handing over books at the educational building at Parādes Street 1 and Vienības Street 13, interlibrary subscription, internet, incl. wireless internet, computers, printers, copiers, multifunctional devices, as well as access to electronic databases and DU final works, incl. remote access. The library users have the opportunity to use the open access reading room with 60 workstations, incl. 15 Computerized, Subscription, Bibliography and Information Sectors. The total area of the library is 1,000 m<sup>2</sup>, including premises to service the users - 400 m<sup>2</sup>. Collection of the library at the beginning of 2023 is 259916 items, incl. books - 243318, periodicals - 16598. Number of books in the field of physical science - 6616, incl. 171 in English, which is 3% of the books in the field of physical science. The number of books in the field of mathematical science - 11873, incl. 1084 in English, which is 9% of the books in the field of mathematical science. Electronic databases mostly contain materials in English. Access to the following electronic databases is provided within and outside the DU network:

- EBSCO Publishing (it includes 8 databases: Academic Search Elite, Business Source Premier, MasterFILE Premier, Newspaper Source, ERIC, Business Wire News, MEDLINE, Health Source - Consumer Edition, Agrikola); there are around 10,000 scientific journals in a number of disciplines (including fields of physics and mathematics) in English.
- Cambridge Journals online. 100 scientific journals in several disciplines.

(including fields of physics and mathematics) in English. -

- Science Direct  
(<https://www.sciencedirect.com/browse/journals-and-books?searchPhrase=mathematics>): Multidisciplinary database from which full texts of about 380 journal titles are available. The most frequently used journals of DSP "Mathematics" are Advances in Applied Mathematics; Applied Mathematics and Computation, Applied Mathematics Letters, Biomathematics, Computers & Mathematics with Applications; Journal of Computational and Applied Mathematics; Journal of Differential Equations; Mathematics and Computers in Simulation; Results in Applied Mathematics (in English).
- Web of Science - multidisciplinary database, what offers extensive options for searching, selecting and analyzing results (including fields of physics and mathematics) in English. The most frequently used journals of DSP "Mathematics" are (<https://wosjournal.com/list-of-journals.php?id=Mathematics>): International Journal Of Mathematics And Mathematical Sciences; Journal Of Computational Dynamics; Advances In Difference Equations; Differential And Integral Equations; Discrete And Continuous Dynamical Systems; Electronic Journal Of Differential Equations; Electronic Journal Of Qualitative Theory Of Differential Equations; Journal Of Modern Dynamics; Journal Of The European Mathematical Society; Nonlinear Analysis-Modelling And Control; Proceedings Of The American Mathematical Society; Qualitative Theory Of Dynamical Systems; Results In Mathematics; Differential Equations And Dynamical Systems.
- Scopus - bibliographic and citation information database of multidisciplinary scientific publications (including fields of physics and mathematics) in English and German. DSP

"Mathematics" (<https://journalrw.org/scopus-indexed-mathematics-journals/>) and DSP "Solid State Physics", AMSP "Physics" more frequently used journals are Nonlinear Dynamics; MDPI Mathematics; Nonlinear Analysis: Modelling and Control; Mathematical Modelling and Analysis; Journal of Applied Mathematics and Computing; Archiv der Mathematik; Advances in Physics; Nature Physics; Chaos, Solitons and Fractals; Computers and Education; IEEE Transactions on Neural Networks and Learning Systems.

- Springer Link ([www.springerlink.com](http://www.springerlink.com)),
- Letonika is a Latvian reference and translation system on the Internet. Currently, these resources include the Latvian Encyclopaedic Dictionary, Glossary of Terms, computer dictionaries for translation and interpretation, and more.

Database usage statistics for 2020, 2021, 2022, respectively

EBSCO: Database Sessions-13230, 13277, 10964, Total Full-Text Requests-3792, 7831, 2704.

ScienceDirect: Total Full-Text Requests - 5885, 3901, 8193.

Scopus: Database Sessions - 4461, 5268, 5611.

The opening hours of the library are suitable for the needs of students. After the students' complaints about the short working hours of the library on working days and unavailability on Saturdays, the working hours of the DU library have been changed since the autumn semester of 2018 (on working days: from 9.00 am to 8.00 pm, on Saturdays: from 10.00 am to 4.00 pm). Students gave a positive evaluation.

Teaching staff of the department offers personal books and the latest magazines in their laboratories or work rooms for students to use.

**2.3.4. Provide a description and assessment of information and communication technology solutions used in the study process (e.g., MOODLE). If the study programmes within the study field are implemented in distance learning, the tools specially adapted for this form of study must also be indicated.**

DU has developed an e-learning environment (Moodle), as a result of providing direct communication (e-mail, consultations) information is available in each study course. Through e-studies, the risk of students dropping out is reduced in cases where it is not possible to fully attend all study courses due to work or health conditions. The use of modern IT solutions (e-mail, Moodle, ZOOM, Skype, Facebook) is an important step in promoting the maintenance of a critical mass of students, thus ensuring preparation of specialists not only for the region of Eastern Latvia, which is represented by the majority of DU students, but also for other regions of Latvia and foreign countries.

In all major study programs, the posting of grades now takes place in Moodle environment, and it is also the place for links to join the class at the scheduled time if it is held remotely. DU lecturers systematically used e-study environment Moodle[1] in their work with students studying ABSP "Mathematics" and AMSP "Mathematics", placing various study materials and other instructions in it. In DSP "Mathematics", DSP "Solid state physics" and AMSP "Physics" these options are not so widely used. Due to the small number of students, an individual approach is more advantageous here, exchanging study materials by e-mail. As part of the study courses, it is planned to send homework and tests by e-mail or add them online to Moodle, receive evaluations and reviews of

works by e-mail, consultations in the e-environment. Students and teachers of ABSP "Mathematics", AMSP "Mathematics" and DSP "Mathematics" often use options offered by the DU e-resources repository[2]. It is led by one of the teaching staff of DSP "Mathematics". The "Study materials" section is available for teachers to place various types of teaching and methodical materials. The following sections are also important "Mathematical Conferences", "Journals of Mathematics", "Study materials - students for students", useful for relaxation "Mathematical Kaleidoscope". It is very useful that Internet addresses various branches of mathematics (mathematical analysis, functional analysis, discrete mathematics, etc.) they all are collected here, which can be useful for both studies and research work.

DU has an information system DUIS that contains descriptions of all study courses, a timetable of classes, and a student can see his/her progress and individual orders related to the study process in his/her profile. The e-learning environment Moodle is synchronized with the DU information system DUIS, which facilitates students' access to study courses created in the e-learning environment without additional registration. DU regularly organizes professional development courses for the lecturers „ development of study courses in the e-learning environment Moodle”, as well as the lecturers are provided with individual consultations. The students can receive technical support at the Student Service Centre and the Dean's Offices of the faculties.

[1] E-learning environment Moodle. Available: <https://estudijas.du.lv/login/index.php?lang=en> [viewed 30.04.2023]

[2] DU e-resources repository (only in Latvian). Available: <https://de.du.lv/matematika.html> [viewed 30.06.2023]

### **2.3.5. Provide information on the procedures for attracting and/or employing the teaching staff (including the call for vacancies, employment, election procedure, etc.), and the assessment of their transparency.**

Election to an academic position takes place in accordance with the requirements of "Regulations on elections to academic positions at Daugavpils University"[1]. According to the regulations, academic positions at DU are professor, associate professor, leading researcher, docent/assistant professor, lecturer, researcher, assistant, research assistant.

The number of positions of assistants, lecturers, docents is determined by the Rector according to the amount of the study work to be performed, upon the proposal of the Faculty Council. The number of positions of researchers, leading researchers and scientific assistants is determined by the Rector according to the need and funding possibilities, upon the proposal of the Institute/Scientific Council. The number of associate professor positions in the relevant science or art subfields is determined by the rector according to the need and funding opportunities after approval by the DU Senate.

Information about vacancies for academic positions and competition announcements are published on the DU website and/or in the official publication of the Republic of Latvia "Latvijas Vēstnesis", thus giving an opportunity to any interested person to apply for a job at DU within a month after the announcement of the competition. DU can elect both citizens of the Republic of Latvia and foreign citizens whose academic education and professional qualifications meet the requirements of the science or art branch, study and research work at DU, and who are proficient in the national language and professional English.

Elections of docents, leading researchers, lecturers, researchers, assistants and research assistants, by open voting, take place in the Councils of faculties or Scientific Councils of scientific institutes no later than within three months from the date of the announcement of the competition. When electing docents and leading researchers, the qualifications of members of the Faculty Council or the scientific institute Council must meet the requirements of the Doctoral Council. The results of the elections of docents and leading researchers are confirmed at the DU Senate meeting.

Elections of professors and associate professors, by open voting, take place in the council of professors of the relevant branch of science.

Visiting teaching staff, unlike elected teaching staff, are recruited when specific specialists are needed in the provision of study programs. For example, Professor A. Salītis is a visiting teaching staff attached to the DSP "Solid State Physics" study course "Laser Physics". Visiting lecturers must also meet certain criteria for an academic position.

[1] "Regulations on elections in academic positions at Daugavpils University"(in Latvian). Available: [https://du.lv/wp-content/uploads/2021/12/Nolikums-par-velesanam-akademiskajos-amatos-DU\\_APST\\_IPRINATAIS.pdf](https://du.lv/wp-content/uploads/2021/12/Nolikums-par-velesanam-akademiskajos-amatos-DU_APST_IPRINATAIS.pdf) [viewed 20.02.2023]

**2.3.6. Specify whether there are common procedures for ensuring the qualification of the academic staff members and the work quality in place and provide the respective assessment thereof. Specify the options for all teaching staff members to improve their qualifications (including the information on the involvement of the teaching staff in different activities, the incentives for their involvement, etc.). Provide the respective examples and specify the way the added value of the possibilities used for the implementation of the study process and the improvement of the study quality is evaluated.**

DU developed internal regulatory enactments and mechanisms that regulate the qualification and quality assurance of academic staff:

- Regulations on elections to academic positions at Daugavpils University [1];
- Procedure for evaluation of the scientific activity of the Daugavpils University academic staff[2];
- Student's surveys .

For the selection of teaching staff to be involved in the AMSP "Physics", DSP "Solid State Physics" and DSP "Mathematics" compliance of the qualification of the teaching staff with the requirements set by the regulatory acts, as well as the knowledge of the national language and foreign languages is assessed. The following basic criteria are set in the evaluation system of the academic staff:

- Excellence – sustainable and continuous development, ensuring process and resource management;
- ability to effectively use academic freedom – to freely choose the directions and methods of academic activity, to create and publish new knowledge, to openly discuss its content, to look for opportunities to implement it in practice;
- academic culture – collegial cooperation with students and other academic staff based on the principles of academic ethics, mutual respect, demandingness, interest and support;

- responsibility for one's work in front of the public and the state in accordance with the DU quality management system and quality culture.

The qualifications of the academic staff meet the requirements of the University Law, because in DSP "Mathematics", DSP "Solid State Physics" all planned lecturers have doctorate degrees in sciences. Reading of study courses AMSP "Physics" is allowed for teaching staff with a master's degree - both elected and guest lecturers. All representatives of the academic staff from DU involved in the implementation of AMSP "Physics" have at least a master's degree, in addition, 7 lecturers have a doctorate degree, which makes up 70% of the total number. English language skills of the teaching staff from DSP "Mathematics", DSP "Solid State Physics" and AMSP "Physics" allow reading the study program in English. Also, knowledge of the national language of the employed academic staff complies with the regulations on the amount of knowledge of the national language to teach the study program in Latvian.

In order to improve the professional competence of DU academic staff, DU regularly provides training. In the period from 2020-2022 within the framework of the ESF project "Strengthening the professional competence of the academic staff of strategic specialization areas of Daugavpils University" (No. 8.2.2.0/18/A/022), several professional development programs were offered to DU as part of the improvement of the professional qualifications of lecturers, for example, "Interaction and communication skills", "ABC of leadership", "Leadership in coaching style", "Communication", "Emotional intelligence in education", "Fundamentals of developing e-study materials and virtual study platforms", "Trends in the use of educational technologies in the 21st century" etc. Within the framework of the mentioned project, self-development lectures on the commercialization of inventions, nutrition, body health, personality charisma and prevention of burnout risks, anti-stress days, 24-hour camps for the promotion of professional efficiency, experience-based training and visits to companies according to the subject of study directions in Latvia were also organized for the academic staff. The team of the study field actively used many of the offered opportunities. For example, in 2021, the specialized training "Interaction and communication skills" was attended in the amount of 12 academic hours (led by Zane Daudziņa), organized within the framework of ESF project No. 8.2.2.0/18/I/005 "Daugavpils University study direction "Education, pedagogy and sports" strengthening the capacity of academic personnel in areas of strategic specialization". ESF project "Education, pedagogy and sports" strengthening the capacity of academic staff within the strategic specialization area No. 8.2.2.0/18/I/005 seminar "Leadership ABC". In 2020, European Social Fund project no. 8.2.3.0/18/A/010 "Development of management and leadership competencies of Daugavpils University" training course "Coaching", as well as training courses "English language skills", "Change management process", "Development of team building competence", "Leadership competences" development", "Innovations of educational content", "Development of personnel management competence". In 2019, participated in the European Social Fund project no. 8.2.3.0/18/A/010 "Improving DU management and management competencies" in the training courses "Academic Integrity", "Communications Competence Development" and "Financial Management". Academic staff confirm the usefulness of the proposed professional development measures, as professional competence is improved.

Within the framework of the ESF project "Reducing the fragmentation of study programs and strengthening the sharing of resources at Daugavpils University" No. 8.2.1.0/18/A/019, seminars were organized for the development and integration of study course support materials necessary for lecturers into the study process. Lecturers in the field of study improve their qualifications by doing internships abroad and lecturing in foreign educational institutions (2.5.3. *Incoming and outgoing mobility of teaching staff*). Most of the teaching staff involved in the realization of the field of study participate in various scientific and academic activities, thus developing new skills and promoting professional growth. Summary of quantitative data on the scientific research activities

corresponding to the field of study during the reporting period (publications of the academic staff, participation in conferences, participation in projects, etc. activities) is given in Appendix 2.4.4. *Compilation of quantitative data for direction*. Improvement of professional competence of teaching staff involved in the realization of the field of study by participating in trainings, international mobility programs, actively engaging in scientific activity, project implementation, etc. in scientific and academic activities, provides significant added value to the overall improvement of the study process and improvement of quality of studies. As the added value of the opportunities used, improvements in the range and content of the offered study courses can be mentioned, for example, by introducing the course *Modern methods in the theory of boundary value problems of ordinary differential equations*, which introduces both new methods in the theory of differential equations and new techniques in the study of the set tasks.

[1] Regulations on elections in academic positions at Daugavpils University versitātē (in Latvian). Available:

[https://du.lv/wp-content/uploads/2021/12/Nolikums-par-velesanam-akademiskajos-amatos-DU\\_APSTIPRINATAIS.pdf](https://du.lv/wp-content/uploads/2021/12/Nolikums-par-velesanam-akademiskajos-amatos-DU_APSTIPRINATAIS.pdf) [viewed 20.02.2023]

[2] The procedure for evaluating the scientific activity of the academic staff of Daugavpils University (in Latvia). Available:

<https://old.du.lv/wp-content/uploads/2016/01/zinatniskas-aktivitates-vertesanas-kartiba.pdf> [viewed 20.02.2023]

### **2.3.7. Provide information on the number of the teaching staff members involved in the implementation of the relevant study programmes of the study field, as well as the analysis and assessment of the academic, administrative (if applicable) and research workload.**

Teaching staff is a very important quality assurance factor in the realization of programs of the field of study "Physics, material science, mathematics and statistics". Implementation of the field of study is provided by 19 lecturers. 7 lecturers are academic staff elected by DU. 16 lecturers (84.2%) have a doctoral degree, and three lecturers have a master's degree (one of them is a candidate for a doctoral degree).

The workload of lecturers is determined in accordance with the "Procedure for Accounting the Workload of the Academic Staff at Daugavpils University". If the lecturer's study work is more than 1000 hours per academic year, then in accordance with the procedure prescribed by law, the work overload is calculated only for the study work for which the company's contract for the performance of academic work is concluded.

Recruitment of lecturers with a doctorate degree is being intensified in order to implement high-quality study programs in accordance with regulatory enactments, starting from 2023/2024 st.y. For example, it is planned to increase the number of lecturers of DSP "Solid Physics" to 10, including 4 new lecturers with a doctor's degree. And to include 1 new lecturer with a doctor's degree in the staff composition of DSP "Mathematics".

The results of the scientific activity of the academic staff are summarized once a year, in accordance with the "Procedure for Evaluating the Efficiency of the Scientific Work of the DU Academic Staff". Based on the evaluation of the efficiency of scientific work, the Science

Department may decide to recommend to the DU Scientific Council and Senate to evaluate the amount of scientific activities of DU structural units and/or remuneration of academic staff and suitability for the position.

Basic information about teaching staff involved in the implementation of the field of study is attached in appendix (2.3.7. *Teaching staff fo study direction\_EN*), and biographies of the teaching staff (2.3.7.CV). Knowledge of the national language of the academic staff employed in the field of study meets the set requirements, respectively, they allow any course in the field of study to be fully taught in the national language.

All major study programs have teaching staff who have both academic and research workloads, but both doctoral study programs have lecturers with this load distribution. This confirms the possibility of lecturers to attract students to current research directions.

Appendix 2.3.7. (2.3.7. *STATEMENT\_native language*) contains statement signed by the university rector to the effect that the state language proficiency of the academic staff involved in the implementation of the study direction programmes complies with the regulations on the state language proficiency level and the procedure for testing the state language proficiency for the performance of professional and official duties, whereas appendix 2.3.7. (2.3.7. *STATEMENT\_foreign\_language\_B2*) provides statement on the respective foreign language proficiency (at least B2 level) of the academic staff involved in the implementation of the study direction programmes in compliance with EU language proficiency assessment levels, if the study programme or its part is implemented in a foreign language.

### **2.3.8. Assessment of the support available for the students, including the support provided during the study process, as well as career and psychological support by specifying the support to be provided to specific student groups (for instance, students from abroad, part-time students, distance-learning students, students with special needs, etc.).**

The DU Student Service Center (SSC) operates at DU and its main task is to inform DU students about current issues, as well as to provide consultations and services. Key features of SSC are as follows:

- issue certificates to students (to the bank, the State Revenue Service and other institutions, as well as certificates about study leaves, elaboration and defense of bachelor and Master's theses, etc.);
- issue the signed study contracts to students;
- advise students on issues related to the study process, extracurricular activities and dormitories;
- participate in organizing informative events (career days, educational exhibitions, etc.);
- listen to, collect students' proposals and submit them to the appropriate structural units.

Students use SSC services very often.

DU infrastructure has been modernized and adapted to improve the accessibility of the environment for people with disabilities (movement, vision, hearing impairment), as well as there have been opened children's rooms for students, who are young parents, so that they could to change and feed their babies and a playroom to entertain the students' children while they are at

their classes[1]. Currently, there are no persons with functional disabilities in the accredited study field.

The students can use DU in various ways: computer classes and auditoriums – for consultations, meetings, library premises – for literature analysis, preparation of independent and research work, as well as specially equipped premises – for conferences, study and extracurricular activities (DU Sports Complex). If necessary, students use these rooms.

The lecturers and the students can receive medical support in a certified health office, where first aid in case of various illnesses is provided by a doctor's assistant (feldsher).

The Psychological Support Center (PSC) operates at DU, which provides psychological support to DU students and employees in solving various daily problems in personal, work related, or educational matters. PSC psychologists provide up to three free consultations per person. If necessary, the number of consultations can be increased. Counseling is organized on the premises of DU in person or remotely (using ZOOM) after prior agreement on the counseling time. PSC psychologists do not advise close colleagues and students they educate to avoid multiple relationships. PSC operates in accordance with the "Regulations of the Daugavpils University Psychological Support Center"[2]. Due to the fact that the center was established recently, the teaching staff and students of the accredited study direction have not used these services until now.

DU has an active DU Student Social Support Program, the purpose whereof is to support academically successful DU full-time study programme students who reside in DU dormitories and have grave social and material conditions. The program provides 50% support to cover the monthly rent for one academic semester. The amount of the program support is up to 10% of the total number of students living in the dormitories.

The Career and Initiative Support Center (CISC)[3] has been established at DU, the purpose of which is to promote career development services, volunteer work and support initiatives that would contribute to the well-being of the residents of the Latgale region by promoting the professional capacity, competitiveness, cooperation and participation of individuals. The operational tasks of CISC are to create and provide an educational, initiative-supporting environment for the residents of the Latgale region; promote cooperation with governmental and non-governmental organizations in the field of research, project management and attracting specialists; cooperate with Latvian and foreign educational institutions, companies in the field of providing education and internships; organize forums, conferences, seminars for increasing competences, involving DU lecturers; offer career counseling and educational psychologist services; provide advice on managing volunteer work.

The DU Department of International and Public Relations provides support functions for foreign students studying at DU.

[1] Availability of DU environment. Available: <https://du.lv/en/about-us/environmental-accessibility/> [viewed 20.02.2023]

[2] Regulations of the Daugavpils University Psychological Support Center (in Latvian). Available: <https://du.lv/wp-content/uploads/2023/02/Psihologiska-atbalsta-centra-nolikums.pdf> [viewed 20.02.2023]

[3] DU Career and Initiative Support Center (only in Latvian). Available: <https://du.lv/karjeras-un-iniciativu-atbalsta-centrs/> [viewed 30.04.2023]

## 2.4. Scientific Research and Artistic Creation

### 2.4.1. Description and assessment of the fields of scientific research and/or artistic creation in the study field, their compliance with the aims of the higher education institution/ college and the study field, and the development level of scientific research and artistic creation (provide a separate description of the role of the doctoral study programmes, if applicable).

According to the collected data, the DU lecturers purposefully and regularly participate in various professional development activities in the fields corresponding to their scientific interests. In addition to academic work at the university, the teaching staff has practical experience in the implementation of scientific projects. This type of activity contributes to a comprehensive understanding of the specifics of the industry, thus ensuring a direct unity of theory and practice during the study process.

Research directions defined by the field of study "Physics, material science, mathematics and statistics":

- 1) topical issues of mathematical modeling, including issues of mathematical modeling of complex networks (genes, neurons, telecommunications);
- 2) qualitative theory of nonlinear boundary value problems of ordinary differential equations;
- 3) numerical and qualitative research of systems and equations of higher order differential equations;
- 4) molecular and solid state physics,
- 5) materials physics, chemical physics, semiconductor physics, materials science,
- 6) laser physics and spectroscopy,
- 7) nanomaterials,
- 8) intelligent materials and structures.

Therefore, DSP "Mathematics" students study dynamical systems that have a regular and/or chaotic nature. These systems find wide application in various applied tasks. Theoretical issues in the theory of differential equations are also studied.

Study programs "Physics of Solids" and "Physics" provide students with the opportunity to deepen their theoretical knowledge, gain experience in scientific work and the ability to conduct independent research in the subfields of physics, engineering and technology. Students mostly conduct interdisciplinary research, solving complicated problems, as well as develop new methods and technologies together with the scientific staff, acquire knowledge in the field of patenting.

The research directions of the field of study correspond to the goals of the field of study of the university and the level of science and development.

The directions of the research work of the academic staff involved in the program are oriented towards the successful implementation of the study program and in most cases are related to the lecturer's specialization within the program.

DSP "Mathematics" and DSP "Solid state physics" implemented by DU plays a significant role in the

development of the scientific potential of the field of study, as well as in promotes the growth of academic staff (publications, scientific projects, etc.). Doctoral studies are a source for academic staff renewal. Continuity of knowledge is ensured, as several DSP graduates and a current student are included in the provision of AMSP "Physics", DSP "Solid State Physics" and DSP "Mathematics". The quality of prepared specialists, which corresponds to the goal of the field of study to prepare highly qualified, internationally competitive physics and mathematics specialists, is evidenced by the fact that the doctoral graduates of the DU field of study "Physics, Materials Science, Mathematics and Statistics" are currently working or have worked not only at DU, but also in other universities and research institutes. For example, at the LU Institute of Mathematics and Informatics, LU Institute of Solid State Physics, LU Institute of Atomic Physics and Spectroscopy, Riga Technical University, Latvian University of Biosciences and Technologies, Rēzekne Academy of Technology. Our former PhD student is successfully working at a research institute in Canada. For more detailed information on the fact that the award of the DSP "Mathematics" and DSP "Solid State Physics" science degrees is based on the achievements and findings of the science sector, see section 3.2.2 of the report (separately for each program).

#### **2.4.2. The relation between scientific research and/or artistic creation and the study process, including the description and assessment of the use of the outcomes in the study process.**

As part of the study process, the latest developments in the industry are followed - academic staff participate in projects, the results are used to update the content of study courses. Lecturers actively participate in approbation and dissemination of research results obtained within the project, speaking at scientific conferences. Information obtained in the scientific activities is used in guiding the doctoral theses. The research activity of academic staff is closely related to the study process. The staff of the field of study consists of lecturers who regularly cooperate in improvement of study processes, as evidenced by many joint publications. Compilation of quantitative data on scientific and applied research activities corresponding to the field of study during the reporting period - for academic staff publications, see in Appendix 2.4.4. *List of scientific publications for the direction*, participation in projects see in Appendix 2.4.3. *Participation in projects for direction*.

Scientific cooperation of the staff confirms interdisciplinarity in the development of students' knowledge and skills. The students of DSP "Solid State Physics" and DSP "Mathematics" are included in the solution of the current problems of science and, therefore, society as a whole, this confirms that student training is based on scientific achievements. Students are actively involved in research (projects, conferences, joint publications with teaching staff of the field of study). DSP "Solid State Physics" students are closely involved in the acquisition and analysis of properties of thin films and nanostructured materials, as well as their practical application in the development of electrochemical sensors for the detection of various organic and inorganic substances. Students mostly conduct interdisciplinary research, solving complicated problems, as well as develop new methods and technologies together with the scientific staff, acquire knowledge in the field of patenting. Research of DSP "Mathematics" students is related to mathematical modeling issues that arise in biomathematics and networks class, the qualitative theory of boundary value problems of ordinary differential equations, for example, calculus of variations approach to boundary value problems, problems for systems of second-order differential equations, problems for fourth-order differential equations, solutions of planar systems with parameters.

The participation of students in scientific conferences and seminars is constantly stimulated, also in

the status of listeners.

The research carried out by the academic staff is an important contribution to the development of the field they represent, as well as to the improvement and updating of study content. The researches cover both theoretical aspects and industry current affairs, which are used in lecturers' study courses, thus promoting the interaction of the research and study process and improving the quality of the study process. For example, the content of the DSP "Mathematics" study course "Selected issues of mathematical modeling" (4KP) was changed in order to include a currently relevant topic - the application of mathematical modeling in biology. The course provides knowledge about complex systems, the behavior of their solutions, self-organization of complex systems, research methods. The development of research directions and further specialization of programs also continues in the field of physics. For example, research into the dynamics of nanoproceses, research into the physical principles of microsensors, and their manufacture.

Science communication is of great importance in the process of society development. The study process is positively influenced by the fact that the representatives of the department, together with their students, are actively involved in the events of the Daugavpils Science Festival, Scientists' Night, which allow students to assume the role of "teachers" themselves. Also, representatives of the field of study have led the classes at the DU Science School, as well as got involved in advising and evaluating the development of students' scientific research works - in the ESF project "Implementation of national and international measures for the development of student talents" No. 8.3.2.1/16/I/002 as reviewers and/or section managers of students' scientific research works (ZPD) in the regional ZPD selection (for example, I. Jermačenko, A.Sondore, V.Mizers; A. Vagalis, V. Kolbjonoks, V. Paškevičs). But I. Mihailova and A. Ogurcovs have acted as experts - school consultants in ZPD issues. The topics and results of students' research works can be used to update the content of study courses. There are cases where students have developed ZPD using scientific equipment of the field of study.

**2.4.3. Description and assessment of the international cooperation in the field of scientific research and/or artistic creation by specifying any joint projects, researches, etc. Specify those study programmes, which benefit from this cooperation. Specify the future plans for the development of international cooperation in the field of scientific research and/or artistic creation.**

DU and LU personnel are involved in the realization of the study programs AMSP "Physics", DSP "Solid State Physics" and DSP "Mathematics", which ensure high scientific capacity of the field of study. During their studies students have access to the scientific laboratories and scientific equipment of several DU and LU scientific institutions.

The lecturers of the field of study "Physics, material science, mathematics and statistics" cooperate with scientific institutions in foreign countries. Lecturer of DSP "Mathematics" is currently involved in an international project that is implemented as part of the Horizon 2020 program ERA-NET JPI-EC-AMR "Diagnostics and surveillance of antimicrobial resistance: development of tools, technologies and methods for global use"). During the implementation of the project, there was cooperation between researchers from the Netherlands, Italy and Latvia (DU). Experience was gained in the analysis of large data sets and new results were obtained in which linear algebra was used in data analysis and prediction. During the implementation of the project, there was an epidemic of COVID-19, which made travel and direct contacts between project partners difficult. The results of

the project are summarized in at least 2 publications. The publications of this project can be used for reading and translating texts in the DSP "Mathematics" study course "English for mathematicians I, II, III".

AMSP "Physics" lecturer in 2017-2019 was involved in an international project in cooperation with Lithuania and Belarus "A living history: cultural and scientific synergy in the border region Zarasai (LT) - Daugavpils (LV) - Vitebsk (BY) for sustainable development", ENI-LLB-1-073, as a program author and lecturer. Another example of international cooperation (with Lithuania) is the project "Robonet" LLI-542 "Development of IT programming and robotics competences in schools of the cross-border region in Latgale, Visaginas and Ignalin" in 2022, whose program author and tutor was a lecturer of AMSP "Physics". In the ENI-LLB-1-073 project, teaching and methodical materials on the use of IT in museum operations were developed. In the project "Robonet" LLI-542, a training program for participants was developed to prepare teachers for conducting robotics interest education classes in schools of the Latgale region. Benefits from cooperation - established contacts and regular cooperation with course participants, especially within the framework of the Robonet project. From the project funds, DU purchased materials for 3D printers, which are now used for the purposes of DU's teaching process. After the conclusion of the Robonet project, the competition stage of the Latvian Robotics Championship was organized in Daugavpils for the first time.

International cooperation is realized also by working in international scientific journals as a member of the editorial board or a reviewer. Faculty members of the doctoral program are reviewers in high-quality international journals such as "Nonlinear Analysis-Modelling And Control", "Mathematical Analysis and Modelling", "Mathematics (MDPI)", "American Mathematical Society". Reviewing scientific papers is time-consuming, but is considered a necessary part of the work of an experienced researcher. Reviewing articles in international journals means raising the level of trust in DU mathematicians and Latvian researchers in general. One of the benefits of cooperation is that individual journals provide a number of benefits to reviewers, such as free publication of articles in Open Access journals. The director of DSP "Solid state physics" is a member of the editorial board of the scientific journal "Journal of Baltic Science Education" (it is on the list of recognized international publications of LZP, is published in Lithuania). Appendix 2.4.4. *Participation in projects for direction\_EN* contains more specific data on these international projects.

There is a wide range of publications of the teaching staff in internationally indexed scientific publications, the publications of the teaching staff for 2017-2022 can be found in Appendix 2.4.4. *List of scientific publications for the direction\_EN*. Also, students of DSP "Solid State Physics" and DSP "Mathematics", doctoral degree applicants and postdoctoral students are involved in the preparation of publications in internationally indexed scientific publications. Publications of students and doctoral degree applicants from 2017-2022 can be found in appendix 2.4.5. *List of scientific publications students\_EN*. Publications of persons who obtained a doctoral scientific degree from 2017-2023 can be found in appendix 3.1.3. *Employment and scientific indicators of persons who obtained a doctorate scientific degree DSP Mathematics and DSP Solid\_physics\_EN*.

As future plans for the development of cooperation in scientific research, should be noted improvement of scientific capacity of the teaching staff of the study area, even more active involvement in the international circulation (international projects, conferences, SCOPUS/WoS publications); conclusion of cooperation agreements and implementation of joint projects with foreign educational and scientific research institutions.

**2.4.4. Specify the way how the higher education institution/ college promotes the involvement of the teaching staff in scientific research and/or artistic creation. Provide the**

**description and assessment of the activities carried out by the academic staff in the field of scientific research and/or artistic creation relevant to the study field by providing examples.**

The scientific capacity of the teaching staff is confirmed by the final work supervised by the publications indexed in the Web of Science and SCOPUS databases, incl. doctoral theses) and research in the implementation of which the lecturers of the study program participate. DU evaluates the scientific activity of the teaching staff every year, within the framework of which the results of research work, activity in projects, as well as pedagogical and organizational work are evaluated. Within the framework of the study process, the latest current events in the field are constantly followed - the academic staff participates in projects, the results are used to update the content of study courses. Lecturers actively participate in the approbation and dissemination of research results by speaking at scientific and practical conferences and seminars. The information obtained in scientific events is used in the management of study courses and works, as well as in the preparation of teaching aids. The research and creative activity of the academic staff is closely related to the study process, promoting students' understanding of the relationship between the innovation sector and the needs of the real organization. The staff of the program consists of lecturers who regularly cooperate in the improvement of study processes, thus achieving interdisciplinarity in the development of students' knowledge and skills.

It is important to note that each lecturer involved in the implementation of the study program is an active scientist, providing science-based studies. DU has a motivation system for academic staff, cascading science performance indicators to the level of a researcher, i.e. see setting the following criteria: Number of WoS / SCOPUS publications (at least 1 year); participation in research projects; participation in international scientific events (at least 1 participation per year); research mobility (at least 1 participation in 2 years), etc. In cases when the lecturer does not meet the set requirements, DU may make a decision to terminate the contract.

Information on the number of academic staff publications indexed in WoS/SCOPUS databases, h index and participation in projects is available in Appendix 2.4.4. *Compilation of quantitative data for direction*. The largest h indexes are for lecturers Vjačeslavs Gerbreders (11), Ēriks Sļedevskis (8), Andrejs Ogurcovs (8), Felikss Sadirbajevs (8).

**2.4.5. Specify how the involvement of the students in scientific research and/ or applied research and/or artistic creation activities is promoted. Provide the assessment and description of the involvement of the students of all-level study programmes in the relevant study field in scientific research and/ or applied research and/or artistic creation activities by giving examples of the opportunities offered to and used by the students.**

While developing master's and doctoral theses, students of the field of study "Physics, Materials Science, Mathematics and Statistics" of DU mostly conducted research in cooperation with the Center for Mathematical Research, which is a part of the Department of Technology of the Institute of Life Sciences and Technologies of DU, and G. Liberts Center for Innovative Microscopy employees.

In order to promote students' skills in the development of scientific projects and the preparation of

publications, students in the bachelor and Master study programmes implemented at DU can apply for an annual student research project competition. Also, in cooperation with DU academic staff, students also have an opportunity to participate in the annual Daugavpils University research project competition and receive funding for the implementation of scientific research. In accordance with the evaluation criteria of DU research projects, it is a mandatory condition to involve at least one Master/Doctoral study programme student or doctoral degree candidate in the implementation of DU research projects. The mentioned condition is effective, because promotes students' involvement in research work. For example, for the period from 2017-2022, 11 times was mentioned participation in DU internal research projects for DSP "Mathematics" and "Solid State Physics" students and postdoctoral students. Four DSP students have used the opportunity to work in the project "Strengthening the professional competence of academic staff in strategic specialization areas of Daugavpils University", the purpose of which was involvement of doctoral students or scientific degree applicants in academic work at Daugavpils University. For information on specific projects of DSP "Mathematics" and "Solid State Physics" students and post-doctoral students, see appendix 2.5.4. *DSP\_students\_projects\_EN*.

In order to promote opportunities for students to develop their skills of presenting the results of their research to the scientific community, students involved in the DU study direction "Physics, material science, mathematics and statistics" are offered an opportunity to present their research results at international scientific conferences organized by DU (annual International Scientific Conference of Daugavpils University[1]), which is organized every spring. During the reporting period, students of the field of study have used this opportunity, and have also participated in many other international conferences, thus promoting international recognition of the field of study. The topics of scientific conferences and papers, in which students and postdoctoral fellows from the field of study "Physics, material science, mathematics and statistics" have participated during the reporting period, can be found in appendix 2.4.5. *Participation of students and post-doctoral students in conferences\_EN*. Let us emphasize that the students of DSP "Mathematics" and "Solid State Physics" actively participate in conferences with reports.

AMSP program "Physics" shared with the University of Warsaw foresees that the 1st year students already participate in conferences as listeners, for example, such approach was realized at the 65th international scientific conference of DU in 2023. The fact that the study process of the field of study "Physics, material science, mathematics and statistics" promotes students' involvement in scientific activity is also confirmed by the fact that 2017 graduate of DSP "Solid State Physics", I. Mihailova received Daugavpils University Year Award 2017, in nomination - Young Scientist 2017.

[1] DU international scientific conference homepage. Available: <https://www.dukonference.lv/en> [viewed 20.02.2023]

**2.4.6. Provide a brief description and assessment of the forms of innovation (for instance, product, process, marketing, and organisational innovation) generally used in the higher education institution, especially in study field subject to the assessment, by giving the respective examples and assessing their impact on the study process.**

In order to achieve the indicators defined in the model of excellence, DU provides in the implementation of the goal of the study process a wide knowledge base, support for research and innovation, support for the development of the personality of students, as well as ensuring

students' future careers by promoting their employment. Various forms of innovation (product innovation, process innovation, marketing innovations, organizational innovations) are applied to the "Fizika, materiālzinātne, matemātika un statistika study direction and DU to achieve this goal.

**Product innovation.** To ensure the study process and conduct scientific research, students have access to specialized classrooms and scientific laboratories at DU Faculty of Natural Sciences and Mathematics, DU Institute of Life Sciences and Technologies. For a summary of the teaching and research infrastructure available to students in the field of study "Physics, materials science, mathematics and statistics", see appendix 2.3.2. *Infrastructure and material technical provision\_EN*. For conducting students' scientific research within the study programmes and for scientific research in biology, DU lecturers, staff and students have access to modern and diverse scientific equipment and software. Teaching and scientific laboratories are used for both the study process and research work providing the introduction of innovations in the study process. Laboratories are modern, comfortable, compliant with work safety and ergonomic rules and they function to promote students' competitiveness and ability to use new technologies and sources of information. The study process in the scientific laboratories contributes to updating the content of the study programmes, increasing the quality of the development of research works, by introducing innovative technological, methodological and IT solutions.

**Process innovation.** Over the last two years, the organization of e-learning has been developed very rapidly using Zoom for conducting online classes; video recordings are recorded; The DU e-learning website (MOODLE) provides descriptions of study courses, necessary study materials, links to certain information for the study course, colloquia and exams. Lecturers have the opportunity to create a student assessment book and students (individually) can follow the progress of the study course. The administration of the DU e-study website is well organized, the administrator's consultations are available (in person, online or by correspondence), the DU e-study website provides instructions and tips on the use of e-studies.

**Marketing innovations.** DU uses certain marketing tools (Open Door Days DU, Night of Scientists, DU Science Festival, for advising and organizing defense of students' scientific research works in Latgale region, information about DU on social networks, etc. onsite and online activities).

**Organizational innovation.** DU uses several digitized systems: DUIS (allows to digitize many processes and document processing: certificate, order, study contract, their amendment, preparation of diplomas, input of statistics, collection of statistical data), Namejs (document management system that provides correspondence, order, contract, reference, management of procurement documents, efficiency of the document circulation process), HoP (employee self-service portal, which provides the employee with the opportunity to view information about himself / herself, absences of his / her colleagues, apply for leave, check his / her accrued leave days, etc.).

The types of organizational and process innovations were essential during the remote study process. They are important even now, because in the process of doctoral studies, when working individually, the student and the teacher still often use remote options. Likewise, implementation of AMSP "Physics", whose lecturers are mostly from LU, could not do without organizational, process and product innovations. Marketing innovations are expected to attract new students to all programs.

## 2.5. Cooperation and Internationalisation

### 2.5.1. Provide the assessment as to how the cooperation with different institutions from

**Latvia (higher education institutions/ colleges, employers, employers' organisations, municipalities, non-governmental organisations, scientific institutes, etc.) within the study field contributes to the achievement of the aims and learning outcomes of the study field. Specify the criteria by which the cooperation partners for the study field and the relevant study programmes are selected and how the cooperation is organised by describing the cooperation with employers. In addition, specify the mechanism for the attraction of the cooperation partners.**

Several important trends in cooperation with employers can be mentioned: improving the quality of study programmes and study courses, taking into account employers' recommendations about the content of study courses and forms of their implementation; involvement in common activities, for example, organizing scientific and practical conferences, science communication events, etc.; employment of students and graduates in companies or scientific institutions. Involvement employers and professional organizations partners, expansion of the knowledge base and innovation resources in the field of natural sciences has been carried out over several years. Unfortunately, there are not many high-tech companies in Latvia where scientific research finds its application, especially outside of Riga, so it is not possible to simply adapt study programs to the requirements of employers, which can lead to a lowering of research level. Cooperation partners should be carefully evaluated in order to mutually coordinate their interests and opportunities for cooperation.

There is no doubt that the industries of Latvia and the region are interested in the technologies and solutions developed by DU. Metal processing industry is rapidly developing in Daugavpils (Ziegler mechanical engineering, Daugavpils Locomotive repair plant, Sanistal, Magistr, BM Industrial, Ditton drive chain plant, East Metal, Special welding, Daugavpils experimental plant, Arhis, etc.), where laser processing technologies are essential. Optical glass fiber manufacturers (Lightguide, Biolitec) are interested in development of research on the possibilities of nanosensors in glass fibers; several companies (GroGlass, Sidrabe, Axon Cable, etc.) are interested in using the experience and technological capabilities of DU scientists in researching and solving various issues and problems. It should also be mentioned that the structural units operating in the field of study (DU G. Liberts Center for Innovative Microscopy (CIM), Mathematical Research Center (MRC) and Belarus-Latvia Scientific Innovative Center in the Field of Strengthening Technologies (BLZICSTJ)) are highly rated in the international scientific evaluation.

DU physicists have several decades of cooperation with the Institute of Solid State Physics of the University of Latvia, both at the level of institutions and personal contacts. Physicists of the University of Latvia often use existing equipment of DU DZTI. In the previous reporting period, some students of DSP "Solid State Physics" were provided with access to the specific scientific equipment at the Institute of Solid State Physics of the LU. Professors of the Department of Physics and Mathematics of DU were active in the joint Council of Professors of Physics and Astronomy of DU and RTU.

When implementing study programs, employers are involved both in formulation of knowledge and skills needed by the employees, in evaluation of quality of educational programs, and in strategic planning. When evaluating at the regional level, an important part of the dialogue is DU's cooperation with Latgale region employers, regional and city municipalities, as well as state and local government institutions. Thus, the programs ensure one of the main basic principles of regional development policy - partnership.

Representatives of employers are involved in the work of the study direction council, participate in

solving various important issues related to the implementation and development of the study programme. In order to ensure the compliance of the study programme with the requirements of the labor market, a survey of employers is regularly carried out. Questionnaires for graduates and employers have been developed. Employers' evaluations and feedback about graduates are important, because these feedbacks and evaluations can contribute to the introduction of certain corrections in the process of study programme implementation. The survey data are analyzed and discussed at the meetings of the structural units involved in the study programmes, at the meetings of the study direction council and the Faculty Council, thus ensuring feedback in cooperation with graduates and employers. In order to achieve the goals and study outcomes of the study direction, cooperation of lecturers with various professional associations and unions is also essential.

Personal contacts are used to attract partners developing further cooperation. Cooperation with the University of Latvia and its institutes has been established as part of the realization of study programs in the field of study "Physics, materials science, mathematics and statistics", as a result of which the new AMSP "Physics" was established and licensed, where Daugavpils University provides training in the sub-program "Technology Physics". It is planned to continue cooperation.

The most important criteria for attracting partners:

- 1) choose one of the leading scientific universities in Latvia, which occupies a recognized place among European and global research and innovation centers;
- 2) choose institutions that can offer the necessary specific scientific equipment for research;
- 3) attract institutions that need the equipment of the Technology Department of DU Institute of Life Sciences and Technologies for research.

**2.5.2. Provide the assessment as to how the cooperation with different institutions from abroad (higher education institutions/ colleges, employers, employers' organisations, municipalities, non-governmental organisations, scientific institutes, etc.) within the study field contributes to the achievement of the aims and learning outcomes of the study field. Specify the criteria by which the cooperation partners suitable for the study field and the relevant study programmes are selected and how the cooperation is organised by describing the cooperation with employers. In addition, specify the mechanism for the attraction of the cooperation partners.**

Since 2022, DU has been admitted to the Baltic group of the European Organization for Nuclear Research (CERN)[1]. Although the study programs included in the field of study are not directly related to the research carried out by CERN, participation in CERN opens wide opportunities for the research staff and students of the field of life sciences to get involved in interdisciplinary research carried out by CERN. Specifically, director of AMSP "Physics" V. Mizers in 2022 participated in an event organized by the CERN Baltic Group in Estonia.

Student and academic staff internships and development of research topics are possible in more than 90 higher education institutions (22 countries of the world) with which DU has concluded cooperation agreements. In order to promote the incoming mobility of foreign students and teaching staff, at the beginning of the year, the DU Erasmus+ coordinator sends an informative letter to all existing Erasmus+ partners about how foreign students and teaching staff can apply for studies, internships, teaching or professional development. The list of offered study courses is

requested from the profiling structural units. The list of study courses is updated every year. For the DU area of study "Physics, material science, mathematics and statistics" the structural units also regularly offer lists of study courses. Instructors have taught study courses for cadets of the US Military Academy, who choose the courses offered by the field of study in addition to their primary program. The DU Erasmus+ coordinator also visits the international Staff Week several times a year, where there is an opportunity to establish new contacts and conclude inter-university agreements on the exchange of students and teaching staff within the Erasmus+ program.

One of the examples of international cooperation was the Belarus-Latvia scientific and innovative center in the field of strengthening technologies (DU, Parades street 1a)<sup>[2]</sup>, which was created by combining the ideas of Daugavpils entrepreneurs, DU and Belarusian National Technical University scientists on the development of industrial technology in the region. The Center has implemented several projects both in cooperation with Belarusian and Lithuanian colleagues, gradually improving the material base and personnel. Main research topics: industrial material processing methods; programming of industrial machines and robots. Unfortunately for Belarus, when it became an ally of Russia in the war against Ukraine, cooperation with the neighboring country was officially stopped, but cooperation with local businessmen remains and continues to develop. Latgale Entrepreneurship Center (LUC) and the Innovative Entrepreneurship Support Center "Latgale", whose board also includes a representative of DU DSP "Solid Physics", help to maintain contacts.

"Physics, Materials Science, Mathematics and Statistics" field of study at DU has no concluded cooperation agreements with foreign institutions. However, the reader of the course P. Daugulis is involved in an international project from the Apvārsnis 2020 program, which is implemented in cooperation with scientific institutions abroad - the Italian National Research Center; Faculty of Medicine, University of Amsterdam; National Microbiology Center in Spain; Center for Disease Dynamics, Economics and Policy Center in India. International recognition of the field of study "Physics, material science, mathematics and statistics" is increased by the individual cooperation of scientific workers with researchers of foreign scientific institutions, publishing scientific articles together with foreign co-authors.

[1] European Organization for Nuclear Research. Available: <https://indico.cern.ch/category/10023/> [viewed 20.02.2023]

[2] Belarusian-Latvian scientific and innovative center in the field of strengthening technologies. Available: <https://du.lv/en/research/institutes/institute-of-life-sciences-and-technologies/structure/department-of-technology/belarus-latvia-science-innovative-reinforcement-technology-centre/> [viewed 30.06.2023]

**2.5.3. Specify the system or mechanisms, which are used to attract the students and the teaching staff from abroad. Provide the assessment of the incoming and outgoing mobility of the teaching staff in the reporting period, the mobility dynamics, and the issues which the higher education institution/ college faces with regard to the mobility of the teaching staff.**

DU within "ERASMUS+" program has concluded cooperation agreements with more than 90 higher education institutions in 22 countries. The "ERASMUS+" program supports academic exchange: DU

lecturers visit one of the foreign universities of cooperation or participate in staff training, improving their professional competences, ensuring participation in training, work observation at a foreign university of cooperation or another relevant organization. The goals of academic mobility provide DU academic and general staff with the opportunity to gain knowledge and specific skills by learning from the experience and good practices of foreign partners, as well as improve the practical skills necessary for work at DU and professional development, encourage the academic staff to expand and improve the range and content of the offered study courses, allow students who do not have the opportunity to participate in the mobility program to benefit from the knowledge and experience provided by the academic staff of universities in other European countries and foreign visiting lecturers, promote the exchange of knowledge and experience of teaching methods among European higher education institutions. Similarly, students both at DU and abroad actively use the opportunities offered within the Erasmus+ program for studies and internships[1]. DU offers exchange mobility to partner universities that do not belong to the Erasmus+ program, in USA, Philippines, India, Israel, Jamaica, China, Lesotho, Tajikistan. In order to attract foreign students, DU provides information about the study programmes implemented by DU, which is available in English on the DU website[2], as well as other Internet sites[3]. DU also implements marketing activities: contracts are concluded with recruitment agents, as well as: e-marketing, participation in international education fairs and agent forums, etc.

Data on the incoming and outgoing mobility of teaching staff for the reporting period are shown in the appendix (2.5.3\_ *Incoming and outgoing mobility of teaching staff*). Data on the incoming and outgoing mobility of students for the reporting period and the programs that we provide in accreditation are presented in the appendix (2.5.3\_ *Incoming and outgoing mobility of students\_EN*).

The mobility of teaching staff and students in the direction during the reporting period is rated as unsatisfactory, there is no incoming mobility. Outgoing student mobility activity has improved in 2021/2022, in 2022, the outgoing mobility of teaching staff had increased. It is necessary to promote the mobility of students and teaching staff (within Erasmus+ and other mobility programs).

Attraction of foreign lecturers and students in the field of study "Physics, material science, mathematics and statistics" was not realized.

[1] Opportunities offered within the Erasmus+ program. Available: <https://du.lv/en/news/apply-for-erasmus-studies-and-traineeship-scholarship/> [viewed 20.02.2023]

[2] Informācija par DU realizētajās studiju programmām. Available: <https://du.lv/en/studies/study-programmes/> [viewed 20.02.2023]

[3] Information about the study programs implemented by DU. Available: <https://www.studyinlatvia.lv/universities/daugavpils-university>, <https://www.study.eu/university/daugavpils-university> [viewed 20.08.2023]

## **2.6. Implementation of the Recommendations Received During the Previous Assessment Procedures**

**2.6.1. Assessment of the fulfilment of the plan regarding the implementation of the recommendations provided by the experts during the previous accreditation of the study field, as well as the assessment of the impact of the given recommendations on the study quality or the improvement of the study process within the study field and the relevant study programmes.**

Recommendations given by experts in the previous accreditation of the field of study "Physics, material science, mathematics and statistics" (ABSP "Mathematics", AMSP "Mathematics" and DSP "Mathematics", ABSP "Physics", AMSP "Physics" and DSP "Solid State Physics") (20.12 .2012) in Appendix 2.6.1.*joint report of Experts\_2012* were analyzed and were fulfilled or partially fulfilled in the following years as far as possible.

The recommendation - to work more closely with the secondary schools of the region to attract the best school graduates, and the recommendation - to continue mathematics and physics study programs, were partially fulfilled, because not all mathematics and physics programs in this direction were preserved. High school graduates of recent years who chose to study physics or mathematics at DU, due to the fact that, due to the small number of applicants, it was not possible to open both a full-fledged group in the field of study "Physics, material science, mathematics and statistics" and "Teacher" were directed to related programs directly in the direction "Teacher", for example, to the DU professional bachelor's study program "Teacher" (Mathematics). However, work with students was carried out in a wide range. The representatives of the field of study conducted classes at the DU School of Young Mathematicians in the premises of DU. The work was done both with the most capable students of the 5th-12th grades and with the 12th grade students from the Daugavpils region to prepare for the exam in mathematics. The Covid-19 pandemic stopped this built-in mechanism. In order to interest students in studying physics, student excursions were held to the DU Astronomy Observatory and the scientific laboratories of the DU Department of Technology. Representatives of the field of physics regularly participate in the Daugavpils Science Festival, Night of Scientists, DU Science School events, DU open door days, with the aim of attracting high school students to study at DU. In 2021, the joint academic master's study program "Physics" was licensed (joint University of Latvia and University of Daugavpils, license No. 2021/07K, issued on 10.11.2021).

The implementation of the provided recommendations has helped to attract more doctoral students, so that they become DU employees already during their studies or after obtaining the degree, in order to prevent the threat of aging of the staff of the field of study. For example, four PhD holders were included as lecturers in the study area during the reporting period. Thinking about the lay/technical direction in the content of mathematics study programs, in the study course "Selected questions of mathematical modeling" (4CP) taught by DSP "Mathematics", mathematical modeling questions in biology are included, knowledge about complex systems, the behavior of their solutions, self-organization of complex systems is provided.

Review of the implementation of the provided expert recommendations is attached in Appendix 2.6.1.*Overview of the implementation of the recommendations\_EN*.

**2.6.2. Implementation of the recommendations given by the experts during the evaluation of the changes to the study programmes in the respective study field or licensed study programmes over the reporting period or recommendations received during the procedure for the inclusion of the study programme on the accreditation form of the study field (if**

**applicable).**

The joint academic master's study program "Physics" of LU and DU was licensed on October 27, 2021 (license no. 2021/07K). In turn, the implementation of the study program at DU started in the winter semester of 2022. Review of implementation of expert recommendations given during licensing in Appendix 2.6.2. *Review of implementation of recommendations\_AMSP Physics.*

Out of 9 recommendations, 7 recommendations were fully implemented, the implementation of 2 recommendations was not completed at the time of document submission. Thanks to the implementation of the recommendations, students of both universities were provided with the opportunity to study in joint courses through the Zoom and MS Teams platforms, as well as active communication between program directors and students was ensured.

# Annexes

I - Information on the Higher Education Institution/ College		
Information on the implementation of the study field in the branches of the higher education institution/ college (if applicable)		
List of the governing regulatory enactments and regulations of the higher education institution/ college	1.2_List of the main internal laws and regulations.pdf	1.2_leksejo normativo aktu un regulējumu saraksts.pdf
The management structure of the higher education institution/ college	1.2_Governance structure.pdf	1.2_Parvaldības struktūra.pdf
II - Description of the Study Field - 2.1. Management of the Study Field		
Plan for the development of the study field (if applicable)	2.1.2.Summary of the study direction development plan_EN.docx	2.1.2.Studiju virziena attīstības plāna kopsavilkums_LV.docx
The management structure of the study field	2.1.3_Structure of the management of the study direction_EN.docx	2.1.3_Studiju virziena parvaldības shematiska struktūra.docx
A document certifying that the higher education institution or college will provide students with opportunities to continue their education in another study programme or another higher education institution/ college (agreement with another accredited higher education institution or college) if the implementation of the study programme is terminated.	2.1.4.Agreements.zip	2.1.4.Vienošanās.zip
A document certifying that the higher education institution or college guarantees compensation for losses to students if the study programme is not accredited or the study programme license is revoked due to actions (actions or omissions) of the higher education institution or college and the student does not wish to continue studies in another study programme.	2.1.4.CONFIRMATION_Compensation guarantee for students_EN.docx	Apliecinājums par zaudējumu kompensāciju.edoc
Standard sample of study agreement	2.1.4.Agreement on studies_DU.docx	2.1.4.Līgums par studijām_DU.docx
II - Description of the Study Field - 2.2. Efficiency of the Internal Quality Assurance System		
Analysis of the results of surveys of students, graduates and employers	2.2.4.Analysis of survey results.zip	2.2.4.Aptauju rezultātu analīze.zip
II - Description of the Study Field - 2.3. Resources and Provision of the Study Field		
Basic information on the teaching staff involved in the implementation of the study field	2.3.7.Teaching staff fo study direction_EN.xlsx	2.3.7.Virziena_macibspeki.xlsx
Biographies of the teaching staff members (Curriculum Vitae in Europass format)	2.3.7.CV_EN.zip	2.3.7.CV_LV.zip
A statement signed by the rector, director, head of the study programme or field that the knowledge of the state language of the teaching staff involved in the implementation of the study programmes within the study field complies with the regulations on the state language knowledge and state language proficiency test for professional and official duties.	2.3.7.STATEMENT_native language.docx	Apliecinājums par valsts valodas prasmi.edoc
A statement of the higher education institution/ college on the respective foreign language skills of the teaching staff involved in the implementation of the study programme at least at B2 level according to the European Language Proficiency Assessment levels (level distribution is available on the website www.europass.lv, if the study programme or part thereof is implemented)	2.3.7.STATEMENT_foreign_language_B2.docx	Apliecinājums par svešvalodas prasmi.edoc
II - Description of the Study Field - 2.4. Scientific Research and Artistic Creation		
Summary of quantitative data on scientific and/ or applied research and / or artistic creation activities corresponding to the study field in the reporting period.	2.4.4.Compilation of quantitative data for direction_EN.docx	2.4.4.Kvantitatīvo datu apkopojums_virzienam.docx
List of the publications, patents, and artistic creations of the teaching staff over the reporting period.	2.4.4. List of scientific publications for the direction_EN.docx	2.4.4. Zinatnisko publikāciju saraksts virzienam.docx
II - Description of the Study Field - 2.5. Cooperation and Internationalisation		
List of cooperation agreements, including the agreements for providing internship	2.5.1.List of Cooperation Agreements with other Institutions_ENG.docx	2.5.1.Sadarbības_līgumu_saraksts_ar_citam_institūcijām.docx
Statistical data on the teaching staff and the students from abroad	2.5.3.Statistical data on foreign students and teaching staff_EN.docx	2.5.3.Statistikas dati par ārvalstu studējošajiem un mācībspēkiem.docx
Statistical data on the incoming and outgoing mobility of students (by specifying the study programmes)	2.5.3.Incoming and outgoing mobility of students_EN.docx	2.5.3.Studējošo ienākšo_izejošo mobilitāte.docx
Statistical data on the incoming and outgoing mobility of the teaching staff	2.5.3.Incoming and outgoing mobility of teaching staff_EN.xlsx	2.5.3.Mācībspēku ienākšo un izejošo mobilitāte.xlsx
II - Description of the Study Field - 2.6. Implementation of the Recommendations Received During the Previous Assessment Procedures		
Report on the implementation of the recommendations received both in the previous accreditation and in the licensing and/ or change assessment procedures and/ or the procedures for the inclusion of the study programme on the accreditation form of the study field.	2.6.1.Overview of the implementation of the recommendations_EN.docx	2.6.1.Studiju virziena akreditācijas rekomendāciju izpildes pārskats.docx
An application for the evaluation of the study field signed with a secure electronic signature	APPLICATION for the evaluation_EN.docx	Iesniegums studiju virziena Fizika, materiālzinātne, matemātika un statistika novērtēšanai.edoc
III - Description of the Study Programme - 3.1. Indicators Describing the Study Programme		
Sample of the diploma and its supplement to be issued for completing the study programme		
For academic study programmes - Opinion of the Council of Higher Education in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions (if applicable)		
Compliance of the joint study programme with the provisions of the Law on Higher Education Institutions (table) (if applicable)		
Statistics on the students in the reporting period		
III - Description of the Study Programme - 3.2. The Content of Studies and Implementation Thereof		
Compliance with the study programme with the State Education Standard		
Compliance of the qualification to be acquired upon completion of the study programme with the professional standard or the requirements for professional qualification (if applicable)		
Compliance of the study programme with the specific regulatory framework applicable to the relevant field (if applicable)		
Mapping of the study courses/ modules for the achievement of the learning outcomes of the study programme		
The curriculum of the study programme (for each type and form of the implementation of the study programme)		
Descriptions of the study courses/ modules		
Description of the organisation of the internship of the students (if applicable)		

III - Description of the Study Programme - 3.4. Teaching Staff

<p>Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable)</p>		
<p>Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable)</p>		

## Other annexes

Name of document	Document
DU normatīvie akti iekšējās kvalitātes nodrošināšanai	1.3_Normatīvie akti iekšējās kvalitātes nodrošināšanai.pdf
Daugavpils University normative acts for internal quality assurance	1.3_List of Regulations for internal quality assurance.pdf
Studiju iekšējās kvalitātes nodrošināšanas politika	1.3_DU-STUDIJU-IEKŠĒJĀS-KVALITĀTES-NODROŠINĀŠANAS-POLITIKA.pdf
Internal Quality Assurance Policy of Studies	1.3_INTERNAL QUALITY ASSURANCE POLICY OF STUDIES AT DAUGAVPILS UNIVERSITY.pdf
Studiju iekšējās kvalitātes sistēmas efektivitātes nodrošināšanas kārtība	1.3_DU-STUDIJU-IEKŠĒJĀS-KVALITĀTES-SISTĒMAS-EFEKTIVITĀTES-NODROŠINĀŠANAS-KĀRTĪBA.pdf
Studiju kvalitātes politikas un studiju kvalitātes pārraudzības stratēģija	1.3_DU-STUDIJU-KVALITĀTES-POLITIKAS-UN-STUDIJU-KVALITĀTES-PĀRRAUDZĪBAS-STRATĒĢIJA.pdf
Vienošāns starp LU, DU un RTU	2.1.4.Vienošāns_LU_DU_RTU.edoc
Agreement between LU, DU and RTU	2.1.4.Agreement between LU DU RTU_EN.docx
Infrastruktūra un materiāltehniskais nodrošinājums	2.3.2.Infrastruktūra un materiāltehniskais nodrošinājums.docx
Infrastructure and material technical provision	2.3.2.Infrastructure and material technical provision_EN.docx
Dalība projektos	2.4.4. Dalība projektos virzienam.docx
Participation in projects	2.4.4. Participation in projects for direction_ENG.docx
Zinātnisko publikāciju saraksts (studenti)	2.4.5.Zinātnisko publikāciju saraksts_students.docx
List of scientific publications (students)	2.4.5.List of scientific publications students_EN.docx
Studējošo un pēcdoktorantu dalība konferencēs	2.4.5 Studējošo un pēcdoktorantu dalība konferencēs.docx
Participation of students and post-doctoral students in conferences	2.4.5 Participation of students and post-doctoral students in conferences_EN.docx
Joint report of experts 2012	2.6.1.joint report of Experts_2012.pdf
Rekomendāciju izpildes pārskats (AMSP Fizika)	2.6.2.Rekomendāciju izpildes pārskats_AMSP Fizika.docx
Review of implementation of recommendations (AMSP Physics)	2.6.2. Review of implementation of recommendations_AMSP Physics.docx
3.1.2.DSP Cietvielu_fizika_diploms un akadēmiskā izziņa.docx	3.1.2.DSP Cietvielu_fizika_diploms un akadēmiskā izziņa.docx
3.1.2.DSP Matematika_diploms un akadēmiskā izziņa.docx	3.1.2.DSP Matematika_diploms un akadēmiskā izziņa.docx
3.1.2.DSP Mathematics_Diploma.docx	3.1.2.DSP Mathematics_Diploma.docx
3.1.2.DSP Mathematics_Transcript.docx	3.1.2.DSP Mathematics_Transcript.docx
3.1.2.DSP Solid State Physics_Diploma.docx	3.1.2.DSP Solid State Physics_Diploma.docx
3.1.2.DSP Solid State Physics_Transcript.docx	3.1.2.DSP Solid State Physics_Transcript.docx
During visit_DSP Mathematics (costs).docx	During visit_DSP Mathematics (costs).docx
During visit_DSP Solid State Physics (costs).docx	During visit_DSP Solid State Physics (costs).docx
During visit_Employers.docx	During visit_Employers.docx
During visit_JMSP Physics (costs).docx	During visit_JMSP Physics (costs).docx
During visit_Software.docx	During visit_Software.docx
After visit_answers to Q 7-10.docx	After visit_answers to Q 7-10.docx
After visit_Composition of the final examination committee for the Master of Physics.pdf	After visit_Fizikas maģistra gala pārbaudījumu komisijas sastāvs.pdf
After visit_Composition of the Promotions Board for Physics and Astronomy.edoc	After visit_Fizikas un astronomijas promocijas padomes sastāvs.edoc
After visit_Members of the Mathematics Promotion Board.pdf	After visit_Matemātikas promocijas padomes sastāvs.pdf
LZP.edoc	2024_4S-113_21.02.2024 - 1-3.N-376.edoc
LZP.docx	LZP edoc.docx

# Mathematics (51460)

Study field	<i>Physics, Material Science, Mathematics, and Statistics</i>
ProcedureStudyProgram.Name	<i>Mathematics</i>
Education classification code	<i>51460</i>
Type of the study programme	<i>Doctoral study programme</i>
Name of the study programme director	<i>Felikss</i>
Surname of the study programme director	<i>Sadirbajevs</i>
E-mail of the study programme director	<i>felikss.sadirbajevs@du.lv</i>
Title of the study programme director	<i>Dr.habil.math., prof.</i>
Phone of the study programme director	<i>+371 26701380</i>
Goal of the study programme	<i>Preparation of a highly qualified specialist - a mathematical scientist who is able to solve practical and theoretical tasks with the methods of theoretical mathematics and mathematical modelling.</i>
Tasks of the study programme	<i>1) to acquire the necessary amount of theoretical knowledge in the field of theoretical mathematics and mathematical modelling; 2) to determine the topic of scientific research, learn the results, provided in the scientific literature on this topic; 3) to obtain new essential results on the selected topic; 4) presenting reports in conferences of regional and international level; 5) to publish the obtained results in publications of various levels, also in scientific journals and collections indexable in international databases; 6) preparation of graduation work for defence.</i>

Results of the study programme	<p><b>Knowledge:</b></p> <ol style="list-style-type: none"> <li>1. Understand the topical scientific theories and modern mathematical research methods in the subfield of differential equations.</li> <li>2. Are familiar with the organization of regional and international scientific research and the ways of improving one's qualifications.</li> </ol> <p><b>Skills:</b></p> <ol style="list-style-type: none"> <li>3. Able to independently evaluate and choose suitable scientific research methods, contribute to expanding the frontier of knowledge or provide a new understanding of existing knowledge and its application in practice, including by publishing scientific publications (knows how to choose publication forms and methods for timely and effective implementation of the results of scientific work).</li> <li>4. Able to communicate both orally and in writing about own scientific field to the wider community of scientists and society in general.</li> <li>5. Able to independently improve own scientific qualification, implement scientific projects, obtaining international science-qualifying achievements.</li> </ol> <p><b>Competence:</b></p> <ol style="list-style-type: none"> <li>6. Carrying out independent, critical analysis, synthesis and evaluation, are able to solve important research or innovation tasks using mathematical modelling methods.</li> <li>7. Are competent to propose the research idea, plan and structure independently, as well as defend idea in discussions without losing the ability to critically perceive other opinions.</li> <li>8. Are able to manage scientific projects, including in an international context, aware of their responsibility and moral obligations to involved organizations and individual researchers.</li> </ol>
Final examination upon the completion of the study programme	Final doctoral examination

## Study programme forms

### Full time studies - 3 years - latvian

Study type and form	Full time studies
Duration in full years	3
Duration in month	0
Language	latvian
Amount (CP)	120
Admission requirements (in English)	- Master's degree in mathematics or computer science; - entrance exam
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	Doctoral degree Doctor of Science (Ph.D.) in Natural Sciences
Qualification to be obtained (in english)	-

### Places of implementation

Place name	City	Address
Daugavpils University	DAUGAVPILS	VIENĪBAS IELA 13, DAUGAVPILS, LV-5401

### Full time studies - 3 years - english

Study type and form	<i>Full time studies</i>
Duration in full years	<i>3</i>
Duration in month	<i>0</i>
Language	<i>english</i>
Amount (CP)	<i>120</i>
Admission requirements (in English)	<i>- Master's degree in mathematics or computer science; - test in mathematics; - report on the research topic and discussions about it; - test in a foreign language (in English). For studies in English: At least B2 level knowledge of the English language.</i>
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	<i>Doctoral degree Doctor of Science (Ph.D.) in Natural Sciences</i>
Qualification to be obtained (in english)	<i>-</i>

### Places of implementation

Place name	City	Address
Daugavpils University	DAUGAVPILS	VIENĪBAS IELA 13, DAUGAVPILS, LV-5401

## 3.1. Indicators Describing the Study Programme

### 3.1.1. Description and analysis of changes in the parameters of the study programme made since the issuance of the previous accreditation form of the study field or issuance of the study programme license, if the study programme is not included on the accreditation form of the study field, including changes planned within the evaluation procedure of the study field evaluation procedure.

Taking into account the planned changes in the implementation of doctoral study programmes in Latvia, which will be implemented on the basis of the conceptual report "On the implementation of a new doctoral study model in Latvia" (supported on June 25, 2020 by Cabinet of Ministers Order No. 345), also the doctoral study programmes implemented by DU incl. DSP "Mathematics" will undergo a gradual transition to the new doctoral studies model. The conceptual report holds that every university should organize doctoral-level studies in centrally established structural units – doctoral schools. For the successful implementation of the transition in 2020, DU developed the "Doctoral Study Programme Development Plan 2020-2026". for the implementation of the new doctoral model at Daugavpils University" (approved at the meeting of the DU Science Council on 22.10.2020 (minutes No. 11, decision No. 1/1)). In 2023, it is planned to develop the regulations of the DU Doctoral School, which will ensure the compliance of the DU Doctoral School with European best practices and international standards, as well as provide conditions for cooperation with other Latvian and foreign scientific institutions and higher education institutions. In 2023/2024, DSP "Mathematics" 1st year students will start their studies at the Doctoral School of DU, while complete transition to the new doctoral model at Daugavpils University is planned to be completed by the end of 2026.

Since the previous accreditation study program parameters, minor changes have been made. When developing the curriculum of the new DSP "Mathematics", the recommendations stated in the conceptual report "On the introduction of a new doctoral model in Latvia" were taken into account regarding the proportion of time devoted to research and study course acquisition. According to these recommendations, credit points in doctoral study programmes should be awarded for the time devoted to research, when the doctoral student elaborates a doctoral thesis and internationally recognized scientific publications (~ 70% of the time of full-time studies), and for the time devoted to study courses and mobility (~ 30%).

Applicants' interests cover much broader subfields of mathematics. Therefore, for students who will start their studies in academic year 2023/2024, the study course *Special Seminars of the Department* replaced with the course *Modern methods in the theory of boundary value problems of ordinary differential equations (4CP)*.

DSP "Mathematics" parts and their amount after the changes planned (students are planned to be enrolled from the academic year of 2023/2024)

- Mandatory courses (30 CP):
- Courses of limited selection (4 CP);
- Free choice courses (2CP);
- Individual research work and development of a thesis (84 CP):
- *Execution of graduation thesis (84 CP)*.
- Graduation examinations - at the end of their studies, students shall take the *Graduation*

*exam in mathematics and the Graduation exam in English.*

The schedule of DSP "Mathematics" is given in the annex *3.2.1.DSP Mathematics plan\_EN*, the ratio of the doctoral student's theoretical and independent work therein is 30 to 70.

**3.1.2. Analysis and assessment of the study programme compliance with the study field. Analysis of the interrelation between the code of the study programme, the degree, professional qualification/professional qualification requirements or the degree and professional qualification to be acquired, the aims, objectives, learning outcomes, and the admission requirements. Description of the duration and scope of the implementation of the study programme (including different options of the study programme implementation) and evaluation of its usefulness.**

Doctoral study program "Mathematics" (code -51460) is a doctoral level study program included in the study field "Physics, material science, mathematics and statistics" implemented by DU.

- the amount of the program - 120 CP
- duration of program implementation - full-time studies - 3 years
- type and form of program implementation - full-time face-to-face studies
- requirements for starting studies - master's degree in mathematics or computer science
- degree to be obtained - Doctor of Science degree Doctor of Science (Ph.D.) in Natural Sciences
- place of program implementation - Daugavpils University
- program director - Dr.habil.math., professor Feliks Sadirbajevs

The aim of the program is to prepare highly qualified specialists who are able to solve practical and theoretical tasks with the methods of theoretical mathematics and mathematical modelling. A successfully defended doctoral thesis serves as proof of the acquired qualification. DSP "Mathematics" fully corresponds to the field of study "Physics, material science, mathematics and statistics". After learning the program, the specialist can conduct theoretical studies related to practical tasks. On the other hand, endowed with the necessary theoretical knowledge, a specialist can perform experimental and numerical calculation work. The usefulness of the program is confirmed by the wide inclusion of mathematical methods in all research fields, including social and humanities.

**The main objectives of the doctoral study program are:**

- to acquire the necessary amount of theoretical knowledge in the field of theoretical mathematics and mathematical modelling;
- to determine the topic of scientific research, learn the results, provided in the scientific literature on this topic;
- to obtain new essential results on the selected topic;
- presenting reports in conferences of regional and international level;
- to publish the obtained results in publications of various levels, also in scientific journals and collections indexable in international databases;
- preparation of graduation work for defence.

Enrollment in the study program takes place in accordance with "Daugavpils University admission

rules for full-time and part-time higher level studies”[1], which are annually approved by the DU Senate. The required level of education for admission is a Master’s degree in mathematics or computer science. During admission, there is a test in mathematics and a test in a foreign language (in English), a report on the research topic must be submitted and discussions on the research topic are organized. These entrance discussions assessment concerns the applicant’s detailed proposal for the doctoral research, the applicant’s motivation, the topic's scientific relevance and relevance to the directions of scientific development, as well as the applicant's orientation to work in economic enterprises or high-level educational institutions. The applicant’s prior achievements are also important including scientific publications, participation in international scientific conferences, connection of professional activity with the topic of the doctoral thesis, as well as knowledge of a foreign language (English).

The aim and objectives of the study programme, as well as the study outcomes obtained during the studies, correspond to the eighth level of EQI, which is the level of doctoral studies. Programme code 51460 reflects the status and content of the programme, in accordance with the requirements set out in the “Regulations on Latvian Education Classification” (MK 13.06.2017. Regulations No. 322). The first digits of the code 51 denote doctoral studies (doctoral degree), which can be implemented after obtaining a master's or professional master's degree or as sequel to education programme with code 49. The second part of the code corresponds to the thematic field of education (46 - Mathematics and Statistics) and the group of educational programmes (460 - Mathematics and Statistics).

DSP “Mathematics” implemented at Daugavpils University is implemented in the format of a full-time study programme. The name of the programme, the degree to be obtained, goals and objectives, student admission requirements are interconnected. The duration of DSP "Mathematics" studies is three years, where the graduate obtains the Academic Doctor’s degree (Ph.D.) in natural sciences. Such education opens opportunities to independently develop and manage scientific research projects, publish the research results in internationally cited publications in Latvia and abroad, publicize the results of scientific research at conferences and seminars, to promote the implementation of innovations in research practice.

Vērtējot studiju procesa ilgumu, var secināt, ka jebkurā programmas variantā trīs gadi vidēji ir pietiekams laiks, lai apgūtu teorētisko kursu un uzkrātu pietiekamu pētījumu rezultātu apjomu, lai uzrakstītu promocijas darbu, lai gan tas reizēm atkarīgs no promocijas darba tematikas and it depends on circumstances independent of the doctoral school. For example, the publication of graduation thesis in publications with a high impact factor is relatively problematic in terms of time, so a doctoral student does not always manage to defend the thesis within three years.

On the study programme acquisition diploma and its appendix sample in accordance with the Cabinet of Ministers regulations of 16.04.2013. No. 202 “The procedure for issuing documents certifying higher education recognized by the state” as well as agreement on studies sample in accordance with the Cabinet of Ministers regulations of 23.01.2007. No. 70 “Mandatory provisions in the study contract” see (3.1.2.DSP Mathematics\_diploma and transcript and 2.1.4.Agreement on studies\_DU).

[1] Daugavpils University admission rules for full-time and part-time higher level studies (international students). Available: <https://du.lv/en/studies/admission/> [viewed 28.02.2023]

### **3.1.3. Economic and/ or social substantiation of the study programme, analysis of graduates' employment.**

Economic justification. The scientists and teaching staff employed in the DU field of studies "Physics, Materials Science, Mathematics and Statistics" are highly qualified, therefore they are able to promote the introduction of modern mathematical modelling and analysis methods in the work and development planning of economic enterprises.

Social justification. DU is the most important centre of exact sciences, higher education, culture and essence of being a Latvian in the region. The development of doctoral studies at DU also plays an important role from the point of view of national security. The city of Daugavpils and the region of Eastern Latvia are distinctly multicultural and located next to the border of the European Union. Saturation of the region with highly qualified specialists who are able to communicate at any level using modern means and methods will contribute to the reduction of tension and the development of the region.

Analysing the further career and employment data of 3 graduates of DU DSP "Mathematics" (in the period from 2017-2022) and one graduate at the beginning of 2023, it can be concluded that two graduates actively continue to engage in scientific work and publish in internationally recognized publications, work in various Latvian universities as lecturers, perform administrative duties; one graduate is already a LZP expert in Natural Sciences - Mathematics. One graduate's job duties are related to software development, while one graduate is currently not working due to family circumstances. More detailed data for the employment and scientific indicators of persons who obtained a doctorate scientific degree within 2017-2023, are shown in the annex *3.1.3. Employment and scientific indicators DSP Mathematics and DSP Solid State Physics*. DSP "Mathematics" applies to the first four graduates.

#### **3.1.4. Statistical data on the students of the respective study programme, the dynamics of the number of the students, and the factors affecting the changes to the number of the students. The analysis shall be broken down into different study forms, types, and languages.**

At the time of submission of the accreditation report, 1 student (in the 3rd year of study) is studying DSP "Mathematics". During the time period from 2017 - 2022, in DSP "Mathematics" a total of 2 students were enrolled at the expense of the state budget, the language of study is Latvian. Foreign students are not enrolled at the program yet. Doctoral students in mathematics are not a mass product, but a piece product. Due to this reason a large number of students is not expected, as it has not been in the past. With sufficient funding, changes are possible. There is no student dropout in DSP "Mathematics".

Statistical data on the students of DSP "Mathematics" during the reporting period are summarized in the annex to the report *3.1.4. Statistikas\_dati\_par\_studejosajiem\_DSP\_Matematika*.

Applicants for scientific degree, who were exmatriculated in the period 2017-2022, have completed the doctoral study program, now cooperate with the thesis supervisor, intensively collect materials and prepare publications on the topics of the thesis. Table 3.1.4.1 shows an overview of the mentioned students.

*3.1.4.1. table. Number of exmatriculated students of the DSP "Mathematics", who are planning to defend the graduation thesis after the time period from 2017-2022.*

<i>Supervisor of the thesis</i>	<i>Topic of the graduation thesis</i>	<i>Notes</i>
Dr.hab.math., professor Felikss Sadirbajevs	A mathematical model for a class of networks in applications	Defended the PhD graduation thesis in 2023
Dr.hab.math., professor Felikss Sadirbajevs	Mathematical modelling of neuronal networks: differential equations approach	Works on completion of the graduation thesis
Dr.hab.math., professor Felikss Sadirbajevs	Bio-oscillators and related problems	Collects materials and publications for graduation thesis
Dr.hab.math., professor Felikss Sadirbajevs	Problems for systems of second-order differential equations	Collects materials and publications for graduation thesis

For the period from 2017 to 2022, see the *topics of defended doctoral theses* in the annex (3.2.5\_DSP\_Mathematics\_List of defended doctoral theses).

### **3.1.5. Substantiation of the development of the joint study programme and description and evaluation of the choice of partner universities, including information on the development and implementation of the joint study programme (if applicable).**

## **3.2. The Content of Studies and Implementation Thereof**

### **3.2.1. Analysis of the content of the study programme. Assessment of the interrelation between the information included in the study courses/ modules, the intended learning outcomes, the set aims and other indicators with the aims of the study course/ module and the aims and intended outcomes of the study programme. Assessment of the relevance of the content of the study courses/ modules and compliance with the needs of the relevant industry, labour market and with the trends in science on how and whether the content of the study courses/ modules is updated in line with the development trends of the relevant industry, labour market, and science.**

The study content is updated in accordance with international practice and the programs adopted by leading universities. Therefore, the labor market and scientific development trends are satisfied. Proposals for updating the study program are submitted to the Study direction Council, where they are discussed and a decision is made to approve or reject the changes. If the changes are approved

by the Study direction Council, they are forwarded to the Faculty Council and the Study Council for approving. After approval by the Study Council, the changes are implemented.

As indicated above, the content of the study program, the achievable results included in the study courses are aligned with the international teaching and research standards of differential equations and mathematical modeling. This gives an opportunity to achieve the goals of the study program, the achievable results.

The content of DSP "Mathematics" is focused on achieving goals and completing formulated tasks. The courses of the program and their content are chosen in such a way as to provide students with the knowledge and skills necessary to fulfil the tasks of the doctoral study program. Content of study courses offered in the study program, achievable results, set goals, etc. indicators are interconnected with study program goals and achievable results (see the descriptions of DSP "Mathematics" study courses in the Appendix 3.2.1.). The content of study courses corresponds to the current affairs of the industry, as well as the needs of the labour market and science. The set requirements regarding the publication of research results in internationally indexed scientific publications, as well as participation in international scientific conferences, develop students' abilities to independently perform critical analysis, synthesis and evaluation of scientific information, as well as to solve important research or innovation tasks. The courses are interconnected. For example, learning the theoretical courses of differential equations requires the ability to perform numerical experiments, which is learned in the course *Using Computers in Mathematics*. The course *English for Mathematicians* is necessary for studying scientific literature and to prepare students for independent creation and presentation of mathematical presentations and mathematical publications in English. The courses correspond to the trends of scientific and economic development. For example, the course *Selected Questions of the Mathematical Modelling*, among others, deals with biomathematical questions which are the focus of research in leading scientific centres.

Study programme aim: preparation of a highly qualified specialist - a mathematical scientist who is able to solve practical and theoretical tasks with the methods of theoretical mathematics and mathematical modelling.

Study programme outcomes:

The study outcomes obtained in the study programme (knowledge, skills, and competence) must ensure the achievement of the aim of the study programme, thereby contributing to the growth of the knowledge and innovation-based economy of the Republic of Latvia and the well-being and sustainability of the Republic of Latvia.

Knowledge. Students in the program know and understand the most current scientific theories and findings in mathematics, manage modern research methodologies and modern research methods in various sub-fields of differential equations. Informed about the connection of the sub-sector with the adjacent fields of natural sciences and social sciences.

1. Understand the topical scientific theories and modern mathematical research methods in the subfield of differential equations.
2. Are familiar with the organization of regional and international scientific research and the ways of improving one's qualifications.

Skills. In the course of learning the programme, students are able to independently evaluate and choose appropriate methods for scientific research, have made an investment in expanding the boundaries of knowledge or given a new understanding to existing knowledge and its applications in practice, by carrying out a significant amount of original research, some of which is at the level of internationally cited publications. Can effectively use various forms and sources of information,

such as the Internet, databases, scientific journals, communication in social networks, discussions in media rooms, in daily work.

3. Able to independently evaluate and choose suitable scientific research methods, contribute to expanding the frontier of knowledge or provide a new understanding of existing knowledge and its application in practice, including by publishing scientific publications (knows how to choose publication forms and methods for timely and effective implementation of the results of scientific work).
4. Able to communicate both orally and in writing about own scientific field to the wider community of scientists and society in general.
5. Able to independently improve own scientific qualification, implement scientific projects, obtaining international science-qualifying achievements.

Competence. Students are able, by performing independent, critical analysis, synthesis and evaluation, to solve important research or innovation tasks, independently put forward a research idea, plan, structure and manage large-scale scientific projects, including in an international context.

6. Carrying out independent, critical analysis, synthesis and evaluation, are able to solve important research or innovation tasks using mathematical modelling methods.
7. Are competent to propose the research idea, plan and structure independently, as well as defend idea in discussions without losing the ability to critically perceive other opinions.
8. Are able to manage scientific projects, including in an international context, aware of their responsibility and moral obligations to involved organizations and individual researchers.

Study programme amount (CP): 120 CP

Study programme duration: 3 years

Program parts and volume:

- Mandatory courses (30 CP);
- Courses of limited selection (4 CP);
- Free choice courses (2 CP);
- Individual research work and development of graduation thesis (84 CP):
- *Execution of graduation thesis (84 CP).*
- Graduation exams - at the end of the studies, students take the *Graduation exam in mathematics* and the *Graduation exam in English*.

Amount of contact hours (%): 1 credit point corresponds to 40 academic hours, of which 16 hours are contact hours, which is 40% of the expected amount.

Degree and/or qualification to obtain: doctor of science degree (PhD) in natural sciences.

Basic principles and procedure of acquisition and assessment of the study programme: the following principles are applied in the acquisition and assessment of the study programme:

- the principle of openness;
- principle of obligation;
- the principle of assessment review options;
- the principle of diversity of the types of tests used.

Taking into account the planned changes in the implementation of doctoral study programmes in Latvia, which will be implemented on the basis of the conceptual report "On the implementation of a new model of doctoral studies in Latvia" (supported on June 25, 2020 by Cabinet of Ministers Order No. 345), DSP "Mathematics" implemented by DU will also undergo a gradual transition to a

new doctoral model. In 2020, DU developed the “PhD study programme development plan 2020-2026 for the implementation of the new doctoral model at Daugavpils University” (approved at the meeting of the DU Science Council on 22.10.2020 (minutes No. 11, decision No. 1/1)). The doctoral study programme development plan is a part of the overall research plan contained in the Development Strategy of Daugavpils University and is aimed at the implementation of the conception included in “Latvian Smart Specialization Strategy”. The doctoral study programme development plan consists of two parts: 1) description of the current situation of DU, which includes a review of DU research capacity and doctoral studies, 2) description and appendices of the new doctoral model and its implementation strategies. In 2023, it is planned to develop the regulations of the DU Doctoral School, which will ensure the compliance of the DU Doctoral School with European best practices and international standards, as well as provide conditions for cooperation with other Latvian and foreign scientific institutions and higher education institutions. In 2023/2024, DSP “Mathematics” 1st year students will start their studies at the Doctoral School of DU. The gradual transition to the new doctoral model at Daugavpils University is planned to be completed by the end of 2026.

Acquisition of the courses developed within the study programme, as well as participation in doctoral seminars, doctoral school and systematic cooperation with the doctoral research adviser contribute to broadening students’ outlook and offer a competitive education in the field of biology; it meets the challenges of the future and is based on the emphasis on students’ independent work, synergy of study and research work, preparing specialists who are competitive on the labor market, developing their abilities and motivating lifelong learning.

**3.2.2. In the case of master’s and doctoral study programmes, specify and provide the justification as to whether the degrees are awarded in view of the developments and findings in the field of science or artistic creation. In the case of a doctoral study programme, provide a description of the main research roadmaps and the impact of the study programme on research and other education levels (if applicable).**

After completing the study program, students with a previously obtained appropriate academic Master's degree in mathematics or computer science obtain an academic doctor’s degree (Ph.D.) in natural sciences. The awarding of the academic degree is based on the achievements and knowledge of the science sector. The main directions of the research are theoretical results in the field of differential equations and their application to mathematical modelling of natural and economic processes. The content of the program is closely related to mathematical education at other levels. This is confirmed by the content of the study program. Currently, a great emphasis in knowledge transfer is placed on the interaction of study work with research and student training based on scientific achievements, the interdisciplinary aspect is always supported. The last doctoral theses defended in DU within the framework of the doctoral program are related to the study of complex networks and their modelling, including genes networks. The last topic is more relevant in biomathematics and is the focus of research in many scientific centres.

**3.2.3. Assessment of the study programme including the study course/ module implementation methods by indicating what the methods are, and how they contribute to the achievement of the learning outcomes of the study courses and the aims of the study programme. In the case of a joint study programme, or in case the study programme is**

**implemented in a foreign language or in the form of distance learning, describe in detail the methods used to deliver such a study programme. Provide an explanation of how the student-centred principles are taken into account in the implementation of the study process.**

The study work of doctoral students takes place using various forms of work organization, most often – group work classes, seminars, consultations, and individual work. The approval of the doctoral student's individual work plan is coordinated with the doctoral research adviser, but is not regulated outside the structural unit. During the implementation of DSP, doctoral students and after its implementation doctoral candidates conduct research on the topic of their doctoral thesis, publish the main research results in generally recognized peer-reviewed scientific publications, carry out science transfer activities, present research results in scientific seminars, symposia, conferences and congresses. This work is most often done in consultation with the research adviser. The doctoral student's work is supervised by the research adviser and the structural unit in which the scientific work is developed. Due to the small number of students, it is possible to emphasize individual student work with a scientific supervisor. This method is effective because it accelerates the student's involvement in scientific research.

When developing the curriculum of the new DSP "Mathematics", the recommendations stated in the conceptual report "On the introduction of a new doctoral model in Latvia" were taken into account regarding the proportion of time devoted to research and study course acquisition. According to these recommendations, credit points in doctoral study programmes should be awarded for the time devoted to research, when the doctoral student elaborates a doctoral thesis and internationally recognized scientific publications (~ 70% of the time of full-time studies), and for the time devoted to study courses and mobility (~ 30%).

According to developed study plan (see the annex 3.2.1.DSP *Mathematics plan*) for the new study courses provided for DSP "Mathematics" *Differential Equations. Basic Course (8 CP)* and *English for Mathematicians (6 CP)*, a significant part of the volume of both study courses could be realized within the framework of the Doctoral School of DU, incl. in doctoral schools organized by other Latvian and foreign universities, according to the specialization chosen by the students.

In the course of the study programme implementation, all basic principles of student-centered education are observed:

- constant reflection,
- individual approach to students, avoiding a 'one-size-fits-all' solution,
- it is taken into account that students have different learning styles, different requirements, interests, experience and previous knowledge,
- students' knowledge, skills and abilities are evaluated not only by the academic staff, but there should also be self-control over their studies,
- students are offered an opportunity to learn by themselves,
- continuous cooperation between students and academic staff.

**3.2.4. If the study programme envisages an internship, describe the internship opportunities offered to students, provision and work organization, including whether the higher education institution/ college helps students to find an internship place. If the study programme is implemented in a foreign language, provide information on how internship opportunities are provided in a foreign language, including for foreign**

**students. To provide analysis and evaluation of the connection of the tasks set for students during the internship included in the study programme with the learning outcomes of the study programme (if applicable).**

### **3.2.5. Evaluation and description of the promotion opportunities and the promotion process provided to the students of the doctoral study programme (if applicable).**

The doctorate promotion process at Daugavpils University is implemented on the basis of the Act on Scientific Activity of the Republic of Latvia, the Act of Higher Education Institutions of the Republic of Latvia, as well as the Cabinet of Ministers decision of 27.12.2005. No. 1001 concerning the "Procedure and criteria for the awarding of a doctoral degree (promotion)"<sup>[1]</sup>. General procedure of founding promotion councils and procedure of promotion at Daugavpils University are regulated by "Regulations on Daugavpils University promotion councils"<sup>[2]</sup>, while the procedure for the formation and promotion of the Mathematics Promotion Council is determined in the "Regulations of the Mathematics Promotion Council of Daugavpils University"<sup>[3]</sup>.

The activity of the Mathematics Promotion Council is based on the accredited doctoral study program "Mathematics". According to the regulations of the Mathematical Promotion Council (Mathematics PP) of the DU, the independent composition of the Mathematical PP includes at least five scientists who have LZP expert rights in the field of Mathematics. The composition of the Mathematics PP should include at least two scientists in the sub-field of mathematical science in which the doctoral thesis is defended. The composition of the current Mathematics PP has been approved on 24.05.2021 with the DU rector's order No.4-4/113, it includes 6 experts<sup>[4]</sup>.

Before submitting the developed doctoral thesis to the Department of Sciences of DU, it is reviewed at a meeting of the Department of Physics and Mathematics of DU. If the structural unit after reviewing the work decides that the doctoral thesis has been elaborated in accordance with the requirements, it is submitted to the Department of Sciences of DU, which delegates the responsibility for examining the doctoral thesis to the promotion council of the relevant branch of science. Within a month after receiving the doctoral thesis, the promotion council decides on the promotion of the thesis for public defense and the appointment of three reviewers. In case of a positive decision of the State Scientific Qualification Commission (SSQC), the reviewers are involved in the work of the promotion council formed by the university and approved by the rector's order for the defence of the particular doctoral thesis.

When announcing the defense of the doctoral thesis, the information (including the summary of the doctoral thesis) is placed on DU website, where all interested parties can familiarize themselves with it (see here<sup>[5]</sup>).

For each specific defense of a doctoral thesis, upon the suggestion of the head of the Promotion Council in Mathematics and the proposal of the vice-rector of science, the rector of DU can issue an order to add to the Promotion Council in Mathematics other scientists who hold LCS expert rights in the relevant sub-branch of mathematical science. After hearing the reports of the doctoral candidate and the reviewers, as well as after the scientific discussion, the Promotion Council makes a decision on awarding or refusing the degree by a majority of votes in an open meeting.

The work of the Promotion Council is provided by the Department of Science of DU. The costs of the

promotion process for graduates of DU doctoral study programmes are covered from the funds intended for the implementation of the doctoral study programme, if the applicant obtains a doctoral degree within two full calendar years after completing the theoretical studies. If the applicant for a doctoral degree has not completed the appropriate doctoral study programme at DU or completed it more than two full calendar years before without obtaining a degree, the decision concerning the funds to cover the costs of the promotion process shall be taken by the DU Council of Science.

The list of doctoral theses defended in the DU Mathematics Promotion Council for the period 2017-2022 see in the annex (3.2.5\_DSP\_Mathematics\_List of defended doctoral theses).

[1] Cabinet of Ministers decision of 27.12.2005. No. 1001 concerning the “Procedure and criteria for the awarding of a doctoral degree (promotion)” (in Latvian). Available: <https://likumi.lv/ta/id/124787-zinatniska-doktora-grada-pieskirsanas-promocijas-kartiba-un-kriteriji> [viewed 30.04.2023]

[2] Regulations on Daugavpils University promotion councils (in Latvian). Available: <https://du.lv/wp-content/uploads/2021/05/Nolikums-par-DU-Promocijas-padomem-1.pdf> [viewed 30.04.2023]

[3] Regulations on the Mathematics promotion council of the Daugavpils University (in Latvian). Available at [https://du.lv/wp-content/uploads/2021/05/Matematikas\\_PP\\_Nolikums\\_grozits\\_precizet-lemuma-nr-1.pdf](https://du.lv/wp-content/uploads/2021/05/Matematikas_PP_Nolikums_grozits_precizet-lemuma-nr-1.pdf) [viewed 22.06.2023]

[4] Composition of the mathematics promotion council (in Latvian). Available at: <https://du.lv/zinatne/promocija/promocijas-padomes/matematikas-promocijas-padome/> [viewed 22.06.2023]

[5] Information about the defense of the doctoral thesis on the DU website (in Latvian). Available: <https://du.lv/promocijas-darbi/pazinojums-par-innas-samuilikas-promocijas-darba-aizstavesanu/> [viewed 22.06.2023]

### **3.2.6. Analysis and assessment of the topics of the final theses of the students, their relevance in the respective field, including the labour market, and the marks of the final theses.**

Students choose the topics of doctoral theses in consultation with their research advisers and the director of the study programme (quite often can be one person). The director of the study programme evaluates the relevance of the scientific experience of the thesis adviser to the scientific specificity of the topic chosen for the doctoral thesis. The research adviser provides necessary consultations to the doctoral student both with DU specialists and those from other universities.

In order to ensure the quality of doctoral theses, the choice of reviewers of the appropriate field is also of great importance in the process of defending the doctoral thesis. According to the regulations of the DU Mathematics Promotion Council, after submitting the thesis to the Mathematics Promotion Council, a meeting of the Mathematics Promotion Board is held, where the appointment of 3 reviewers is voted, 1 of whom is an expert of this council in the relevant sub-

branch of science, and 2 are sub-branch experts from other scientific institutions or organizations (preferably outside Latvia).

More detailed information about the promotion process at DU Promotion Council in Mathematics see in section 3.2.5.

So far all doctoral theses developed within the framework of the DU DSP "Mathematics" have been defended at the DU Mathematics Doctoral Council. In the period from 2017 to 2023, a total of 4 doctoral theses were defended at the DU Mathematics Doctoral Council.

After the establishment of the "Mathematics" Department of the DU, the topics of the first doctoral theses were devoted to the classical theory of boundary value problems of ordinary differential equations. Basically, the topics were oriented towards current topics of nonlinear analysis. Essential results were obtained in thesis "Quasi-linearization and types of solutions of nonlinear boundary value problems", thesis "Boundary Value Problems for the Third Order Differential Equations", thesis "Bifurcations in nonlinear boundary value problems and multiplicity of solutions", thesis "Spectral properties of nonlinear boundary value problems for the second order ordinary differential equations". Later these achievements were developed and continued in the thesis "Approximation schemes in boundary value problems of nonlinear ordinary differential equations" (classification of solutions), thesis "Resonant boundary value problems for ordinary differential equations", and thesis "Periodical solutions of planar systems" (non-linear problems, research with phase plane methods). A new phase was opened in 2016, as another one thesis of student was devoted to applications. Current mathematical modelling tasks, oriented to genes networks and their research, were solved and published in high-ranking international journals. These studies were continued in the work of other student. The new results were published in high-quality articles in prominent journals, including in quarters Q1 and Q2.

The list of topics of defended graduation theses, managers of theses for the time period from 2017 - 2023 is shown in the annex (*3.2.5\_DSP\_Mathematics\_List of defended doctoral theses*).

In total, 2 out of 4 persons who defended their doctoral theses in 2017-2023, currently works in higher education institutions (Latvia) and continues the research started as part of their doctoral thesis (see annex *3.1.3.Employment and scientific indicators DSP Mathematics and DSP Solid State Physics*). This confirms the relevance of the topics of final theses of DSP "Mathematics" students in the industry.

### **3.3. Resources and Provision of the Study Programme**

**3.3.1. Assessment of the compliance of the resources and provision (study provision, scientific support (if applicable), informative provision (including libraries), material and technical provision, and financial provision) with the conditions for the implementation of the study programme and the learning outcomes to be achieved by providing the respective examples.**

To ensure the study process and conduct scientific research, the students of DSP "Mathematics" have access to modern resources, for example, a well-stocked library with the necessary books (scientific books mostly in English), access to Internet databases, offices with computers equipped

with the programs necessary for the study courses. You can read more about the library, its resources and services in chapter 2.3.3. You can connect to the Electronic databases in the educational buildings at Parades Street 1 and Vienības Street 13 - EBSCO Publishing (it includes 8 databases: Academic Search Elite, Business Source Premier, MasterFILE Premier, Newspaper Source, ERIC, Business Wire News, MEDLINE, Health Source – Consumer Edition, Agrikola); about 10,000 scientific journals in several fields of science (including mathematical field) are available in English.

- The necessary materials and sources can be found in popular databases:
- Cambridge Journals online. 100 scientific journals in English are available in several fields of the science (including, field of mathematics);
- Science Direct -DSP “Mathematics” the most used journals are Advances in Applied Mathematics; Applied Mathematics and Computation, Applied Mathematics Letters, Biomathematics, Computers & Mathematics with Applications; Journal of Computational and Applied Mathematics; Journal of Differential Equations; Mathematics and Computers in Simulation; Results in Applied Mathematics (all in English).
- Web of Science - DSP “Mathematics” the most used journals are International Journal Of Mathematics And Mathematical Sciences; Journal Of Computational Dynamics; Advances In Difference Equations; Differential And Integral Equations; Discrete And Continuous Dynamical Systems; Electronic Journal Of Differential Equations; Electronic Journal Of Qualitative Theory Of Differential Equations; Journal Of Modern Dynamics; Journal Of The European Mathematical Society; Nonlinear Analysis-Modelling And Control; Proceedings Of The American Mathematical Society; Qualitative Theory Of Dynamical Systems; Results In Mathematics; Differential Equations And Dynamical Systems.
- Scopus - DSP “Mathematics” the most used journals are Nonlinear Dynamics; MDPI Mathematics; Nonlinear Analysis: Modelling and Control; Mathematical Modelling and Analysis; Journal of Applied Mathematics and Computing; Archiv der Mathematik;

Additional information about resources and services is available in the sections 2.3.1-2.3.3 of Part II of the given document.

### **3.3.2. Assessment of the study provision and scientific base support, including the resources provided within the framework of cooperation with other science institutes and higher education institutions (applicable to doctoral study programmes) (if applicable).**

Studies and research are closely related to the research plans of the Laboratory of Ordinary Differential Equation of the Institute of Mathematics and Computer Science of the University of Latvia. All employees of the laboratory, except for its head, are former DU doctoral students. The laboratory infrastructure is used for joint research.

### **3.3.3. Indicate data on the available funding for the corresponding study programme, its funding sources and their use for the development of the study programme. Provide information on the costs per one student within this study programme, indicating the items included in the cost calculation and the percentage distribution of funding between the specified items. The minimum number of students in the study programme in order to ensure the profitability of the study programme (indicating separately the information on**

**each language, type and form of the study programme implementation).**

DSP "Mathematics" funding source is the state budget funding for studies (grant) and tuition fees. In addition to the development of the program, funding is attracted from Latvian and European projects and science-based funding, the amount of which depends on scientific performance. The tuition fee for DSP "Mathematics" is set at 2,200 EUR per year of study or 6,600 EUR for three academic years.

The calculation of costs for one student in the study field programs is performed in the DU Finance and Accounting Department, including the salary fund and the employer's State Social Insurance Mandatory Contributions, business trip, material, energy and inventory costs, purchase of books, equipment and investment costs, as well as social security costs for students. Calculation of costs per student of DSP "Mathematics" (full-time studies, 3 years, 120 CP) and information on the percentage distribution of funding see in the Table 3.3.3.1.

Daugavpils University does not have a minimum number of students for doctoral study programs.

*Table 3.3.3.1. Calculation of costs per student of DSP "Mathematics"*

### **3.4. Teaching Staff**

**3.4.1. Assessment of the compliance of the qualification of the teaching staff members (academic staff members, visiting professors, visiting associate professors, visiting docents, visiting lecturers, and visiting assistants) involved in the implementation of the study programme with the conditions for the implementation of the study programme and the provisions set out in the respective regulatory enactments. Provide information on how the qualification of the teaching staff members contributes to the achievement of the learning outcomes.**

The qualification of teaching staff involved in DSP "Mathematics" fully meets the conditions of program implementation, program content and the requirements of regulatory acts. The knowledge of the national language of the academic staff employed in the implementation of the study program complies with the regulations on the amount of knowledge of the national language and the procedure for testing the knowledge of the national language for the performance of professional and official duties.

Specialists involved in teaching the course master the English language at a sufficient level for the performance of work tasks, as evidenced by several publications in scientific journals, which demonstrate the high level of language requirements. Almost all lecturers involved in the realization of the study program have at least a B2 level of English knowledge (*appendix 2.3.7. teaching\_staff*).

When submitting documents for accreditation, it is planned that 5 lecturers will be involved in the implementation of DSP "Mathematics" (see table 3.4.1.1), the place of primary election for all of them is DU.

Table 3.4.1.1. Academic staff involved in DSP "Mathematics"

<b>Position</b>	<b>Number</b>	<b>% from total</b>	<b>Elected at DU</b>
<i>Professor</i>	1	20	1
<i>Assoc. prof.</i>	2	40	2
<i>Docent</i>	1	20	1
<i>Leading researcher</i>	1	20	1
<i>Researcher</i>	0	0	0
<b>Total</b>	5	100	5

From the teaching staff involved in the realization of the study program, all five are doctors of science, and three are LZP approved experts in the field of mathematics. The list of academic staff involved in DSP "Mathematics", information about the place of primary election of teaching staff, as well as the term of the expert's rights, see in the annex 3.4.1. *STATEMENT of experts\_DSP\_Mathematics\_EN*.

In addition to the academic work at the university, the teaching staff has practical experience in the implementation of industry-related projects. This type of activity contributes to a comprehensive understanding of the specifics of the industry, thus also ensuring a direct unity of theory and practice during the study process. The list with the experience of the academic staff involved in DSP "Mathematics" in the implementation of industry projects is given in the annex 3.4.4. *DSP Mathematics\_Participation in projects*. The implementation projects mentioned in the annex are focused on the use of mathematical methods in topical areas, such as energy (thermal reactors), health care, use of nature resources.

The directions of the research work of the academic staff involved in the study programme are focused on the successful implementation of the study programme and in most cases are related to the teacher's specialization within the programme. Academic staff members prepare scientific articles published also in internationally peer-reviewed journals, participate in conferences and practical seminars, training, internships and various scientific events. Note that chapters have been published in educational and scientific books, 1) Sadyrbaev, F., Atslega, S., Brokan, E. (2020). Dynamical Models of Interrelation in a Class of Artificial Networks. In: Pinelas, S., Graef, J.R., Hilger, S., Kloeden, P., Schinas, C. (eds) Differential and Difference Equations with Applications. ICDDEA 2019. Springer Proceedings in Mathematics & Statistics, vol 333. Springer, Cham. [https://doi.org/10.1007/978-3-030-56323-3\\_18](https://doi.org/10.1007/978-3-030-56323-3_18); 2) Sadyrbaev, F. CHAPTER 5 Modeling the evolution of complex networks arising in applications, in *Human-Assisted Intelligent Computing* Modeling, simulations and applications, Published April 2023. Copyright © IOP Publishing Ltd 2023 <https://iopscience.iop.org/book/edit/978-0-7503-4801-0/chapter/bk978-0-7503-4801-0ch5>) and develop methodological materials. The most important publications of the teaching staff involved in the implementation of DSP "Mathematics" are added in the annex 2.4.4. *List of scientific publications for the direction\_EN*.

### **3.4.2. Analysis and assessment of the changes to the composition of the teaching staff over the reporting period and their impact on the study quality.**

When submitting documents for accreditation, it is planned that 5 lecturers will be involved in the implementation of DSP "Mathematics". Since the previous accreditation of the study field, there have been changes in teaching staff in the provision of study courses. In order to update the composition of the teaching staff, PhD A. Kiričuka was involved, who has obtained the status of an expert in the law of Latvian Science Council.

These changes contributed to maintaining the level necessary to fulfill the program's tasks.

**3.4.3. Information on the number of the scientific publications of the academic staff members, involved in the implementation of doctoral study programme, as published during the reporting period by listing the most significant publications published in Scopus or WoS CC indexed journals. As for the social sciences, humanitarian sciences, and the science of art, the scientific publications published in ERIH+ indexed journals or peer-reviewed monographs may be additionally specified. Information on the teaching staff included in the database of experts of the Latvian Council of Science in the relevant field of science (total number, name of the lecturer, field of science in which the teaching staff has the status of an expert and expiration date of the Latvian Council of Science expert) (if applicable).**

The academic staff involved in the implementation of DSP "Mathematics" in the period from 2017-2022 has published a total of 52 scientific publications indexed in Scopus or WoS databases. Of these, a large number are top-ranked publications published in Q1 or Q2 quartile journals. During the reporting period, teaching staff involved in DSP "Mathematics" published the results of their scientific research in Q1 and Q2 quartile publications such as Mathematical Modelling and Analysis, Nonlinear Analysis: Modeling and Control, Mathematics (MDPI), Fluids (MDPI), Mathematical Biosciences and Engineering etc. A significant part of the scientific articles developed by the teaching staff of DSP "Mathematics" have been published in close cooperation with the students of DSP "Mathematics".

The most important publications of the teaching staff involved in the implementation of DSP "Mathematics" are added in the annex 2.4.4. *List of scientific publications for the direction\_EN*. The three representatives of the teaching staff involved in the implementation of the study programs are LZP experts. The list of teaching staff, as well as information on the place of primary election of teaching staff, science branches in which LZP expert rights and the term of rights are granted, can be found in the annex 3.4.1. *STATEMENT of eksperts\_DSP\_Mathematics\_EN*.

**3.4.4. Information on the participation of the academic staff, involved in the implementation of the doctoral study programme, in scientific projects as project managers or prime contractors/ subproject managers/ leading researchers by specifying the name of the relevant project, as well as the source and the amount of the funding. Provide information on the reporting period (if applicable).**

During the reporting period, teaching staff involved in the implementation of DSP "Mathematics"

have participated in the implementation of 4 scientific projects (of which 1 international and 2 LZP projects). The implemented research projects are focused on the use of mathematical methods in topical areas, such as energy (thermal reactors), health care, use of natural resources. For detailed information see the annex 3.4.4. *DSP Mathematics\_Participation in projects*.

**3.4.5. Assessment of the cooperation between the teaching staff members by specifying the mechanisms used to promote the cooperation and ensure the interrelation between the study programme and study courses/ modules. Specify also the proportion of the number of the students and the teaching staff within the study programme (at the moment of the submission of the Self-Assessment Report).**

Mutual cooperation of teaching staff exists, it is a necessary part of the learning process of the program.

Examples:

- Ināra Jermačenko is Felikss Sdirbajevs' former PhD student, who currently actively works as a lecturer in DU DSP "Mathematics". The both authors have 12 joint publications in accordance with Google Scholar data. The publication Sadyrbaev, F. Yermachenko, I. "Quasilinearization and multiple solutions of the Emden-Fowler type equation", *Mathematical Modelling and Analysis*, 2005, 10(1), pp. 41-50 according to Scopus data has been quoted 34 times, the publication Sadyrbaev, F. Yermachenko, I. "Types of solutions and multiplicity results for two-point nonlinear boundary value problems", *Nonlinear Analysis, Theory, Methods and Applications*, 2005, 63(5-7) is quoted 15 times (Scopus).
- The thesis of Armands Gricāns and Felikss Sadirbajevs on Nehari equations "Extension of the example by Moore-Nehari", *Tatra Mountains Mathematical Publications*, 2015, 63(1), pp. 115-127 marked the beginning of a series of articles by foreign authors on the same subject, published in first-class international journals.
- Gricāns, F. Sadirbajevs, I. Yermačenko jointly participate in the project of the Latvian Council of Science (see the annex 3.4.4. *DSP Mathematics\_Participation in projects*).

Within the doctoral study program, the need for cooperation between teaching staff is primarily determined by joint research and scientific cooperation. However, when creating the study program, the needs of the students come to the fore, while the interests of the teaching staff are secondary. In the implementation of DU DSP "Mathematics" during the reporting period, it was possible to harmonize the needs, interests and opportunities of all involved parties.

The ratio of the number of students and teaching staff within the study program (at the time of submitting the self-evaluation report) is 1:4. because in the academic year 2022/2023 a total of 4 teaching staff are involved in the implementation of the doctoral study program. At the time of submission of the accreditation report, a total of 1 student is studying.

# Annexes

III - Description of the Study Programme - 3.1. Indicators Describing the Study Programme		
Sample of the diploma and its supplement to be issued for completing the study programme	3.1.2.DSP Mathematics_diploma and transcript.zip	3.1.2.DSP Matematika_diploms un akadēmiskā izziņa.docx
For academic study programmes - Opinion of the Council of Higher Education in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions (if applicable)		
Compliance of the joint study programme with the provisions of the Law on Higher Education Institutions (table) (if applicable)		
Statistics on the students in the reporting period	3.1.4. DSP Mathematics_Statistical data on students.xlsx	3.1.4. DSP Matemātika_Statistikas_dati_par_studejosajiem.xlsx
III - Description of the Study Programme - 3.2. The Content of Studies and Implementation Thereof		
Compliance with the study programme with the State Education Standard		
Compliance of the qualification to be acquired upon completion of the study programme with the professional standard or the requirements for professional qualification (if applicable)		
Compliance of the study programme with the specific regulatory framework applicable to the relevant field (if applicable)	3.2.1.DSP_Mathematics_comparison_MC regulations_No.1001.docx	3.2.1.DSP_Matemātika_salīdzinājums_MK_not_Nr.1001.docx
Mapping of the study courses/ modules for the achievement of the learning outcomes of the study programme	3.2.1.DSP Mathematics_study course mapping.docx	3.2.1.DSP Matematika_studiju kursu kartējums.docx
The curriculum of the study programme (for each type and form of the implementation of the study programme)	3.2.1.DSP Mathematics plan.xls	3.2.1.DSP Matematika plans.xls
Descriptions of the study courses/ modules	3.2.1.DSP Mathematics_Study course descriptions.zip	3.2.1.DSP Matemātika_Studiju kursu apraksti.zip
Description of the organisation of the internship of the students (if applicable)		
III - Description of the Study Programme - 3.4. Teaching Staff		
Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable)	3.4.1.STATEMENT of eksperts_DSP_Mathematics_EN.docx	Apliecinājums par LZP ekspertiem DSP Matemātika.edoc
Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable)		

# Solid State Physics (51443)

Study field	<i>Physics, Material Science, Mathematics, and Statistics</i>
ProcedureStudyProgram.Name	<i>Solid State Physics</i>
Education classification code	<i>51443</i>
Type of the study programme	<i>Doctoral study programme</i>
Name of the study programme director	<i>Irēna</i>
Surname of the study programme director	<i>Mihailova</i>
E-mail of the study programme director	<i>irena.mihailova@du.lv</i>
Title of the study programme director	<i>Dr. phys.</i>
Phone of the study programme director	<i>+371 28226689</i>
Goal of the study programme	<i>To prepare a highly qualified specialist - a physicist who is able to raise and solve the most important problems of modern physics and material science, thereby strengthening the scientific potential of DU and in general in Latvia in the mentioned branch and sub-branch of sciences, as well as integrating into the international scientific environment.</i>
Tasks of the study programme	<i>1) to ensure the acquisition of the latest scientific information in the solid state physics subfield, performance of independent research work, 2) to ensure the learning and development of high-tech and innovative research work methods with their subsequent implementation in practice, 3) to promote practice in managing research and study work at the university by speaking at seminars and conferences, 4) to promote the inclusion of doctoral students in the international scientific environment and provide a summary of research results in the doctoral thesis.</i>

Results of the study programme	<p><i>Knowledge:</i></p> <ol style="list-style-type: none"> <li>1. Are familiar with the most current scientific theories and methods in physics.</li> <li>2. Are familiar with modern research methodology and modern physics research methods in various sub-fields.</li> </ol> <p><i>Skills:</i></p> <ol style="list-style-type: none"> <li>3. Able to independently evaluate and choose suitable scientific research methods, contribute to expanding the frontier of knowledge or provide a new understanding of existing knowledge and its application in practice, including by publishing scientific publications.</li> <li>4. Able to communicate both orally and in writing about own scientific field to the wider community of scientists and society in general.</li> <li>5. Able to independently improve own scientific skills, implement scientific projects, obtaining international science-qualifying achievements.</li> </ol> <p><i>Competence:</i></p> <ol style="list-style-type: none"> <li>6. Carrying out independent, critical analysis, synthesis and evaluation, are able to solve important research or innovation tasks.</li> <li>7. Are competent to propose the research idea, plan and structure independently.</li> <li>8. Are able to manage large-scale scientific projects, including in an international context.</li> </ol>
Final examination upon the completion of the study programme	<i>Final doctoral examination</i>

## Study programme forms

### Full time studies - 3 years - latvian

Study type and form	<i>Full time studies</i>
Duration in full years	3
Duration in month	0
Language	<i>latvian</i>
Amount (CP)	120
Admission requirements (in English)	- Master's degree in physics and related fields or equivalent higher education; - entrance exam
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	<i>Doctoral degree Doctor of Science (Ph.D.) in Natural Sciences</i>
Qualification to be obtained (in english)	-

### Places of implementation

Place name	City	Address
Daugavpils University	DAUGAVPILS	VIENĪBAS IELA 13, DAUGAVPILS, LV-5401

### Full time studies - 3 years - english

Study type and form	<i>Full time studies</i>
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Duration in full years	3
Duration in month	0
Language	english
Amount (CP)	120
Admission requirements (in English)	- <i>Master's degree in physics or related sciences (biophysics, physical chemistry, etc.), in engineering, as well as higher education equivalent to a master's degree in the mentioned fields - discussions on the research topic and discussions in a foreign language (English) For studies in English: At least B2 level knowledge of the English language.</i>
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	<i>Doctor of Science degree Doctor of Science (Ph.D.) in Natural Sciences</i>
Qualification to be obtained (in english)	-

### Places of implementation

Place name	City	Address
Daugavpils University	DAUGAVPILS	VIENĪBAS IELA 13, DAUGAVPILS, LV-5401

## 3.1. Indicators Describing the Study Programme

### 3.1.1. Description and analysis of changes in the parameters of the study programme made since the issuance of the previous accreditation form of the study field or issuance of the study programme license, if the study programme is not included on the accreditation form of the study field, including changes planned within the evaluation procedure of the study field evaluation procedure.

No significant changes are made in the study program since the previous accreditation. Taking into account the planned changes in the implementation of doctoral study programmes in Latvia, which will be implemented on the basis of the conceptual report "On the implementation of a new doctoral study model in Latvia" (supported on June 25, 2020 by Cabinet of Ministers Order No. 345), also the doctoral study programmes implemented by DU, including DSP "Solid state Physics" will undergo a gradual transition to the new doctoral studies model. The conceptual report holds that every university should organize doctoral-level studies in centrally established structural units - doctoral schools. For the successful implementation of the transition in 2020, DU developed the "Doctoral Study Programme Development Plan 2020-2026". for the implementation of the new doctoral model at Daugavpils University" (approved at the meeting of the DU Science Council on 22.10.2020 (minutes No. 11, decision No. 1/1)). In 2023, it is planned to develop the regulations of the DU Doctoral School, which will ensure the compliance of the DU Doctoral School with European best practices and international standards, as well as provide conditions for cooperation with other Latvian and foreign scientific institutions and higher education institutions. In 2023/2024, DSP "Solid state Physics" 1st year students will start their studies at the Doctoral School of DU, while complete transition to the new doctoral model at Daugavpils University is planned to be completed by the end of 2026.

The current study plan of the DSP "Solid State Physics" includes courses that provide the theoretical and experimental basis of solid state physics. Evaluating the previous program as a whole, it could be called successful, taking into account the number and quality of doctoral theses defended. Of course, due to the fact that during the 32 years of Latvia's regained independence the ministers of education and science change in an average of 1.1 years, as well as considering the annual subject matter of EU-funded projects, any study program must be ready for unexpected changes. If doctoral schools continue to operate successfully, it is hoped that program changes can be made without lengthy bureaucratic procedures.

When developing the study plan of the new DSP "Physics of Solids", the prerequisites for ensuring the quality of doctoral study programs defined in the conceptual report "On the introduction of a new doctoral model in Latvia" were taken into account. According to these recommendations, the credit points of the academic DSP should reflect the time allocated for scientific research (~70%) and studying study courses (~30%). Thus, the proportion of credit points from the part of compulsory study courses to research work was slightly changed:

1. The share of compulsory courses was increased from 19 CP to 26 CP;
2. The number of CPs intended for individual research work and the development of a doctoral thesis was reduced from 98 CPs to 94 CPs;

In the previous DSP "Solid State Physics" study plan, 1 CP study course was planned to supplement English language knowledge and 2 CP were planned to prepare for the doctoral exam in solid state

physics. In the new study plan, there are no additional provisions for supplementing the CP English language, because, guided by the documents regulating the education of the Republic of Latvia, the English language must be mastered at a sufficient level when entering the doctoral program. As for the doctoral examination in solid state physics, it is supposed to be taken on the basis of the doctoral theoretical course, without additional CP to prepare for it.

Although one of the tasks of the doctoral program is the renewal of the academic staff of universities, the new study program does not include the courses "*Individual issues of Physics Didactics*" (1 CP) and "*Management of Physics classes at the university*" (1 CP). This will give additional time for the development of the doctoral thesis, as it is often not possible to publish research results in internationally recognized scientific publications within three years.

*In the new study program, 2 CP are allocated to Part C or Free Elective courses.*

In the existing program, there is no division of study courses into parts A and B, which was also accepted by the previous accreditation commission, because all study courses are equally important.

It should be noted that after the economic crisis in Latvia, when the funding of state universities was reduced by 60%, the DU Senate made a decision to reduce the contact hours in doctoral study programs to 400 hours, which is still in force.

***DSP "Solid State Physics" program in its current version (students enrolled in the program until the 2022/2023 academic year)***

- Compulsory courses (19KP):
  - *Amorphous As chalcogenides, their compounds (1 CP);*
  - *Methods of obtaining high vacuum (1 CP);*
  - *Experimental methods of solid state physics (1 CP);*
  - *separate questions of physics didactics (1 CP);*
  - *Conducting physics classes at a university (1 CP);*
  - *Computer modeling of physical processes (2 credits);*
  - *Physics of lasers (1 CP);*
  - *Modern microscopy (2 CP);*
  - *Nanostructured materials (2 CP);*
  - *Physics of non-crystalline substances (2 CP);*
  - *Optical recording physics (2 CP);*
  - *Physics of thin films and their production (1 CP);*
  - *X-ray structural analysis (2 CP).*
- Individual research work and development of a doctoral thesis (98KP):
  - *Research according to the individual work plan (92 CP).*
  - *Seminars on research results and current affairs in physics (6 CP);*
- Promotional exams – at the end of their studies, students take the *Graduation Examination in their specialty (2 CP)* and the *Graduation Examination in English (1CP)*.

**DSP "Solid State Physics" parts and their amount after the changes planned (students are planned to be enrolled from the academic year of 2023/2024)**

- Mandatory courses (24 CP):
  - Amorphous As chalcogenides, their compounds (2 CP);
  - Methods of obtaining high vacuum (2 CP);
  - Experimental methods of solid state physics (4 credits);
  - Computer modeling of physical processes (2 credits);
  - Physics of lasers (2 CP);
  - Modern microscopy (2 CP);
  - Nanostructured materials (2 CP);
  - Physics of non-crystalline substances (2 CP);
  - Optical recording physics (2 CP);
  - Physics of thin films and their production (2 CP);
  - X-ray structural analysis (2 CP).
- Individual research work and development of graduation thesis (94 CP):
  - Researches according to individual work schedule (84 CP),
  - Special seminars on research results (10 CP).
  - Free elective courses (2 CP).
  - Graduation examinations - at the end of their studies, students take the *Graduation Examination in Solid State Physics* and the *Graduation Examination in English*.

DSP "Solid State Physics" plan and mapping of study courses given in the annex 3.2.1 (3.2.1.DSP *Solid State Physics\_Study plan* and 3.2.1.DSP *Solid State Physics\_mapping*), in the new study program the ratio of theoretical and independent work of the doctoral student is 30 to 70.

**3.1.2. Analysis and assessment of the study programme compliance with the study field. Analysis of the interrelation between the code of the study programme, the degree, professional qualification/professional qualification requirements or the degree and professional qualification to be acquired, the aims, objectives, learning outcomes, and the admission requirements. Description of the duration and scope of the implementation of the study programme (including different options of the study programme implementation) and evaluation of its usefulness.**

DSP "Solid State Physics" is a doctoral level study program included in the study direction "Physics, Materials Science, Mathematics and Statistics" implemented by DU. DSP "Solid State Physics" provides high-quality and versatile internationally recognized education in the field of physical sciences at the doctoral study program level.

**The aim of the program** is to prepare a highly qualified specialist - a physicist who is able to raise and solve the most important problems of modern physics and material science, thereby strengthening the scientific potential of DU and in general in Latvia in the mentioned branch and

sub-branch of sciences, as well as integrating into the international scientific environment.

Enrollment in the study program takes place in accordance with "Daugavpils University admission rules for full-time and part-time higher level studies"[1], which are annually approved by the DU Senate. The level of education required for admission is a master's degree in physics and higher education in related fields or equivalent. During the admission, discussions on the research topic and discussions in a foreign language (English) are organized. These entrance discussions assessment concerns the applicant's detailed proposal for the doctoral research, the applicant's motivation, scientific relevance and compliance with the priority directions of the development of physical science. The applicant's prior achievements are also important including scientific publications, participation in international scientific conferences, connection of professional activity with the topic of the doctoral thesis, as well as knowledge of a foreign language (English).

The aim and objectives of the study programme, as well as the study outcomes obtained during the studies, correspond to the eighth level of EQI, which is the level of doctoral studies. Programme code 51443 reflects the status and content of the programme, in accordance with the requirements set out in the "Regulations on Latvian Education Classification" (MK 13.06.2017. Regulations No. 322). The first digits of the code 51 denote doctoral studies (doctoral degree), which can be implemented after obtaining a master's or professional master's degree or as sequel to education programme with code 49. The second part of the code corresponds to the thematic field of education (44 - Physical sciences) and the group of educational programmes (443 - Physics).

DSP "Solid State Physics" implemented at Daugavpils University is implemented in the form of a full-time study program. The name of the programme, the degree to be obtained, goals and objectives, student admission requirements are interconnected. DSP "Solid State Physics", which is planned to be implemented within three years leading to obtaining by the graduate a doctoral degree (Ph.D.) in natural sciences, opens opportunities to independently develop and manage scientific research projects, publish the research results in internationally cited publications in Latvia and abroad, publicize the results of scientific research at conferences and seminars, to promote the implementation of innovations in research practice.

Evaluating the duration of the study process, it can be concluded that in any version of the program, three years on average is enough time to learn the theoretical course and accumulate a sufficient amount of research results to write a doctoral thesis, although it sometimes depends on the topic of the doctoral thesis. It should be noted that in Latvia there have been several discussions at the government level about the 4-year study period for doctoral studies. Despite the large number of scientific publications in the world in the field of physics, publishing the results of a doctoral thesis in publications with a high impact factor is relatively problematic in terms of time, so a doctoral student does not always manage to defend the thesis within three years.

According to the current DSP "Solid State Physics" study plan, within the study program students are offered to take the courses "*Physics Didactics Individual Questions*" (1 CP) and "*Physics Lessons in Higher Education*" (1 CP). In the new program, it is suggested to abandon these courses, instead to expand and deepen the specialization courses "*Amorphous As chalcogenides, their compounds*", "*Methods of obtaining high vacuum*", "*Physics of lasers*", "*Physics of thin films and their production*", moving from 1 CP for 2 CP courses. The study course "*Experimental methods of solid state physics*" (1 CP) was expanded to 4 CP. The study course "*Special seminars on research results and current affairs in physics*" (6 CP) was expanded to 10 CP. This will provide additional theoretical knowledge and practical skills for work in scientific laboratories, as well as additional time for the development of a doctoral thesis, as it is often not possible to publish research results in internationally recognized scientific publications within three years.

On the study programme acquisition diploma and its appendix sample in accordance with the

Cabinet of Ministers regulations of 16.04.2013. No. 202 as well as agreement on studies sample in accordance with the Cabinet of Ministers regulations of 23.01.2007. No. 70 see (3.1.2.DSP Solid State Physics\_Diploma and transcript un 2.1.4.Agreement on studies\_DU).

[1] Daugavpils University admission rules for full-time and part-time higher level studies (international students). Available: <https://du.lv/en/studies/admission/> [viewed 28.02.2023]

### **3.1.3. Economic and/ or social substantiation of the study programme, analysis of graduates' employment.**

In order to improve the integration of science in studies, to improve the management of knowledge and technology, to promote scientific activity and to adjust the research activity in general to the needs of the market, international level research is being carried out in the field of research specialization "Natural Sciences" of DU. The direction of specialization "Natural Sciences" purposefully develops cooperation with representatives of industry, expands international partnership in scientific networks and consortia, as well as, jointly with entrepreneur and employer associations, adjusts research to the needs of industry.

DU's scientific excellence, intellectual and infrastructural capacity, as well as knowledge and technology transfer, accumulated experience in the implementation of important international projects, inclusion in information circulation and cooperation networks contribute to science, innovation, and doctoral development in the above-mentioned DU specialization directions, which generally correspond to the following Smart Specialization Strategy (RIS3) priority directions: Industrial modernization, industry and applied research, material engineering, medical technology, nanotechnology.

According to the data of the Ministry of Education and Culture for the period from 2016 to 2020, 8% of Latvia's total amount of science in the field of natural sciences, as well as 5% of the total number of scientific publications in the field of natural sciences in Latvia, were concentrated in the "Natural Sciences" specialization of DU. A significant part of these indicators was provided by the scientists and teaching staff employed in the research field of "Physics, Materials Science, Mathematics and Statistics" of DU.

The development of doctoral studies at DU also plays an important role from the point of view of national security. The city of Daugavpils and the region of Eastern Latvia are distinctly multicultural and located on the border of the European Union. DU is the most important center of science, higher education, and Latvian culture promotion in the region.

In the period from 2017-2022 there are 6 graduates of the DU DSP "Solid State Physics" and one person who obtained a doctor of science degree, who received the educational document already at the beginning of 2023. Analysing their further career and employment data, it can be concluded that 6 out of 7 persons who defended their doctoral theses at the Physics and Astronomy Promotion Council of DU during the reporting period, are employed as scientists or as academic staff in scientific institutions or higher education institutions in Latvia, they participate in scientific work and publish internationally in indexed scientific publications. Between 2017-2022 3 of the persons who obtained a doctorate scientific degree are also LZP experts in Natural Sciences - Physics and Astronomy. This confirms the high quality and competitiveness of the education offered by DSP "Solid State Physics". One of the graduates works in a private business related to technological

matters. More detailed data for the period of 2017-2022 concerning the employment and scientific indicators of persons who obtained a doctorate scientific degree, see in appendix *3.1.3. Employment and scientific indicators DSP Mathematics and DSP Solid State Physics*.

**3.1.4. Statistical data on the students of the respective study programme, the dynamics of the number of the students, and the factors affecting the changes to the number of the students. The analysis shall be broken down into different study forms, types, and languages.**

At the moment of submission of the accreditation report, a total of 3 students are studying at DSP "Solid State Physics". 2 students are in the 2nd year of study and 1 student is in the 3rd year of study). During the period from 2017 to 2022, a total of 10 students were admitted to DSP "Solid State Physics", studying in Latvian. It doesn't seem like much, but it might be enough for a region in a country with around 1.9 million inhabitants. The dynamics of the number of students could be described as an unpredictable change of increase and decrease. The largest number of matriculated students was 4 in 2019, but no one applied for studies in 2022. There were no foreign students from 2017 - 2022. At the time of accreditation, 3 persons have expressed their desire to study. There are several reasons for this situation. There is a pronounced shortage of physics specialists (especially physics teachers) in Latvia, which is further aggravated by the demographic situation and, in fact, since the restoration of Latvia's independence, the long-term education reform, the theses of which changes with the each new minister of the Education and Science. Although priority is declared in the field of exact sciences, it is not fulfilled in reality.

All doctoral students have studied at the expense of the state budget, as well as received scholarships. Unfortunately, this does not provide a full-fledged means of livelihood for the doctoral student, and they are forced to work outside DU, especially if there is no income from the realization of research projects at the moment. This could also be the reason for the small number of students, because experimental physics requires daily work in research laboratories. By implementing the new doctoral model, the situation could significantly improve in terms of funding.

Evaluating the dropout rate of DSP "Solid State Physics" it can be concluded that 6 students stopped their studies during the reporting period, or 46% of the number of students who started their studies. The high number of student dropouts in doctoral study programs is an actual problem in Latvia as a whole. The most important reason for the large dropout of doctoral students is the current funding model, which does not cover the actual costs of implementing the doctoral program and thus threatens the sustainability of the doctoral program and does not stimulate the increase in quality. The low amount of income (stipend) of a doctoral student has a negative impact on both the time that the doctoral student can devote to studies, the quality of the doctoral work, as well as the number of doctors and, successively, the renewal of the academic staff and scientific workers of the higher education and science sector.

Statistical data on DSP "Solid State Physics" students during the reporting period are summarized in the annex to the report *3.1.4. (3.1.4.DSP Solid State Physics\_Statistical data on students)*.

**3.1.5. Substantiation of the development of the joint study programme and description and evaluation of the choice of partner universities, including information on the development and implementation of the joint study programme (if applicable).**

## 3.2. The Content of Studies and Implementation Thereof

**3.2.1. Analysis of the content of the study programme. Assessment of the interrelation between the information included in the study courses/ modules, the intended learning outcomes, the set aims and other indicators with the aims of the study course/ module and the aims and intended outcomes of the study programme. Assessment of the relevance of the content of the study courses/ modules and compliance with the needs of the relevant industry, labour market and with the trends in science on how and whether the content of the study courses/ modules is updated in line with the development trends of the relevant industry, labour market, and science.**

The content of DSP "Solid State Physics" is aimed at developing the necessary competencies in the field of physical sciences, familiarization with current scientific theories and findings, learning research methodologies. Content of study courses offered in the study program, achievable results, set goals, etc. indicators are interrelated with study program goals and achievable results (Schedule of the DSP "Solid State Physics" study program is shown in the annex 3.2.1 (3.2.1.DSP *Solid State Physics\_Study plan*). The content of study courses corresponds to the current affairs of the industry, as well as the needs of the labour market and science. It should be noted that there are just few production companies in Latvia that apply the latest scientific achievements in the world or in the EU, therefore the demand for scientists to comply with the requirements of the labour market is often exaggerated. This sometimes leads to the fact that the head of the company, who does not know the scientific terminology, has the right to dictate his down-to-earth requirements to the university program. If you look at the history of science, science has always been a step or two ahead of society's needs, otherwise it is not science. The set requirements regarding the publication of research results in internationally indexed scientific publications, as well as participation in international scientific conferences, develop students' abilities to independently perform critical analysis, synthesis and evaluation of scientific information, as well as to solve important research or innovation tasks.

The purpose of the study program: preparation of a highly qualified specialist - scientist in the field of physics, who is able to raise and solve the most important problems of modern physics and material science.

Achievable results of the study program:

The study results obtained in the study program (knowledge, skills and competence) must ensure the achievement of the goal of the study program, thereby contributing to the growth of the knowledge and innovation-based economy of the Republic of Latvia and, therefore, the well-being and sustainability of the Republic of Latvia.

Knowledge. The program students know and understand the most current scientific theories and findings in physics, manage modern research methodologies and modern research methods in various sub-fields of physics.

1. Are familiar with the most current scientific theories and methods in physics.

2. Are familiar with modern research methodology and modern physics research methods in various sub-fields.

Skills. In the course of learning the programme, students are able to independently evaluate and choose appropriate methods for scientific research, have made an investment in expanding the boundaries of knowledge or given a new understanding to existing knowledge and its applications in practice, by carrying out a significant amount of original research, some of which is at the level of internationally cited publications. Able to communicate both orally and in writing about his field of scientific activity with wider scientific circles and society in general. Able to independently improve his scientific qualifications, implement scientific projects, achieving achievements that meet the international criteria of the scientific field.

3. Able to independently evaluate and choose suitable scientific research methods, contribute to expanding the frontier of knowledge or provide a new understanding of existing knowledge and its application in practice, including by publishing scientific publications.
4. Able to communicate both orally and in writing about own scientific field to the wider community of scientists and society in general.
5. Able to independently improve own scientific skills, implement scientific projects, obtaining international science-qualifying achievements.

Competence. Students are able, by performing independent, critical analysis, synthesis and evaluation, to solve important research or innovation tasks, independently put forward a research idea, plan, structure and manage large-scale scientific projects, including in an international context.

6. Carrying out independent, critical analysis, synthesis and evaluation, are able to solve important research or innovation tasks.
7. Are competent to propose the research idea, plan and structure independently.
8. Are able to manage large-scale scientific projects, including in an international context.

Study program volume (CP): 120 CP

Duration of the study program implementation: 3 years

Volume of contact hours (%): 1 credit conforms to 40 academic hours, of which 8 hours are contact hours, which are 40% of the volume scheduled.

Granted degree and/or qualification to be obtained: Doctor of Science Degree Doctor of Science (Ph.D.) in Natural Sciences.

Taking into account the planned changes in the implementation of doctoral study programmes in Latvia, which will be implemented on the basis of the conceptual report "On the implementation of a new model of doctoral studies in Latvia" (supported on June 25, 2020 by Cabinet of Ministers Order No. 345), DSP "Solid State Physics" implemented by DU will also undergo a gradual transition to a new doctoral model. In 2020, DU developed the "PhD study programme development plan 2020-2026 for the implementation of the new doctoral model at Daugavpils University" (approved at the meeting of the DU Science Council on 22.10.2020 (minutes No. 11, decision No. 1/1)). The doctoral study programme development plan is a part of the overall research plan contained in the Development Strategy of Daugavpils University and is aimed at the implementation of the conception included in "Latvian Smart Specialization Strategy". The doctoral study programme development plan consists of two parts: 1) description of the current situation of DU, which includes a review of DU research capacity and doctoral studies, 2) description and appendices of the new doctoral model and its implementation strategies. In 2023, it is planned to develop the regulations of the DU Doctoral School, which will ensure the compliance of the DU Doctoral School with

European best practices and international standards, as well as provide conditions for cooperation with other Latvian and foreign scientific institutions and higher education institutions. In 2023/2024, DSP "Solid State Physics" 1st year students will start their studies at the Doctoral School of DU. The gradual transition to the new doctoral model at Daugavpils University is planned to be completed by the end of 2026.

DSP specializations are made up of a combination of research traditions and current scientific trends, which, as a result of the cooperation of teachers and researchers, turn into current study courses that dynamically follow the latest scientific trends. The doctoral study program "Solid State Physics" is a comprehensive doctoral program in physics, within the framework of which several specialized specializations are available:

- molecular and solid state physics,
- physics of materials,
- chemical physics,
- physics of semiconductors,
- material science,
- laser physics and spectroscopy,
- nanomaterials, intelligent materials and structures.

The study program gives students the opportunity to deepen their theoretical knowledge, gain experience in scientific work and the ability to conduct independent research in the subfields of physics, engineering and technology. Students mostly conduct interdisciplinary research, solving complicated problems, as well as develop new methods and technologies together with the scientific staff, acquire knowledge in the field of patenting.

Acquisition of the courses developed within the study programme, as well as participation in doctoral seminars, doctoral school and systematic cooperation with the doctoral research adviser contribute to broadening students' outlook and offer a competitive education in the field of physics; it meets the challenges of the future and is based on the emphasis on students' independent work, synergy of study and research work, preparing specialists who are competitive on the labor market, developing their abilities and motivating lifelong learning.

The DSP "Solid State Physics" study program plan is attached in the appendix (*3.2.1.DSP Solid State Physics Study Plan*, while the study program study course descriptions are attached in *3.2.1\_DSP Solid State Physics Study Course Descriptions*). The mapping of study courses for achieving the study results of the study program can be found in the appendix (*3.2.1.DSP Solid State Physics\_study course mapping*).

**3.2.2. In the case of master's and doctoral study programmes, specify and provide the justification as to whether the degrees are awarded in view of the developments and findings in the field of science or artistic creation. In the case of a doctoral study programme, provide a description of the main research roadmaps and the impact of the study programme on research and other education levels (if applicable).**

Students with a previously obtained corresponding academic Master's degree or corresponding professional higher education in the field of physical sciences after completing the study program obtain a doctor of science degree Doctor of Science (PhD) in natural sciences. The awarding of a science degree is based on the achievements and findings of the field of physical science, which is

confirmed by the content of the study programme. More detailed information, how the doctoral process is implemented and attention is paid to ensure that the doctoral thesis is developed in accordance with the requirements and that the awarding of the degree is based on the achievements and findings of the field of physical science, read in section 3.2.5.

DSP "Solid State Physics" scientists make a serious contribution to solving various problems of modern physics and economy, including the study of material properties, their application in optoelectronics, microelectronics and nanotechnologies, providing interdisciplinary solutions in various areas of society, including in energy and medical diagnostics.

DSP "Solid State Physics" scientists use their knowledge and creativity by participating in dialogue and working with community to achieve common goals. Based on the strengths of the study direction and the experience of the academic staff, it is possible to adapt or recreate evidence-based research that can address many problems of public importance. It is very important that the staff involved in the study direction provide an innovative study environment and professional experience for students at all levels, especially in the doctoral study programme. It should be noted that currently a great deal of emphasis in knowledge transfer is placed on the interaction of study work with research and student training based on scientific achievements. The interdisciplinary aspect of this aspect and the inclusion of students of different study programs (Biology, Chemistry, Environmental Science, Physiotherapy, Physics, Mathematics, etc.) and of different levels (Bachelor, Master, doctoral) in solving current problems of science and, therefore, society as a whole is essential. The study direction scientists from 2017-2022 engaged in the study direction ensure a study process that fully meets modern requirements, including the management of studies, bachelor's, Master's and doctoral theses. Students mostly conduct interdisciplinary research, solving complicated problems, as well as develop new methods and technologies together with the scientific staff, acquire knowledge in the field of patenting.

DU physicists are ready to make a serious contribution to the understanding of the interaction of physical and biological nanoobjects, as well as to the modification of material properties, providing interdisciplinary solutions to a number of energy, environmental, health, nano-safety and other problems. The research area includes fundamental work with nanostructured functional materials, their synthesis methods and their use in biosensors, photonics; modification and research of material properties - laser processing, industrial applications and technological solutions. The unique opportunity for the cooperation of scientists from several fields creates the potential for the development of interdisciplinary research, combining nanotechnology, physics, mathematics, environmental sciences and engineering and generating products for the modern economy.

With the appearance of more and more new products and solutions, there is currently a rapid development of nanotechnology, bio-nanotechnology, nanostructured materials research, which is promoted by the growth of the industry in this sector, which indicates a series of global, national and regional drivers for the development of this research field. At the global level, there is a very rapid increase in the proportion of nanotechnological and highly scientific technological solutions in industry (engineering, chemical production, medicine, energy, etc.), which also increases the development of scientific research and international project programs in this field. This field is also highlighted as a priority in Latvia's strategic documents - the field of smart specialization "Smart materials, technologies and engineering systems" is defined.

Undoubtedly, the industries of Latvia and the region are also interested in the technologies and solutions developed by DU. The metal processing industry is rapidly developing in Daugavpils (Ziegler mašīnbūve, Daugavpils Locomotive Repair Plant, Sanistal, Magistr, BM Industrial, Ditton drive chain plant, East Metal, Special welding, Daugavpils experimental plant, Arhis, etc.), in which laser processing technology is essential. Optical glass fibre manufacturers (Z-Light, Biolitec) are

interested in developing research on the possibilities of nano-sensors in glass fibres; several companies (GroGlass, Sidrabe, Axon Cable, etc.) are interested in using the experience and technological capabilities of DU scientists in researching and solving various issues and problems. It should also be mentioned that the structural units operating in the field (DU G. Liberts Innovative Microscopy Centre (IMC), Mathematical Research Centre (MPC) and Byelorussia-Latvia Scientific Innovative Centre in the Field of Strengthening Technologies (BLZICSTJ)) are highly rated in the international scientific evaluation.

DU has already developed a top-level infrastructure base that provides both an appropriate environment (clean rooms) and technological support (vacuum sputtering, electron, laser, atomic power, etc. microscopy, X-ray diffraction, high-power laser processing and robotic process control, etc.) for conducting top-level research. Thanks to the development of the infrastructure, a high-level scientific group of DSP "Physics" graduates and students has been formed at DU, which contributes to the development of world scientific thought, as evidenced by publications in internationally cited journals. Sustainable planning of research development, study and human resources development strategy will be an important factor in the growth of the number of students, including doctoral students, and personnel involved in science in the coming years. The above corresponds to the "Daugavpils University Development Strategy 2015-2020"<sup>[1]</sup>.

When determining the priority directions of research in the field of physics, DU has been guided by the following criteria: number of SCI (Web of Science & SCOPUS) publications, attracted funding, existence of research infrastructure, existence of a scientific group (number of PhDs, number of doctoral students), average citation index, activity in international scientific in networking, maintenance of international collections and databases, and perspectives in creating clusters with entrepreneurs.

<sup>[1]</sup> Development strategy of Daugavpils University 2015-2020. Available at: <https://du.lv/wp-content/uploads/2022/09/DU-Strategy-summary-1.pdf> [revised 28.02.2023]

**3.2.3. Assessment of the study programme including the study course/ module implementation methods by indicating what the methods are, and how they contribute to the achievement of the learning outcomes of the study courses and the aims of the study programme. In the case of a joint study programme, or in case the study programme is implemented in a foreign language or in the form of distance learning, describe in detail the methods used to deliver such a study programme. Provide an explanation of how the student-centred principles are taken into account in the implementation of the study process.**

The study work of doctoral students takes place using various forms of work organization, which allows to ensure the achievement of study results and promotes the organization of a student-centered study process, most often – group work classes, seminars, consultations, and individual work. The approval of the doctoral student's individual work plan is coordinated with the doctoral research adviser, but is not regulated outside the structural unit. During the implementation of DSP, doctoral students and after its implementation doctoral candidates conduct research on the topic of their doctoral thesis, publish the main research results in generally recognized peer-reviewed scientific publications, carry out science transfer activities, present research results in scientific seminars, symposia, conferences and congresses. This work is most often done in consultation with

the research adviser. The doctoral student's work is supervised by the research adviser and the structural unit in which the scientific work is developed. The program director also monitors the development and provision of the study process.

Taking into account the planned changes in the implementation of doctoral study programs in Latvia, which will be implemented based on the conceptual report "On the implementation of a new doctoral study model in Latvia" (supported on June 25, 2020 by Cabinet of Ministers Order No. 345), also in the doctoral study programs implemented by DU, i.e. see DSP "Solid State Physics" will undergo a gradual transition to a new doctoral model. The conceptual report envisages that every university should organize doctoral-level studies in centrally established structural units - doctoral schools. In 2023, it is planned to develop the regulations of the DU Doctoral School, which will ensure the compliance of the DU Doctoral School with European best practices and international standards, as well as provide conditions for cooperation with other Latvian and foreign scientific institutions and higher education institutions. 2023/2024 During the study year, DSP "Solid Physics" 1st year students will start their studies at the Doctoral School of DU.

When developing the curriculum of the DSP "Solid State Physics", the recommendations stated in the conceptual report "On the introduction of a new doctoral model in Latvia" were taken into account regarding the proportion of time devoted to research and study course acquisition. According to these recommendations, credit points in doctoral study programmes should be awarded for the time devoted to research, when the doctoral student elaborates a doctoral thesis and internationally recognized scientific publications (~ 70% of the time of full-time studies), and for the time devoted to study courses and mobility (~ 30%).

According to the developed study plan (see appendix 3.2.1. *DSP Solid State Physics\_Study\_plan*) in the new study courses of *Solid State Physics experimental methods* (4 CP) and *Nanostructured materials* (2 CP) provided by DSP "Solid State Physics", a significant part of the volume of both study courses could be realized within the framework of the Doctoral School of DU, incl. in doctoral schools organized by other Latvian and foreign universities, according to the specialization chosen by the students.

In the course of the study programme implementation, all basic principles of student-centered education are observed:

- constant reflection,
- individual approach to students, avoiding a 'one-size-fits-all' solution,
- it is taken into account that students have different learning styles, different requirements, interests, experience and previous knowledge,
- students' knowledge, skills and abilities are evaluated not only by the academic staff, but there should also be self-control over their studies,
- continuous cooperation between students and academic staff.

Basic principles and procedure of acquisition and assessment of the study programme: the following principles are applied in the acquisition and assessment of the study programme:

- the principle of openness;
- principle of obligation;
- the principle of assessment review options;
- the principle of diversity of the types of tests used.

At the same time, it should be taken into account that persons with a certain life experience, who are motivated towards a certain scientific goal, study in the doctoral program, so the formal requirements set after that should not bring the study process to the level of a general education school.

**3.2.4. If the study programme envisages an internship, describe the internship opportunities offered to students, provision and work organization, including whether the higher education institution/ college helps students to find an internship place. If the study programme is implemented in a foreign language, provide information on how internship opportunities are provided in a foreign language, including for foreign students. To provide analysis and evaluation of the connection of the tasks set for students during the internship included in the study programme with the learning outcomes of the study programme (if applicable).**

**3.2.5. Evaluation and description of the promotion opportunities and the promotion process provided to the students of the doctoral study programme (if applicable).**

The doctorate promotion process at Daugavpils University is implemented on the basis of the Act on Scientific Activity of the Republic of Latvia, the Act of Higher Education Institutions of the Republic of Latvia, as well as the Cabinet of Ministers decision of 27.12.2005. No. 1001 concerning the "Procedure and criteria for the awarding of a doctoral degree (promotion)"[1]. General procedure of founding promotion councils and procedure of promotion at Daugavpils University are regulated by "Regulations on Daugavpils University promotion councils"[2], while the procedure for the creation and promotion of the Physics and Astronomy Promotion Council is determined in the "Regulations of the Physics and Astronomy Promotion Council of Daugavpils University"[3].

The activity of the Physics and Astronomy Promotion Council is based on the accredited doctoral study program "Solid State Physics". According to the regulations of the Physics and Astronomy Doctoral Council of DU (Physics and Astronomy PP), the Physics and Astronomy PP the permanent composition of the Doctoral Council includes at least five scientists holding Latvia Council of Science (LCS) expert rights in the field of solid state physics and in sub-sectors thematically close to it. The PP of Physics and Astronomy must consist of at least two scientists in the sub-field of physical science in which the doctoral thesis is defended. The composition of the current PP of Physics and Astronomy has been approved on 25.07.2022 with DU rector's order No.4-4/PP/2022/1, it includes 6 experts[4].

Before the submission the developed doctoral thesis to the Department of Sciences of DU, it is reviewed at a meeting of the Technology Department of the Institute of Life Sciences and Technologies (DZTI) of DU. If after revision of the thesis it is decided, that the doctoral thesis has been elaborated in accordance with the requirements, it is submitted to the Department of Sciences of DU, which delegates the responsibility for examining the doctoral thesis to the promotion council of the relevant branch of science. Within a month after receiving the doctoral thesis, the promotion council decides on the promotion of the thesis for public defense and the appointment of three reviewers. In case of a positive decision of the State Scientific Qualification Commission (SSQC), the reviewers are involved in the work of the promotion council formed by the university and approved by the rector's order for the defence of the particular doctoral thesis.

When announcing the defense of the doctoral thesis, the information (including the summary of the doctoral thesis) is placed on DU website, where all interested parties can familiarize themselves with it (see here[5]).

For each specific defense of a doctoral thesis, upon the suggestion of the head of the Promotion Council in Physics and astronomy and the proposal of the vice-rector of science, the rector of DU can issue an order to add to the Promotion Council in Physics and astronomy other scientists who hold LCS expert rights in the relevant sub-branch of physical science. After hearing the reports of the doctoral candidate and the reviewers, as well as after the scientific discussion, the Promotion Council makes a decision on awarding or refusing the degree by a majority of votes in an open meeting.

The work of the Promotion Council is provided by the Department of Science of DU. The costs of the promotion process for graduates of DU doctoral study programmes are covered from the funds intended for the implementation of the doctoral study programme, if the applicant obtains a doctoral degree within two full calendar years after completing the theoretical studies. If the applicant for a doctoral degree has not completed the appropriate doctoral study programme at DU or completed it more than two full calendar years before without obtaining a degree, the decision concerning the funds to cover the costs of the promotion process shall be taken by the DU Council of Science.

The list of doctoral theses defended by the Faculty of Physics and Astronomy of DU for the period 2017-2022 see in the annex (3.2.5.DSP Solid State Physics\_*List of defended doctoral theses*).

[1] Cabinet of Ministers decision of 27.12.2005. No. 1001 concerning the “Procedure and criteria for the awarding of a doctoral degree (promotion)” (in Latvian). Available in Latvian: <https://likumi.lv/ta/id/124787-zinatniska-doktora-gradapieskirsanas-promocijas-kartiba-un-kriteriji> [viewed 28.02.2023]

[2] Regulations on Daugavpils University promotion councils (in Latvian). Available in Latvian: <https://du.lv/wp-content/uploads/2021/05/Nolikums-par-DU-Promocijas-padomem-1.pdf> [viewed 28.02.2023]

[3] Regulations of the Daugavpils University Physics and Astronomy Promotion Council. Available in Latvian: [https://du.lv/wp-content/uploads/2022/11/Fizikas\\_astronomijas\\_PP\\_Nolikums\\_apst.pdf](https://du.lv/wp-content/uploads/2022/11/Fizikas_astronomijas_PP_Nolikums_apst.pdf) [revised 22.06.2023]

[4] Composition of the Physics and Astronomy Promotion Council. Available in Latvian: <https://du.lv/zinatne/promocija/promocijas-padomes/fizikas-un-astronomijas-promocijas-padome/> [revised 22.06.2023]

[5] Information about the defense of the doctoral thesis on the DU website. Available in Latvian: <https://du.lv/promocijas-darbi/pazinojums-par-promocijas-darba-aizstavesanu-janis-snikeris/> [viewed 28.02.2023]

### **3.2.6. Analysis and assessment of the topics of the final theses of the students, their relevance in the respective field, including the labour market, and the marks of the final theses.**

Students choose the topics of doctoral theses in consultation with their research advisers and the director of the study programme. The director of the study programme evaluates the relevance of the scientific experience of the thesis adviser to the scientific specificity of the topic chosen for the doctoral thesis. It is quite often practiced that research advisers or consultants from others or

foreign scientific institutions who have relevant scientific experience in the chosen topic of the doctoral thesis are invited for elaboration of the doctoral thesis. The supervisor provides necessary consultations to the doctoral student both with DU and with specialists from other universities.

In order to ensure the quality of doctoral theses, the choice of reviewers of the appropriate field is also of great importance in the process of defending the doctoral thesis. According to the regulations of the PP of Physics and Astronomy of DU after submitting the work to the promotional council, the chair of the council appoints 3 reviewers for the work, 1 of whom is an expert of this council in the relevant sub-branch of science, and 2 are sub-branch experts from other scientific institutions or organizations (preferably outside Latvia).

More detailed information about the promotion process at DU Promotion Council in Physics and astronomy see in section 3.2.5.

Until now, all doctoral theses developed within the framework of DU DSP "Solid State Physics" have been defended at the DU Promotion Council in Physics and astronomy. In the period from 2017 to 2022, A total of 6 doctoral theses have been defended in the Physics and Astronomy Promotional Council of DU. The topics of the doctoral theses defended during the reporting period correspond to the actualities of modern physics and related natural sciences (intermediate sciences). The topics of the theses are varied, the defended doctoral theses have both applied and theoretical significance. The possibilities of applying research results are also determined by cooperation with entrepreneurs. See the list of topics of the defended doctoral theses, supervisors, consultants and reviewers for the period from 2017 to 2022 in the annex (*3.2.5.DSP Solid State Physics\_List of defended doctoral theses*).

In total, 5 out of 6 persons who defended doctoral theses during the reporting period are currently working in various scientific or higher education institutions in Latvia. (see the annex *3.1.3.Employment and scientific indicators DSP Mathematics and DSP Solid State Physics*, which confirms the appropriate educational quality of DSP "Solid State Physics". The new doctors of physical sciences prepared by DU are sought-after specialists since DSP "Solid Physics" has been operating at DU and make a significant contribution to the development of the national economy.

### **3.3. Resources and Provision of the Study Programme**

#### **3.3.1. Assessment of the compliance of the resources and provision (study provision, scientific support (if applicable), informative provision (including libraries), material and technical provision, and financial provision) with the conditions for the implementation of the study programme and the learning outcomes to be achieved by providing the respective examples.**

DU has established an effective research infrastructure that provides an appropriate environment for research and the study process. To ensure the study process and conduct scientific research, doctoral students have access to more than 20 specialized offices and teaching or scientific research laboratories at the Institute of Life Sciences and Technologies (DZTI). Clean rooms with an appropriate microclimate and modern equipped laboratories at DZTI allow to perform interdisciplinary research, develop technologies for the needs of industry and society (X-ray diffractometry, mass spectrography, digital holography, electron, laser, atomic force, etc.

microscopy, genetic material analysis kits, etc.). Although mostly doctoral students of DSP "Solid State Physics" work in the Technology Department of DZTI, they have access to scientific equipment in other laboratories of DZTI structural units within the framework of interdisciplinary natural science research. The most important equipment available in scientific and teaching laboratories is shown in the annex (*2.3.2.Infrastructure and material technical provision\_EN*).

The students of the DSP "Solid State Physics" have access to all services offered by the DU Library - the library's electronic catalogue, ordering, reserving and renewing books on the Internet, automated user service, as well as access to electronic databases subscribed to DU, incl. Web of Science, Scopus, Science Direct, etc.

The collection of the library at the beginning of 2023 is 259916 items, incl. books - 243318, periodicals - 16598. Number of books in the field of physical science - 6616, incl. 171 in English, which is 3% of the books in the field of physical science. Electronic databases mostly contain materials in English. Access to the following electronic databases is provided in the DU network:

- EBSCO Publishing (it includes 8 databases: Academic Search Elite, Business Source Premier, MasterFILE Premier, Newspaper Source, ERIC, Business Wire News, MEDLINE, Health Source - Consumer Edition, Agrikola); about 10,000 scientific journals in several branches of science (including physics) are available in English.
- Cambridge Journals online. 100 scientific journals in several branches of science (including physics) are available in English.
- Science Direct: Multidisciplinary database from which full texts of about 380 journal titles are available. (English).
- Web of Science - Multidisciplinary database that offers extensive search, selection and results analysis options (including in the field of physics) in English.
- Scopus - bibliographic and citation information database of multidisciplinary scientific publications (including in the fields of physics) in English and German.
- Springer Link ([www.springerlink.com](http://www.springerlink.com)), etc.

Students are also provided with the opportunity to use the specialized scientific literature available in the scientific laboratories of DU DZTI. You can read more about the information base in the section 2.3.3.

### **3.3.2. Assessment of the study provision and scientific base support, including the resources provided within the framework of cooperation with other science institutes and higher education institutions (applicable to doctoral study programmes) (if applicable).**

Students of DU DSP "Solid State Physics" are offered a wide study and scientific base with all the resources necessary to ensure a successful study and scientific process for learning the study programme and developing doctoral theses. For students who need specific scientific equipment or analyzes for the development of their doctoral theses, solutions are sought in agreement with other scientific institutions as far as possible. DU physicists have several decades of cooperation with the Institute of Solid State Physics of the University of Latvia, both at the level of institutions and personal contacts. Physicists of the University of Latvia often use the existing equipment of DZTI. In the previous reporting period, some students of DSP "Solid State Physics" were provided with access to specific scientific equipment at the Institute of Solid State Physics of the University of Latvia.

Since 2022, DU has been admitted to the Baltic group of the European Organization for Nuclear Research (CERN)[1]. Although the study programs included in the field of study are not directly related to the research carried out by CERN, participation in CERN opens wide opportunities for the research staff and students of the field of life sciences to get involved in interdisciplinary research carried out by CERN.

One of the examples of international cooperation was the Byelorussian-Latvian scientific and innovative centre in the field of strengthening technologies (DU, Parādes Street 1a), which was created by combining the ideas of Daugavpils entrepreneurs, DU and Byelorussian National Technical University scientists on the development of industrial technologies in the region. The centre has implemented several projects both in cooperation with Byelorussian and Lithuanian colleagues, gradually improving the material base and personnel. The main research topics: *Industrial material processing methods* and *Industrial equipment and robot programming*. Unfortunately for Byelorussia, becoming an ally of Russia in the war against Ukraine, the cooperation with the neighbouring country was officially stopped, but the cooperation with local businessmen remains and continues to develop. The Latgale Entrepreneurship Centre (LUC) and the Innovative Entrepreneurship Support Centre "Latgale", whose board also includes a representative of DU DSP "Solid State Physics", help to maintain contacts.

[1] Baltic Group of the European Organization for Nuclear Research (CERN). Available: <https://indico.cern.ch/category/10023/> [viewed 28.02.2023]

**3.3.3. Indicate data on the available funding for the corresponding study programme, its funding sources and their use for the development of the study programme. Provide information on the costs per one student within this study programme, indicating the items included in the cost calculation and the percentage distribution of funding between the specified items. The minimum number of students in the study programme in order to ensure the profitability of the study programme (indicating separately the information on each language, type and form of the study programme implementation).**

DSP "Solid state Physics" funding source is the state budget funding for studies (grant) and tuition fees. In addition to the development of the program, funding is attracted from Latvian and European projects and science-based funding, the amount of which depends on scientific performance. The tuition fee for DSP "Mathematics" is set at 2,200 EUR per year of study or 6,600 EUR for three academic years.

The calculation of costs for one student in the study field programs is performed in the DU Finance and Accounting Department, including the salary fund and the employer's State Social Insurance Mandatory Contributions, business trip, material, energy and inventory costs, purchase of books, equipment and investment costs, as well as social security costs for students. Calculation of costs per student of DSP "Solid state Physics" (full-time studies, 3 years, 120 CP) and information on the percentage distribution of funding, see in the table 3.3.3.1.

Daugavpils University does not have a minimum number of students for doctoral study programs.

*Table 3.3.3.1. Calculation of costs for one student in DSP "Solid state Physics"*

## 3.4. Teaching Staff

**3.4.1. Assessment of the compliance of the qualification of the teaching staff members (academic staff members, visiting professors, visiting associate professors, visiting docents, visiting lecturers, and visiting assistants) involved in the implementation of the study programme with the conditions for the implementation of the study programme and the provisions set out in the respective regulatory enactments. Provide information on how the qualification of the teaching staff members contributes to the achievement of the learning outcomes.**

The qualifications of the teaching staff involved in the DSP "Solid State Physics" generally meet the conditions of program implementation, the content of the program and the requirements of regulatory acts. The academic staff employed in the implementation of the study program has adequate knowledge of the national language and English (German).

It should be noted that teaching staff improve and raise their qualifications not only during the reference period, but throughout their working life, as evidenced by their CVs, see the annex 2.3.7. CV.

At the time of the preparation of the accreditation report, a total of 10 lecturers are involved in the implementation of DSP "Solid State Physics" (see table 3.4.1.1), of which the place of primary election is DU.

*Table 3.4.1.1. Academic staff involved in DSP "Solid state Physics"*

<b>Position</b>	<b>Number</b>	<b>% from total</b>	<b>Elected at DU</b>	<b>Visiting lecturer</b>
<i>Professor</i>	2	20	1	1
<i>Leading researcher</i>	4	40	4	
<i>Researcher</i>	4	40	4	
<b>Total</b>	<b>10</b>	<b>100</b>	<b>9</b>	<b>1</b>

The six teaching staff involved in the implementation of the study program are LZP experts in the field of physics. The list of experts, the branch of science they represent and the expiration date of the expert's rights are given in table 3.4.1.2.

*Table 3.4.1.2. List of LZP experts*

<b>No.</b>	<b>Name</b>	<b>Surname</b>	<b>Field of science</b>	<b>Expiry date of the LZP Expert's rights</b>
1	Vjačeslavs	Gerbreders	Physics and astronomy	31.03.2024

2	Ēriks	Sļedevskis	Physics and astronomy	02.06.2024
3	Andrejs	Bulanovs	Physics and astronomy	01.09.2024
4	Irēna	Mihailova	Physics and astronomy	02.06.2024
5	Marina	Krasovska	Physics and astronomy	04.05.2025
6	Jānis	Sņiķeris	Physics and astronomy	01.03.2026.

According to the collected data, DU teaching staff purposefully and regularly engage in various professional development activities in the fields corresponding to their scientific interests, both at DU and at foreign universities. In addition to the academic work at the university, the teaching staff has practical experience in the implementation of industry-related projects and contract work. This type of activity contributes to a comprehensive understanding of the specifics of the branch, thus ensuring a direct unity of theory and practice during the study process.

The directions of the research work of the academic staff involved in the study programme are focused on the successful implementation of the study programme and in most cases are related to the teacher's specialization within the programme. Academic staff members prepare scientific articles published also in internationally peer-reviewed journals, participate in conferences and practical seminars, training, internships and various scientific events, publish textbooks and develop methodological materials, participate in international and national research projects. The list with the experience of the academic staff involved in the implementation of DSP "Solid State Physics" in the implementation of industry projects is attached in the annex (3.4.4.DSP\_Solid State Physics\_projects).

The most important publications of the teaching staff involved in the implementation of DSP "Solid state Physics" are attached in the annex 2.4.4. *List of scientific publications for the direction\_EN*.

### **3.4.2. Analysis and assessment of the changes to the composition of the teaching staff over the reporting period and their impact on the study quality.**

Since the previous accreditation of the study field, there have been minor changes in the provision of compulsory study courses and specialized elective courses. One of the leading teaching staff, prof. Edmunds Tamanis, has terminated his working relationship with DU. Unfortunately, this temporarily affected the quality of the studies, because, for example, it is not easy to find a lecturer with equal qualifications for teaching the "X-ray Structural Analysis" and "Modern Microscopy" courses. Graduates of DSP "Solid State Physics" were invited. At the time of preparation of the report, the realization of DSP "Solid State Physics" is provided by a total of 10 teaching staff.

### **3.4.3. Information on the number of the scientific publications of the academic staff members, involved in the implementation of doctoral study programme, as published during the reporting period by listing the most significant publications published in Scopus or WoS CC indexed journals. As for the social sciences, humanitarian sciences, and the science of art, the scientific publications published in ERIH+ indexed journals or peer-reviewed monographs may be additionally specified. Information on the teaching staff**

**included in the database of experts of the Latvian Council of Science in the relevant field of science (total number, name of the lecturer, field of science in which the teaching staff has the status of an expert and expiration date of the Latvian Council of Science expert) (if applicable).**

The academic staff involved in the implementation of DSP "Solid State Physics" in the period from 2017-2022 have published a total of 17 scientific articles in publications included in international databases. During the reporting period, the teaching staff involved in DSP "Solid State Physics" published the results of their scientific research in publications such as Beilstein Journal of nanotechnology, Sensing and Bio-Sensing Research, Thin solid films, CrystEngComm, Surfaces and Interfaces, Environment technology, Journal of Nanomaterials, Technical Physics Letters, Journal of Micro/Nanopatterning, Materials, and Metrology. Eight of the scientific articles developed by the teaching staff of DSP "Solid State Physics" have been published in cooperation with the students of DSP "Solid State Physics".

The most important publications of the teaching staff involved in the realization of DSP "Solid State Physics" are added in the annex *2.4.4. List of scientific publications for the direction\_EN*. Six out of 10 teaching staff involved in the implementation of the study program are LZP experts.

**3.4.4. Information on the participation of the academic staff, involved in the implementation of the doctoral study programme, in scientific projects as project managers or prime contractors/ subproject managers/ leading researchers by specifying the name of the relevant project, as well as the source and the amount of the funding. Provide information on the reporting period (if applicable).**

The scientists involved in the implementation of DU field of studies "Physics, Materials Science, Mathematics and Statistics", including, DSP "Solid State Physics" actively cooperate in joint research projects, as well as use the infrastructure offered by the cooperation institution to conduct specific research. The scientists of DSP "Solid State Physics" have entered the international scene and, together with scientists from other countries, participate in the development of world science. During the reporting period, teaching staff involved in the implementation of DSP "Solid State Physics" have participated in the implementation of 8 scientific projects for a total amount of € 7'731'136.82.

Information on the involvement of academic staff, which is involved in the implementation of DSP "Solid State Physics", in research projects in the period from 2017 to 2022 can be found in the annex *3.4.4.DSP\_Solid State Physics\_projects*).

**3.4.5. Assessment of the cooperation between the teaching staff members by specifying the mechanisms used to promote the cooperation and ensure the interrelation between the study programme and study courses/ modules. Specify also the proportion of the number of the students and the teaching staff within the study programme (at the moment of the submission of the Self-Assessment Report).**

All study courses have been developed and further organized in the study program, taking into account the topics necessary in both theory and practice. Study courses are developed in cooperation with all teaching staff of the respective course. The teaching staff regularly cooperates with the program director - current issues are discussed, and lecturers are provided with consultative support in various aspects of the implementation of study courses, ensuring a uniform approach to the study process.

The teaching staff has close mutual cooperation, which is promoted in various aspects - for example, in the implementation of a joint study course; regular meetings - seminars, deciding on activities related to the organization and management of the learning process; considering questions about the content of studies; in the development of joint publications and studies; in the planning of scientific events.

In the regular meetings of the lecturers, the content and structure of the courses are discussed, how to maintain the basic principle of creating the courses of the developed program - systematicity, how to improve the organizational forms of the learning process in order to promote the growth of students. Such discussions take place both collectively and individually. At the end of the semester, the results of student and program graduate surveys are discussed with lecturers and/or heads of departments in order to outline possible measures for improving the teaching of the program content and study courses.

Within the doctoral study programme, the need for cooperation among the academic staff is primarily determined by joint research and scientific cooperation. However, when creating a study programme, the needs of students come to the fore, while the interests of the academic staff are secondary. In the optimal variant, it is possible to harmonize the needs, interests and opportunities of all involved parties, as was observed in the implementation of DU DSP "Solid State Physics" during the reporting period. During the reporting period, several joint scientific research projects were implemented, involving more than 50% of all DSP "Solid State Physics" teaching staff and several doctoral students, for example:

- ERDF project "*Creation of an analytical molecular identification device based on metal oxide nanostructures for the detection of biomolecules*" (Agreement No. 1.1.1.1/16/A/001). (implementation period: 2017-2020; involved - E. Tamanis, V. Gerbreders, E. Sļēdevskis, I. Mihailova, M. Krasovska, A. Ogurtsovs, J. Sņķeris)
- DU internal research project: No. 14-95/2020/20. "*Development of a gas sensor based on cobalt oxide nanostructures*".(2020)
- DU internal research project: no. 14-95/2021/11 "*Development of an electrochemical sensor for the detection of oxidant concentrations that exceed the physiological norms of healthy cell structure activity*" (2021).

With the involvement of DSP "Solid Physics" teaching staff and doctoral students, joint scientific research was carried out, scientific publications were developed. The most important publications of the teaching staff involved in the realization of DSP "Solid State Physics" are added in the appendix 2.4.4. *List of scientific publications for the field*. The obtained research results are used in the teaching of study courses.

Taking into account the planned changes in the implementation of doctoral study programmes in Latvia, which will be implemented on the basis of the conceptual report "On the implementation of a new doctoral study model in Latvia" (supported on June 25, 2020 by Cabinet of Ministers Order No. 345), also the doctoral study programmes implemented by DU, incl. DSP "Solid State Physics", will undergo a gradual transition to the new doctoral model, which will allow students within the

framework of the Doctoral School of DU to offer wider research and study opportunities.

In academic year 2022/2023 a total of 10 teaching staff are involved in the implementation of the doctoral study program. At the moment of submission of the accreditation report, a total of 3 students are studying at DSP " Solid state Physics". There are 2 doctoral students who have taken a study break and are not currently on the student list.

# Annexes

III - Description of the Study Programme - 3.1. Indicators Describing the Study Programme		
Sample of the diploma and its supplement to be issued for completing the study programme	3.1.2.DSP Solid State Physics_Diploma and transcript.zip	3.1.2.DSP Cietvielu_fizika_diploms un akadēmiskā izziņa.docx
For academic study programmes - Opinion of the Council of Higher Education in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions (if applicable)		
Compliance of the joint study programme with the provisions of the Law on Higher Education Institutions (table) (if applicable)		
Statistics on the students in the reporting period	3.1.4.DSP Solid State Physics_Statistical data on students.xlsx	3.1.4.DSP Cietvielu fizika_Statistikas_dati_par_studejosajiem.xlsx
III - Description of the Study Programme - 3.2. The Content of Studies and Implementation Thereof		
Compliance with the study programme with the State Education Standard		
Compliance of the qualification to be acquired upon completion of the study programme with the professional standard or the requirements for professional qualification (if applicable)		
Compliance of the study programme with the specific regulatory framework applicable to the relevant field (if applicable)	3.2.1.DSP Solid State Physics_Comparison to MC regulations No 1001.docx	3.2.1.DSP Cietvielu fizika_Salīdzinājums ar MK noteikumiem Nr 1001.docx
Mapping of the study courses/ modules for the achievement of the learning outcomes of the study programme	3.2.1.DSP_Solid State Physics_mapping.docx	3.2.1.DSP_Cietvielu_fizika_kartejums.docx
The curriculum of the study programme (for each type and form of the implementation of the study programme)	3.2.1.DSP Solid State Physics_Study plan.xls	3.2.1. DSP Cietvielu fizika_Studiju plans.xls
Descriptions of the study courses/ modules	3.2.1.DSP Solid State Physics_Course descriptions.zip	3.2.1.DSP Cietvielu fizika_Kursu apraksti.zip
Description of the organisation of the internship of the students (if applicable)		
III - Description of the Study Programme - 3.4. Teaching Staff		
Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable)	3.4.1.STATEMENT of experts_DSP_Solid state physics_EN.docx	Apliecinājums par LZP ekspertiem DSP Cietvielu fizika.edoc
Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable)		

# Physics (45443)

Study field	<i>Physics, Material Science, Mathematics, and Statistics</i>
ProcedureStudyProgram.Name	<i>Physics</i>
Education classification code	<i>45443</i>
Type of the study programme	<i>Academic master study programme</i>
Name of the study programme director	<i>Valdis</i>
Surname of the study programme director	<i>Mizers</i>
E-mail of the study programme director	<i>valdis.mizers@du.lv</i>
Title of the study programme director	<i>Mg.phys., elektronisko iekārtu inženieris</i>
Phone of the study programme director	<i>+371 27626702</i>
Goal of the study programme	<i>To prepare highly qualified and internationally competitive Master's level physics specialists for the labour market by providing the opportunity to specialise during studies in physics sub-disciplines specific to Latvia with high research and innovation potential and by stimulating the acquisition of interdisciplinary competences.</i>
Tasks of the study programme	<ul style="list-style-type: none"> <li><i>• To promote the development of students as professionals in the field by providing the opportunity to complement the knowledge and skills acquired in the BSc programme in their chosen specialisation in physics.</i></li> <li><i>• To give students the opportunity to gain experience in independent research under the guidance of a supervisor.</i></li> <li><i>• To enhance students' scientific research skills and competence in analysing research problems.</i></li> <li><i>• To develop students' critical and creative thinking, reasoning and decision-making skills, and the ability to apply acquired knowledge and competences in physics and interdisciplinary research.</i></li> <li><i>• To ensure flexibility of the restricted elective part of the study programme in line with labour market requirements.</i></li> <li><i>• To ensure effective and monitorable delivery of the planned programme outcomes.</i></li> <li><i>• Create prerequisites for graduates' successful doctoral studies.</i></li> </ul>

Results of the study programme	<p><i>Achievable results of the study program (contains the descriptors of the European Master of Physics specifications, which are explained later in this chapter):</i></p> <p><i>Knowledge:</i></p> <ol style="list-style-type: none"> <li><i>1. Demonstrates advanced or extended knowledge in selected areas of physics, as appropriate to the chosen specialisation within the MSPP (e.g. atomic, molecular and optical physics, physics of solids and materials, physics of continuous media, physics of technology, theoretical physics, etc).</i></li> <li><i>2. Demonstrate interdisciplinary knowledge that complements knowledge in physics sub-disciplines such as biophotonics, medical physics, physics of nanostructures, chemical physics, atmospheric and/or environmental physics and other interdisciplinary fields.</i></li> </ol> <p><i>Skills:</i></p> <ol style="list-style-type: none"> <li><i>1. Uses mathematical description for explaining and analysing physical processes, formulating physical problems, choosing adequate approximation and solution methodologies;</i></li> <li><i>2. Plans and carries out experiments or calculations in one of the fields of physics, obtains data independently, evaluates errors in measurements and calculations;</i></li> <li><i>3. Analyses results by comparing them with theoretical models, numerical simulations and available experimental data.</i></li> </ol> <p><i>Competences:</i></p> <ol style="list-style-type: none"> <li><i>1. At a qualitative level, be aware of current developments in physics and demonstrate an understanding of the highest standards of physical science in their field of specialisation; summarise research results in the form of a scientific publication (e.g. a Master's thesis) based on knowledge of the current state of at least one sub-field of physics and be able to integrate knowledge from different fields as appropriate;</i></li> <li><i>2. Sees essential details on the subject, manipulate precise and complex ideas, use logical arguments and correct terms in communication on the subject of physics with professionals and non-specialists;</i></li> <li><i>3. By conducting independent research with a high degree of autonomy within the framework of the master's thesis, demonstrates competence in information gathering and analysis, obtaining information from journal articles, databases and communications with colleagues, sorting it according to relevance;</i></li> <li><i>4. Is aware that falsification and plagiarism of data are contrary to academic integrity, is objective and honest in his/her actions, recognises the limits of his/her knowledge, understands and is aware of the ethical responsibility for the potential impact of the results of his/her actions on the environment and society.</i></li> </ol>
Final examination upon the completion of the study programme	Master's thesis

# Study programme forms

## Full time studies - 2 years - latvian

Study type and form	<i>Full time studies</i>
Duration in full years	2
Duration in month	0
Language	<i>latvian</i>
Amount (CP)	80
Admission requirements (in English)	<i>- First-cycle higher education (bachelor's degree or second-level professional higher education or equivalent higher education) in physics or mathematics; - or first-cycle higher education (bachelor's degree or second-level professional higher education, or equivalent higher education) in natural sciences or engineering sciences and technologies and successfully completed study courses in the field of physics (not less than 5 credit points) and study courses in the field of mathematics (not less than 4 credit points).</i>
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	<i>Master's degree of Natural Sciences in Physics</i>
Qualification to be obtained (in english)	-

## Places of implementation

Place name	City	Address
Daugavpils University	DAUGAVPILS	VIENĪBAS IELA 13, DAUGAVPILS, LV-5401

## Full time studies - 2 years - english

Study type and form	<i>Full time studies</i>
Duration in full years	2
Duration in month	0
Language	<i>english</i>
Amount (CP)	80
Admission requirements (in English)	<i>- First-cycle higher education (bachelor's degree or second-level professional higher education or equivalent higher education) in physics or mathematics; - or first-cycle higher education (bachelor's degree or second-level professional higher education, or equivalent higher education) in natural sciences or engineering sciences and technologies and successfully completed study courses in the field of physics (not less than 5 credit points) and study courses in the field of mathematics (not less than 4 credit points). For foreign applicants, knowledge of the English language at least at B2 level.</i>
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	<i>Master's degree of Natural Sciences in Physics</i>
Qualification to be obtained (in english)	-

## Places of implementation

<b>Place name</b>	<b>City</b>	<b>Address</b>
Daugavpils University	DAUGAVPILS	VIENĪBAS IELA 13, DAUGAVPILS, LV-5401

## 3.1. Indicators Describing the Study Programme

**3.1.1. Description and analysis of changes in the parameters of the study programme made since the issuance of the previous accreditation form of the study field or issuance of the study programme license, if the study programme is not included on the accreditation form of the study field, including changes planned within the evaluation procedure of the study field evaluation procedure.**

Joint academic master's study program "Physics" (joint University of Latvia and Daugavpils University) licensed on 27.10.2021 (license number 2021/07K). Since the study programme license was issued, no changes have been made to the parameters of the study programme. Changes are not planned within the evaluation procedure of the study direction either.

**3.1.2. Analysis and assessment of the study programme compliance with the study field. Analysis of the interrelation between the code of the study programme, the degree, professional qualification/professional qualification requirements or the degree and professional qualification to be acquired, the aims, objectives, learning outcomes, and the admission requirements. Description of the duration and scope of the implementation of the study programme (including different options of the study programme implementation) and evaluation of its usefulness.**

The joint Master's study programme "Physics" (hereinafter referred to as MSPF) of LU and DU is designed as a competitive programme in the Baltic region, based on local world-class research, making maximum use of the expertise, teaching staff and researchers of both universities, cooperating with research institutes in Latvia, as well as high-tech companies in the implementation of the study programme.

AMSP is created in accordance with the requirements of the Act on HEI of Latvia "[Regulations on the national standard of academic education \(13.05.2014. regulations No. 240 - available in Latvian\)](#)". It correspond to the level 7 knowledge, skills and competence of the European qualification framework determined in the Latvian education classification.

**Aim of the programme** - is to prepare highly qualified and internationally competitive Master's level physics specialists for the labour market by providing the opportunity to specialise during studies in physics sub-disciplines specific to Latvia with high research and innovation potential and by stimulating the acquisition of interdisciplinary competences.

### **Tasks of the study programme**

The following tasks are subordinate to the achievement of the aim of the study programme:

- To promote the development of students as professionals in the field by providing the opportunity to complement the knowledge and skills acquired in the BSc programme in their chosen specialisation in physics.

- To give students the opportunity to gain experience in independent research under the guidance of a supervisor.
- To enhance students' scientific research skills and competence in analysing research problems.
- To develop students' critical and creative thinking, reasoning and decision-making skills, and the ability to apply acquired knowledge and competences in physics and interdisciplinary research.
- To ensure flexibility of the restricted elective part of the study programme in line with labour market requirements.
- To ensure effective and monitorable delivery of the planned programme outcomes.
- Create prerequisites for graduates' successful doctoral studies.

Programme code 45443 reflects the status and content of the programme, in accordance with the requirements set out in the "Regulations on Latvian Education Classification" (MK 13.06.2017. Regulations No. 322). The first digits of the code 45 denote academic education (master degree), which can be implemented after bachelor or professional bachelor degree. The second part of the code corresponds to the thematic field of education (44 - Physical sciences) and the group of educational programmes (443 - Physics).

Admission of students to the joint academic Master's study programme "Physics" (hereinafter referred to as MSPP) of LU and DU takes place in accordance with the Agreement on the Implementation of the Joint Academic Master's Study Programme "Physics" concluded by the two universities. According to this Agreement, before each academic year the two universities mutually agree on the language of MSPP implementation (Latvian and/or English) and the number of students to be enrolled for the following academic year. The number of budget places at each university is determined according to the funding allocated to each university by the Ministry of Education and Science. Admission of students is carried out independently by the admissions committee of each university. Admission shall be by means of a single competition for places financed by the State budget and by natural and legal persons, in accordance with the procedure laid down by each party. Each university shall independently matriculate the enrolled students and shall conclude a Study Agreement with the student, which shall define his/her rights and obligations and consent to the processing of the student's personal data for the purposes of organising the study process.

On the basis of a proposal from the Director of the Study Programme of each party and in accordance with the procedures established by each university, a competition committee of 3 members from each party shall be established and the chairperson of the competition committee of each university shall be appointed in order to assess the educational eligibility of applicants for admission in situations where such an assessment is necessary.

Enrollment in the study programme takes place in accordance with the "Daugavpils University admission rules for full-time and part-time higher level studies"[\[1\]](#).

Admission requirements:

- First-cycle higher education (bachelor's degree or second-level professional higher education or equivalent higher education) in physics or mathematics;
- or first-cycle higher education (bachelor's degree or second-level professional higher education, or equivalent higher education) in natural sciences or engineering sciences and technologies and successfully completed study courses in the field of physics (not less than 5 credit points) and study courses in the field of mathematics (not less than 4 credit points).
- For foreign applicants, knowledge of the English language at least at B2 level.

Participates in the competition with the average grade of the final/national exams.

The name of AMSP, the degree to be obtained, aims and objectives, student admission requirements are interconnected. Implementation of the program is planned within two years, graduates obtain Master's degree of Natural Sciences in Physics with an in-depth specialization in one of the sub-programmes, DU offers specialization in "Physics of Technology".

On the study programme acquisition diploma and its appendix sample in accordance with the Cabinet of Ministers regulations of 16.04.2013. No. 202 "The procedure for issuing documents certifying higher education recognized by the state" as well as agreement on studies sample in accordance with the Cabinet of Ministers regulations of 23.01.2007. No. 70 "Mandatory provisions in the study contract" see in Appendices (*3.1.2.AMSP Physics\_Sample of the diploma and its supplement un 2.1.4.Agreement on studies\_DU*).

[1] Daugavpils University admission rules for full-time and part-time higher level studies (international students). Available: <https://du.lv/en/studies/admission/> [viewed 28.02.2023]

### **3.1.3. Economic and/ or social substantiation of the study programme, analysis of graduates' employment.**

High-quality studies and opportunities for graduates on the labor market are the main criteria by which future students choose a university to study at. The MSPP content is based on the European Master of Physics specifications produced by the European Physical Society (EPS), the most authoritative physics society in Europe. The MSPP offers specialisations relevant to real opportunities (atomic, molecular and optical physics, solid and materials physics, physics of continuous media, physics of technology, theoretical physics), mainly targeting specialisations in areas where there is a strong demand for qualified professionals and a clear potential to provide a high quality and competitive study programme.

The latest labour market forecasts show that engineering, high-tech and life sciences professionals will be particularly in demand over the next five years. The Ministry of Economy's 2020 report on the development of Latvia's economy[1] predicted that the shortage of skilled workers in these sectors could exceed 17 000 by 2025. According to the target value for the share of science, mathematics and information technology graduates in the total number of graduates in higher education defined in the Latvian National Development Plan 2021-2027[2] is 12%, which will ensure the demand for physics study programmes in the coming years. The target indicator for the increase in the share of full-time academic staff in higher education institutions (ISCED 5-8) defined in the Latvian National Development Plan 2021-2027 could also contribute to the demand for graduates of Masters and PhD programmes.

In the past years, a constructive dialogue has been maintained at both universities between teaching staff and employers and, taking into account the experience gained, a concept has been developed to modernise the content of the Master's degree programmes in physics to better meet the needs of the labour market and ensure the transfer of physics knowledge to industrial enterprises. Employer representatives in the context of the MSPP range from physics research institutes to high-tech companies (AS Sidrabe, Light Guide Optics International, Ceram Optec, Regula Baltica, Groglass, Axon Cable, Lattelecom, SIA BELAM, CENOS, Lightspace Technologies, EU-ROLCDs, Baltic Scientific Instruments, RD Alfa, KEPP EU, UAVFACTORY, Zippy Vison, u.c..), gan

asociācijas (LETERA, arī LfSA[3], etc..),

Regarding the employment of the currently implemented AMSP graduates, no data are available for the reporting period, as the study programme was licensed at the end of 2021, while the first-year students were enrolled in 2022/2023 and will graduate from the programme in 2023/2024.

[1] Informative report on mid- and long-term labor market forecasts. Available in Latvian: <https://www.em.gov.lv/lv/media/17038/download?attachment>

[2] National Development Plan of Latvia 2021-2027. Available in Latvian: [https://pkc.gov.lv/sites/default/files/inline-files/NAP2027\\_apstiprin%C4%81ts%20Saeim%C4%81\\_1.pdf](https://pkc.gov.lv/sites/default/files/inline-files/NAP2027_apstiprin%C4%81ts%20Saeim%C4%81_1.pdf)

[3] Latvian Association of Physics Teachers. Available in Latvian: <http://lfsa.lv/>

**3.1.4. Statistical data on the students of the respective study programme, the dynamics of the number of the students, and the factors affecting the changes to the number of the students. The analysis shall be broken down into different study forms, types, and languages.**

At the time of submission of the accreditation report, AMSP DU has one student (in the 1st study year), while in the period from 2017 - 2022 the total number of students enrolled in the AMSP "Physics" (old) and AMSP "Physics" (new) reached 14 students. In the reporting period, a total of 8 students graduated from the study programme AMSP "Physics".

13 students studied in the new AMSP "Physics" in 2022, i.e. see 12 students in the specializations of the University of Latvia and 1 student in the specializations of the University of Daugavpils. DU student study for state budget funds. The program is implemented only in the form of full-time studies.

The annex *3.1.4.AMSP Physics Statistical data on students\_EN* on dropout statistics shows that some students who started in the "old" programme have not graduated, namely five. The main reasons for terminating studies are academic failure, financial difficulties as well as, inappropriate choice of the study programme. The dropout statistics of DU AMSP "Physics" students reflect the general trends in the field of natural sciences in Latvia.

**3.1.5. Substantiation of the development of the joint study programme and description and evaluation of the choice of partner universities, including information on the development and implementation of the joint study programme (if applicable).**

The study programme is established on the basis of the Cooperation Agreement signed on 31 May 2019 between the two universities, LU and DU on the implementation of the project "Establishment of Internationally Competitive Study Programmes at the University of Latvia Promoting the Development of Latvian Economy", co-financed by the European Social Fund, Agreement No 8.2.1.0/18/A/015. Both universities have more than 50 years of experience in training specialists in

physics. For several years, LU and DU were the only universities in Latvia to offer Master's level education in physics. The MSPP was created on the basis of the Master's programmes in Physics of both universities, merging and further evolving the existing programmes and eliminating the fragmentation of Master's education in Physics in Latvia. The procedure for the establishment of this study programme is in line with the Regulations on Study Programmes and Continuing Education Programmes of the University of Latvia[1] and the Regulations on Opening and Management of Study Directions and Study Programmes of the University of Daugavpils[2]. The joint Master's study programme "Physics" of LU and DU is a competitive programme in the Baltic region, which is based on local world-class research, makes the most of the expertise, teaching staff and researchers of both universities, and cooperates with research institutes in Latvia and high-tech companies in the implementation of the study programme.

The possibility of establishing a joint MSPP is supported by a number of considerations:

- in the Development Strategies of both universities (DU Development Strategy[3] and LU Development Strategy[4]) a number of goals and results can be found, the achievement of which will be stimulated by the new study programme, within the framework of which it will be possible to develop certain specialisation opportunities;
- demand for professionals in high-tech companies, such as, AS Sidrabe, Light Guide Optics International, Ceram Optec, Regula Baltica, Groglass, Axon Cable, Lattelecom, SIA BELAM, CENOS, Lightspace Technologies, EUROLCDs, Baltic Scientific Instruments, RD Alfa, KEPP EU, UAVFACTORY, Zippy Vison , and cooperation between universities and these companies has already been established, thus ensuring synergies between industry, science and education for high-tech development;
- students get modern premises in the Torņakalna Centre of the University of Latvia in Riga, Jelgavas iela 3 and in the University of Latvia in Daugavpils, Parādes street 1 and Parādes street 1a;
- the modern technical and logistical facilities, which have been created at both universities using infrastructure development funds. For example, at LU, facilities and equipment in several institutes and laboratories have been substantially upgraded, covering a wide range of physics topics, ranging from equipment for material science sample characterisation and device development, including in clean rooms, composites development and testing benches, overpressure rooms with additional stabilised optical bench systems, atomic, molecular, laser physics studies, sensor-equipped liquid metal circuits for the study of magnetohydrodynamic phenomena and the development of pumps, mixers or other elements, telescopes and laser locating equipment, high-performance computing resources for solving various problems with computer modelling approaches, etc. But DU has acquired the necessary equipment for the synthesis, research and development of nanomaterials and nanotechnologies such as sensors - so the scientific laboratories must be used efficiently and sustainably;
- LU and DU have the highly qualified staff needed to implement the MSPP;
- The geographical location of LU and DU gives a special synergistic effect to the MSPP, thanks to which the attraction of students from the Latgale region will be strengthened so that they can study together with students studying in the capital.

The basic concept of the study programme was developed by the teaching staff of the Department of Physics, Mathematics and Optometry of the Faculty of Physics of the University of Latvia, taking into account previous discussions with students and representatives of employers. It defined the compulsory part of the study programme, the content of its courses and the outcomes. The content and outcomes of the compulsory part were then agreed with the teaching staff of the Department of Physics and Mathematics of the Faculty of Natural Sciences and Mathematics of DU, arriving at the final version of the study programme outcomes, which are determined by the compulsory part

of the study programme.

The study programme was supplemented with restricted elective study courses, the design, content and outcomes of which, and their impact on the study programme outcomes, were developed through a broader dialogue between the teaching staff and representatives of employers in the sector, taking into account the views of students gathered through surveys and interviews. The selection of courses for individual specialisations was led by the Departments, both at the LU (Departments of Solid State and Materials Physics, Experimental Physics, Electrodynamics and Continuous Media, Theoretical Physics) and at the DU (Department of Physics and Mathematics), in close dialogue with collaborating institutes (Institute of Solid State Physics of the LU, Institute of Astronomy of the LU, Institute of Atomic Physics and Spectroscopy of the LU, Institute of Physics of the LU, Institute of Chemical Physics of the LU, Institute of Mechanics of Materials of the LU, Institute of Life Sciences and Technologies of the DU).

The content and results of specialisation study courses were coordinated with employers' representatives by presenting the study programme concept at the LETERA[5] Board meeting, involving representatives of specific companies (AS Sidrabe, SIA GroGlass, Ceram Optec etc.) in the discussion of the study programme content and results. The set of courses for the specialisation in Solid State and Materials Physics, developed within the framework of the LU CFI Horizont 2020 projekta CAMART2[6] project in collaboration with the experts from the Royal Swedish Institute of Technology[7], played an important role in the development of the study programme. Daugavpils University provides teaching of the "Physics of Technology" specialization, while the University of Latvia provides the other specializations.

Negotiating with employers (AS Sidrabe, Light Guide Optics International, Ceram Optec, Regula Baltica, Groglass, Axon Cable, Lattelecom, SIA BELAM, CENOS, Lightspace Technologies, EU-ROLCDs, Baltic Scientific Instruments, RD Alfa, KEPP EU, UAVFACTORY, Zippy Vison, etc.), and associations (LETERA, also LFSA[8], etc.), showed a strong interest in MSPP graduates as a future workforce. Employers particularly supported the inclusion of the course "Academic internship for Master of Physics" in the study plan, including the possibility to work on a Master's thesis in both institutes and companies. Research institutes participated in the development of the content of the specialisation courses, while small enterprises supported the possibility to develop individual laboratory projects for specific skills and competences within the "Research laboratory work I, II" courses.

In relation to teaching staff, the performance indicators of each HEI were analysed, describing the qualifications and competences of teaching staff, performance (student satisfaction, evaluation of methodological materials and teaching methods, participation in research projects and research results, mobility, etc.), staff development needs, etc..

MSPP target audience is

- Graduates of the Bachelor's study programme of Physics (SP);
- Graduates of Bachelor's degree programmes in natural sciences (especially chemistry) at LU and DU;
- Riga Technical University bachelor's degree graduates whose knowledge of physics and mathematics meets the admission requirements;
- Students of foreign origin with physics/maths knowledge relevant to the admission requirements.

The development of the AMSP "Physics" takes into account:

- Article 55 of the Higher Education Law of the Republic of Latvia. Master's study program (<https://likumi.lv/doc.php?id=37967> - available in Latvian).

- Regulations of study programs and further education programs of the University of Latvia (Senate 24.04.2017 decision no. 102).
- Regulation on the opening and management of study directions and study programs of DU (<https://du.lv/en/about-us/documents/>).

A table on the compliance of the joint study program with the requirements of the University Law is attached (*3.1.5.AMSP Physics\_Compliance of the joint program with the University Law\_EN*). The agreement of partner universities on the implementation of the joint study program (in Latvian) is added to "Other appendices".

[ 1 ] Available in Latvian:  
[https://www.lu.lv/fileadmin/user\\_upload/LU.LV/www.lu.lv/Dokumenti/Dokumenti\\_LV/3.\\_STUDIJU\\_UN\\_ZINATNES\\_PROCESU\\_REGLAMENTEJOSIE\\_DOKUMENTI/Latvijas\\_Universitates\\_Studiju\\_programmu\\_un\\_talakizglitibas\\_programmu\\_nolikums.pdf](https://www.lu.lv/fileadmin/user_upload/LU.LV/www.lu.lv/Dokumenti/Dokumenti_LV/3._STUDIJU_UN_ZINATNES_PROCESU_REGLAMENTEJOSIE_DOKUMENTI/Latvijas_Universitates_Studiju_programmu_un_talakizglitibas_programmu_nolikums.pdf)

[2] <https://du.lv/en/about-us/documents/>

[3] <https://du.lv/wp-content/uploads/2022/09/DU-Strategy-summary-1.pdf>

[ 4 ] Available in Latvian:  
[https://www.lu.lv/fileadmin/user\\_upload/lu\\_portal/zinas/2018/julijis/LUstrat\\_Kopsavilk\\_250517.pdf](https://www.lu.lv/fileadmin/user_upload/lu_portal/zinas/2018/julijis/LUstrat_Kopsavilk_250517.pdf)

[5] Latvian Electrical Engineering and Electronics Industry Association. Available in Latvian:  
<https://www.letera.lv/>

[6] <https://camart2.eu/>

[7] <https://www.kth.se/en>

[8] Latvian Association of Physics Teachers. Available in Latvian: <http://ifsa.lv/>

## 3.2. The Content of Studies and Implementation Thereof

**3.2.1. Analysis of the content of the study programme. Assessment of the interrelation between the information included in the study courses/ modules, the intended learning outcomes, the set aims and other indicators with the aims of the study course/ module and the aims and intended outcomes of the study programme. Assessment of the relevance of the content of the study courses/ modules and compliance with the needs of the relevant industry, labour market and with the trends in science on how and whether the content of the study courses/ modules is updated in line with the development trends of the relevant industry, labour market, and science.**

MSPP is an inter-university study programme. The content of the MSPP is based on the European Master of Physics specifications produced by the European Physical Society (EPS), the most authoritative physics society in Europe. The content of the MSPP is designed in line with the university specialisation defined in the SAM 8.2.1 project. Let us underline that the MSPP is a specialisation-based study programme (as opposed to a general physics Master's programme), following the information gathered in the STEPS TWO - Stakeholders Tune European Physics Studies

project (2008-11) and based on the recommendations of the European Physical Society (EPS) summarised in the EPS publication "A European Specification For Physics Master Studies" (available: [https://www.eps.org/page/policy\\_studies](https://www.eps.org/page/policy_studies)) with interdisciplinary physics education options. The specialisation areas were determined both by the demand of the labour market and by the possibilities to offer study courses in topics where each university - both LU and DU - has an internationally competitive research competence in the specialisation areas offered. Therefore, the implementation of the study programme (laboratory work, internship, Master's thesis) is closely linked to research. The implementation of the study programme is also provided in English, attracting foreign students.

The aim and objectives of the MSPP programme are aligned, the objective is in line with the 5<sup>th</sup> Growth Priority of the Smart Specialisation Strategy of Latvia "Modern Education System", which provides for the development of quality education, ensuring the development of competences at all levels of education and creating a balance between education, science, society, economy, politics and economy both locally and globally. The MSPP will also promote more effective cooperation between education and the economy, a personalised approach (offering several fields of specialisation), interdisciplinary courses of study.

MSPP results are obtained by combining the Latvian Qualifications Framework (LQF) with "A European specification for Physics master studies, EPS Publications, 2010".

Study programme amount (CP): 80 CP

Study programme duration: 2 years

Programme parts and their amount:

The compulsory (A) part of the MSPP, excluding the Master's thesis, is 26 CPs (28 CPs for foreigners). It consists of:

- Master's in physics specialisations, 8 CP CP
- Research laboratory work I, 6 CP
- Master's academic internship in physics, 6 CP
- Current topics in physics and astronomy I, 2 CP
- Numerical modelling of physical processes, 4 CP
- Basic course in Latvian language, 2 CP, only for some students (foreigners must master, while studying in English (Section 56 (3)-1 of the Law on Higher Education).

In addition, Part A of the MSPP includes a Master's thesis (course of study divided into 2 parts, 4CP+16CP), total 20CP.

The results of the compulsory (A) part of the courses contribute to the majority of the study programme outcomes, as illustrated by the mapping of study outcomes, and the internship and Master's thesis cover a wide variety of topics across all students. Part A courses are provided by the teaching staff of the University of Latvia. Daugavpils University students connect to the lecture remotely, while Daugavpils University provides advisory assistance to local students.

The offer of courses in the restricted elective (B) part is closely related to the term specialisation used in this report, so we explain the use of this term:

### **Specializations**

In the Master's study programme Physics, specialization is understood as a set of study courses in the restricted elective (B) part of the study programme, in the course of which the student acquires knowledge, skills and competence in selected subfields of physics or in an interdisciplinary topic related to physics with high research potential. Specialization in one of the offered fields enables

the preparation of highly qualified physics specialists at Master's level for the Latvian labour market in a specific topic, who are also competitive at international level.

MSPP specializations are a combination of research traditions and current scientific trends, which are translated into topical study courses that dynamically follow the latest scientific trends through the collaboration of teachers and researchers. The Faculty of Physics, Mathematics and Optometry (FPMO) and the Faculty of Natural Sciences and Mathematics (FNSM) of DU and research institutions actively interact with innovative companies in both consultative and applied cooperation, so that the interests of the economic sector are also reflected in the course offerings.

The offer of specializations is institutionalized in the sense that at LU and DU they are implemented by structural units with appropriate competence. Specializations are offered:

- Atomic, molecular and optical physics
- Physics of solids and materials
- Physics of continuous medium
- Physics of technology (implemented by DU)
- Theoretical physics.

The Department of Physics and Mathematics (DPM) of DU implements study courses in the specialization *Physics of Technology*. It basically includes courses that will provide students with basic knowledge, skills and competences in technological processes of creation and processing of various materials, including nanomaterials, and structures, robotics and sensor technologies, in accordance with the aim and planned results of the study programme.

The study courses of the specialization *Physics of Technology* have been developed by the DPM in cooperation with the researchers of the Centre for Innovative Microscopy of the G. Libertas Institute of Life Sciences and Technologies of DU, taking into account the current research in physics and interdisciplinary fields at DU and the recommendations of the industrial partners in the selection of study content.

In addition to the specializations included in the MSPP, the development of new specializations and the study of interdisciplinary themes is encouraged and supported by including in Part B relevant courses of study driven by labour market demand and scientific developments. Students are already free to choose their own courses of study, according to their own professional interests or on the basis of recommendations from research supervisors or colleagues.

Compliance with the requirements of the Act on Environmental Protection and Civil Defense and Disaster Management: the study programme includes the study courses "Civil Defense" (1 CP) and "Environmental Protection" (1 CP) (for students who have not studied civil and environment protection in bachelor studies).

Degree and/or qualification to obtain: Master's degree of Natural Sciences in Physics.

Opportunities of continuing studies: continuing studies in doctoral study programmes.

Basic principles and procedure of acquisition and assessment of the study programme: the following principles are applied in the acquisition and assessment of the study programme:

- the principle of openness;
- principle of obligation;
- the principle of assessment review options;
- the principle of diversity of the types of tests used

The principles and procedures for the assessment of the study outcomes are stated in the "Regulations on studies at Daugavpils University"[1]. A more detailed description of the assessment

is reflected in the credit requirements of each individual study course. Study outcomes are assessed on a 10-point scale or with a “pass/fail” rating.

Appendices of the report summarize the study programme parameters testifying to the compliance of the study programme to the state education standard (*3.2.1.AMSP Physics\_Compliance with National Educational Standard*). AMSP study programme curriculum is provided in appendix (*3.2.1.AMSP Physics\_Study plan*), whereas study programme course descriptions are supplied in appendix (*3.2.1.AMSP Physics\_Descriptions of study courses*). Study course mapping for achieving the study programme outcomes see in appendix (*3.2.1.AMSP\_Mapping of study courses*). Explanation of descriptors used in the learning outcomes is added in "Other attachments" (*3.2.1.Explanation of descriptors used in the learning outcomes*).

[1] Regulations on studies at Daugavpils University. Available: [https://du.lv/wp-content/uploads/2022/06/ENG-NOLIKUMS\\_PAR\\_STUDIJAM\\_DU\\_2018-1-1.pdf](https://du.lv/wp-content/uploads/2022/06/ENG-NOLIKUMS_PAR_STUDIJAM_DU_2018-1-1.pdf)

**3.2.2. In the case of master’s and doctoral study programmes, specify and provide the justification as to whether the degrees are awarded in view of the developments and findings in the field of science or artistic creation. In the case of a doctoral study programme, provide a description of the main research roadmaps and the impact of the study programme on research and other education levels (if applicable).**

After completing the study programme, students with a previously obtained appropriate bachelor degree or level 2 professional higher education (or equivalent higher education) obtain an academic Master of science degree in physics. The awarding of the Master’s degree is based on the achievements and findings of the field of physical science confirmed by the content of the study programme.

The MSPP content was developed with the participation of current students, employers' representatives and a student-graduate survey, focusing on the demand for professionals in high-tech companies.

The compulsory part of the joint LU-DU MPSP consists of courses in which students learn useful principles in the fields of materials science, continuous media, atomic physics and theoretical physics, as well as up-to-date numerical modelling skills. The range of compulsory elective courses corresponds to the interests of the students and the scientific specialization of the academic staff. A complementary course is "Current Topics in Physics and Astronomy I", which ensures the development of highly relevant soft-skills. There is also a laboratory course ("Research Laboratory Work I"), which focuses on developing experimental skills in physics while learning about different physics research topics, and an internship course, which provides an insight into the working environment of a research institute or company. The MSPP provides the opportunity to specialize in five areas - Atomic, Molecular and Optical Physics; Physics of Solids and Materials; Physics of Continuous Media; Physics of Technology; Theoretical Physics. These are topics in which Latvia has a strong tradition and, at least regionally, a unique offer, such as magnetohydrodynamics, biophotonics, soft-medium physics, some areas of nanotechnology.

The structure of the programme also focuses on the development of students' skills to carry out

research independently and to integrate into the research process, which is necessary for the successful development of a Master's thesis.

**3.2.3. Assessment of the study programme including the study course/ module implementation methods by indicating what the methods are, and how they contribute to the achievement of the learning outcomes of the study courses and the aims of the study programme. In the case of a joint study programme, or in case the study programme is implemented in a foreign language or in the form of distance learning, describe in detail the methods used to deliver such a study programme. Provide an explanation of how the student-centred principles are taken into account in the implementation of the study process.**

Studies are organised in a in-presence format (offering studies in both Latvian and English). The study programme uses various study methods of contact classes, incl. lectures, practical lessons and laboratory work, seminar, consultations, individual and group work, discussions. The challenge is to provide students with the compulsory part and the opportunity to take elective courses in both Riga and Daugavpils.

For the compulsory part of the study courses, lectures are held mainly in Riga, LU, and students have the possibility to attend lectures by videoconference. Students have access to recordings of lectures in the e-learning environment, as well as lecture notes where they are needed. At the DU side, students matriculated at DU are provided with advisory support, practical work, laboratory work and seminars, as well as assessment of the results achieved, in accordance with the expected outcomes of the courses of study. The implementation of the study courses "Research Laboratory Work I", "Current Topics in Physics and Astronomy I" is carried out jointly, in cooperation between the two universities. The location of the Master's thesis is linked to the chosen laboratory, company or other research-related institution where it takes place.

The timetabling of elective courses has been done in such a way that students do not overlap their chosen study courses, providing for the possibility to attend classes both in Riga at LU and in Daugavpils at DU.

At the beginning of the studies, students are scheduled to attend orientation seminars at both universities.

The compulsory part of the joint MSPP includes the study course " Academic Internship for Master in Physics " of 6 CP. The "Master's thesis", like the academic internship, is carried out either in a research institution (including research structures of LU and DU) or in a company that is able to provide research topics and infrastructure appropriate for the Master of Physics level research.

The lectures are scheduled on weekdays between 8:30 and 18:00. Of course, contact hours (lectures, practical and laboratory work, seminars) take up only part of this time, the rest being for students' independent study and research work (outside contact hours).

A variety of teaching (and learning) methods are used to achieve learning outcomes, based on a student-centred approach:

- Lectures and seminars use active learning methods alongside traditional teaching methods, such as discussions, student votes on correct answers to conceptual questions, various forms of group work, etc..

- It is taken into account that learners have different learning styles, requirements, interests, backgrounds and prior knowledge,
- "Learning by doing" under the guidance of an experienced member of staff (laboratory work, internship, Master's thesis).
- Use of e-technologies for remote participation in lectures, active use of the e-learning (Moodle) environment through the provision of information for independent study, as well as special tools of the e-learning environment (assignment submission with teacher's feedback, forums, chat room, etc.)
- Intermediate tests.
- Presentations at seminars, making and presenting presentations at various lectures, and presenting the results of the Master's thesis at the thesis defence.
- Research work (during the development of the Master's thesis), including group work, scientific communication with colleagues.

The MSPP is implemented using various forms of study, formal and non-formal education methods and methodological approaches, as well as e-learning for the organisation of students' independent work in order to achieve the results of the course and study programme. Emphasis is placed on the need for intermediate tests and final examinations to enable teaching staff to adequately identify and assess learning outcomes.

Work in a research environment (internship and Master's thesis) is an integral part of the Master's degree programme in Physics. The high quality of this work will be ensured by the research environment, where work is usually done on projects, and by companies, where work on the implementation of modern technologies with high added value is essential.

The total student workload is 40 academic hours per credit point, of which at least 12 academic hours are contact hours, as stipulated by Paragraph 19 of Cabinet Regulation No. 240[1] "In full-time studies, not less than 30% of the Master's study programme volume (excluding the volume for internship, if any, and the volume for the Master's thesis) consists of contact hours."

[1] Cabinet of Ministers Regulation No 240, Riga, 13 May 2014 (Minutes No 28, § 18) "Regulations on the State Standard of Academic Education"

**3.2.4. If the study programme envisages an internship, describe the internship opportunities offered to students, provision and work organization, including whether the higher education institution/ college helps students to find an internship place. If the study programme is implemented in a foreign language, provide information on how internship opportunities are provided in a foreign language, including for foreign students. To provide analysis and evaluation of the connection of the tasks set for students during the internship included in the study programme with the learning outcomes of the study programme (if applicable).**

Although the MSPP is an academic study programme, which according to the Regulation of the Cabinet of Ministers No. 240[1] does not have to include a compulsory study internship, the study course "Academic Internship for Master in Physics " of 6 CP is included in the compulsory part of the common MSPP. The academic internship is included with the aim of acquiring the professional skills and competences of a physicist in a real professional activity, in an environment similar to the

future workplace. This is also in line with the educational development guidelines 2021-2027 "Skills for the future society".[2]

The course "Academic Internship for Master in Physics" is included in the compulsory part and is a kind of "career guidance" tool that allows the student to better understand his/her specialization and to choose the topic of the Master's thesis. The student chooses the place of the internship. To facilitate the choice, a list of possible internship and Master's thesis topics is kept up to date every year.

The academic internship of the Master of Physics is carried out in accordance with the course description "Academic Internship of Master in Physics" and the internship regulations of the Master's study programme "Physics", which, in turn, are developed in accordance with:

1. the Regulations on the National Standard for Academic Education (Cabinet of Ministers Regulation No 240 of 13.05.2014);
2. the Regulations of Study Programmes and Continuing Education Programmes of the University of Latvia (Decision No 102 of the Senate of the University of Latvia of 24.04.2017);
3. the Rules for the Organisation of Student Internships at the University of Latvia (Order of the University of Latvia No 1/417 of 25.11.2019).

The academic internship for the Master of Physics is 6 CP, which corresponds to 240 hours of work at the internship site. The internship is organised in the departments of natural sciences of the LU/DU, as well as in other organisations where fundamental or applied research is carried out (Institute of Physics of the LU, Institute of Atomic Physics and Spectroscopy of the LU, Institute of Chemical Physics of the LU, Institute of Solid State Physics (CFI), Technology Department of the Institute of Life Sciences of the DU) or science intensive production (*Light Guide Optics International, Ceram Optec, Lattelecom*, etc.). In the event that foreign students participate in the learning process, some of the offered institutions are also ready to conduct academic practice in English. In this way, foreign students do not need to look for an internship separately from Latvian language students.

These institutes and institutions carry out research/commercial projects related to the synthesis and research of various new materials and the deployment of smart technologies.

The student chooses the internship placement, but LU/ DU prepares and concludes agreements with the selected organisations for the provision of the student's internship. The conclusion of agreements and coordination of internship work is carried out by the internship supervisor of the Master's study programme "Physics" in accordance with the internship regulations of the Master's study programme "Physics".

During the internship, the student performs specific tasks: familiarises himself/herself with the structure of a particular institution, the specifics of scientific activity (fundamental, applied research), the organisation of work and with problems of a physical nature relevant to that institution, and prepares and presents the results achieved. The coordination/approval of the internship site and specific tasks of the internship shall be carried out by the Director of the Master's study programme "Physics" or a teaching staff member involved in the implementation of the programme appointed by the Director - the internship supervisor.

The internship is planned in one semester and is organised in accordance with the internship regulations of the Master's study programme "Physics" approved by the University. The specific tasks of the academic internship in physics are specified in the course description.

The student's internship is supervised/supported by the Director of the Master's study programme "Physics" or a member of the teaching staff involved in the implementation of the programme, and

at the internship site - by the student's internship supervisor appointed by the head of the institution/company.

During the Academic internship of the Master in Physics, at least four seminars are foreseen, the main purpose of which is to explain the objectives of the internship, to support the students in achieving the planned results and to guide their own performance.

In the introductory seminar, the internship supervisor familiarises students with the aims, objectives, content, general rules and procedures of the internship, the documentation of the internship and the procedures and criteria for the assessment of the internship.

In the current internship seminars, the emphasis will be on the exchange of student experiences and group learning, because 1) in the seminars students have the opportunity to share what they have learned and done, to receive support and information from both university staff and other students about current research in Latvia, about available equipment and research methods if they are interning in different institutions; 2) the student group is also a mutual support and learning group - such exchange of experiences can be a valuable professional support in the study process and for starting a career in an area of interest to the student.

At the end of the internship, the student prepares and submits to the internship supervisor an internship report, reflecting what has been planned and what has been achieved. The current placement documentation forms are available in the e-course material "Academic internship for Master in Physics". The student's performance, growth and attitude to work are also evaluated by the internship supervisor of the institution or company in the form of an internship supervisor's report.

The final seminar of the internship is the internship defence, where the student presents the work done during the internship, evaluates his/her growth, acquired/strengthened competences and receives expert feedback on the work done. The final evaluation of the internship is given by the internship supervisor, according to the criteria formulated in the internship regulations and the results achieved in the study course "Academic internship for Master in Physics".

[1] Cabinet of Ministers Regulation No 240, Riga, 13 May 2014 (Minutes No 28, § 18) "Regulations on the State Standard of Academic Education". Available in Latvian: <https://likumi.lv/ta/id/266187-noteikumi-par-valsts-akademiskas-izglitibas-standartu>

[2] Education development guidelines for 2021-2027 "Future skills for future society". Available in Latvian: [https://www.izm.gov.lv/sites/izm/files/iap2027\\_projekta\\_versija\\_apspriesana\\_160720201\\_2.pdf](https://www.izm.gov.lv/sites/izm/files/iap2027_projekta_versija_apspriesana_160720201_2.pdf)

### **3.2.5. Evaluation and description of the promotion opportunities and the promotion process provided to the students of the doctoral study programme (if applicable).**

### **3.2.6. Analysis and assessment of the topics of the final theses of the students, their relevance in the respective field, including the labour market, and the marks of the final theses.**

At the time of submitting the report, there are no AMSP Physics graduates.

### **3.3. Resources and Provision of the Study Programme**

**3.3.1. Assessment of the compliance of the resources and provision (study provision, scientific support (if applicable), informative provision (including libraries), material and technical provision, and financial provision) with the conditions for the implementation of the study programme and the learning outcomes to be achieved by providing the respective examples.**

The implementation of the AMSP for DU matriculated students is carried out both using the shared infrastructure of DU, as well as the specialized laboratories corresponding to the specifics of a particular study course, provided by several structural units of DU - Institute of Life Sciences and Technologies, Faculty of Natural Sciences and Mathematics (for more detailed information, see section 2.3.2).

AMSP "Physics" students have access to all services offered by the DU Library - the library's electronic catalog, ordering, reserving and renewing books online, automated user service, as well as access to electronic databases subscribed to DU, incl. Web of Science, Scopus, Science Direct, etc. (for more detailed information, see section 2.3.3). The curriculum is compiled in such a way that it is possible to learn the specialization "Physics of Technology" using only the resources of Daugavpils University. In this specialization, the University of Latvia provides only part A courses, which are conducted remotely and do not require the physical presence of the student.

**3.3.2. Assessment of the study provision and scientific base support, including the resources provided within the framework of cooperation with other science institutes and higher education institutions (applicable to doctoral study programmes) (if applicable).**

**3.3.3. Indicate data on the available funding for the corresponding study programme, its funding sources and their use for the development of the study programme. Provide information on the costs per one student within this study programme, indicating the items included in the cost calculation and the percentage distribution of funding between the specified items. The minimum number of students in the study programme in order to ensure the profitability of the study programme (indicating separately the information on each language, type and form of the study programme implementation).**

AMSP "Physics" funding source is the state budget funding for studies (grant) and tuition fees. In

addition to the development of the program, funding is attracted from Latvian and European projects and science-based funding, the amount of which depends on scientific performance. The tuition fee for AMSP "Physics" is set at 1,600 EUR per year of study or 3,200 EUR for two academic years.

The calculation of costs for one student in the study field programs is performed in the DU Finance and Accounting Department, including the salary fund and the employer's State Social Insurance Mandatory Contributions, business trip, material, energy and inventory costs, purchase of books, equipment and investment costs, as well as social security costs for students. Calculation of costs per student of AMSP "Physics" (full-time studies, 2 years, 80 CP) and information on the percentage distribution of funding see in the Table 3.3.3.1.

The costs per student in the study programme in Latvian and in English will not differ. The minimum number of students in a group to ensure the profitability of the study programme is 5 students in a group.

### **3.4. Teaching Staff**

**3.4.1. Assessment of the compliance of the qualification of the teaching staff members (academic staff members, visiting professors, visiting associate professors, visiting docents, visiting lecturers, and visiting assistants) involved in the implementation of the study programme with the conditions for the implementation of the study programme and the provisions set out in the respective regulatory enactments. Provide information on how the qualification of the teaching staff members contributes to the achievement of the learning outcomes.**

The qualifications of teaching staff involved in AMSP "Physics" fully meet the conditions of the study programme implementation, programme content, and the requirements of regulatory acts. See the attachment for the statement that the academic staff involved in the implementation of the academic study programme meets the requirements specified in the third paragraph of the first part of Article 55 of the Act on Higher Education Institutions. The proficiency of the state language of the academic staff employed in the implementation of the study direction programmes complies with the regulations on the state language proficiency level and the procedure for testing it for the performance of professional and official duties, respectively, they allow any course in the study direction to be fully taught in the state language.

As already mentioned, the content of the AMSP is designed with an emphasis on specialization opportunities. Therefore, quite a number of industry specialists are involved in the implementation of the study program, whose main activity is scientific work. Law on Higher Education Institutions (Article 55, Part One, Paragraph Three) determines that no less than five professors and associate professors, who have been elected to academic positions at the respective university, participate in the implementation of the compulsory part and the limited optional part of academic study programs. 15 professors and associate professors elected by the LU participate in the implementation of AMSP (data can be seen in table 3.4.1).

**Table 3.4.1. Professors and associate professors involved in the implementation of the study program**

<b>No.</b>	<b>SURNAME, name</b>	<b>Position of academic staff</b>
1	Asmuss Svetlana	professor
2	Auziņš Mārcis	professor
3	Bartkevičs Vadims	professor
4	Cēbers Andrejs	professor
5	Erts Donāts	professor
6	Ferbers Ruvins	professor
7	Kaščejevs Vjačeslavs	professor
8	Spīgulis Jānis	professor
9	Valeinis Jānis	professor
10	Barinovs Ģirts	asociētais profesors
11	Bērziņš Agris	associated professor
12	Lācis Sandris	associated professor
13	Šarakovskis Anatolijs	associated professor
14	Vaivars Guntars	associated professor
15	Belovs Aleksandrs	associated professor

At the time of drawing the accreditation report, a total of 11 lecturers are involved in the implementation of AMSP "Physics" (see Table 3.4.1.1) whereof 4 are elected as academic staff members at DU, while 7 are visiting lecturers. Teaching of MSPP courses is open to teaching staff with a Master's degree, both elected and visiting. All academic staff members from DU involved in the implementation of AMSP "Physics" have at least a Master's degree, in addition, 8 lecturers have a PhD degree, which accounts for 72,7% of the total number. On the part of the University of Latvia, 58 lecturers are involved in the implementation of the program, of which 10 lecturers teach subjects to Daugavpils University students. Of those, 8 lecturers have a doctor's degree.

**Table 3.4.1.1 Academic staff of Daugavpils University AMSP "Physics"**

<b>Position</b>	<b>Number</b>	<b>% from total</b>	<b>Elected at DU</b>	<b>Visiting lecturer</b>
Professor	2	18,2	0	2
Lecturer	1	9	1	0

Electronics engineer	2	18,2	0	2
Research assistant	1	9	1	0
Leading researcher	2	18,2	1	1
Researcher	1	9	1	0
Does not work in DU	2	18,2	0	2
<b>Total</b>	<b>11</b>	<b>100</b>	<b>4</b>	<b>7</b>

According to the collected data, DU academic staff and visiting lecturers purposefully and regularly engage in various professional development activities in the fields corresponding to their scientific interests. Lecturers prepare scientific articles, including in internationally peer-reviewed journals, participate in conferences and practical seminars, various scientific events, participate in research projects. In addition to the academic work at the university, the academic staff has practical experience in the implementation of branch-related projects and contractual works. This type of activity contributes to a comprehensive understanding of the specifics of the branch, thus ensuring a direct unity of theory and practice during the study process. The list with the experience of the academic staff involved in the implementation of the study programmes of the study direction "Physics, material science, mathematics and statistics" in the implementation of branch projects is attached in the appendix (2.4.4. *Participation in projects for direction\_ENG*), whereas the list of the academic staff members is provided in 2.4.4. *List of scientific publications for the direction\_EN* with indicated study programme related scientific publications and research achievements and patents of 6 recent years. As an example of how the qualification of the selected lecturers helps to ensure the quality of studies, it can be pointed out that for the specialization "Physics of Technology" Part B course "Practical Holographic Systems" lecturer, Doctor of Physics, leading researcher Andrejs Bulanovs has written several publications on holographic recording technologies in peer-reviewed journals indexed by Scopus. See CVs of the academic staff members in appendix 2.3.7.CV.

The directions of the research work of the academic staff involved in the study programme are focused on the successful implementation of the study programme and in most cases are related to the teacher's specialization within the programme.

The research carried out by the academic staff is an important contribution to the development of the branch they represent, as well as to the development of the study programme, improvement and updating of the study content.

3.4.2. Mācībspēku sastāva izmaiņu analīze un novērtējums par pārskata periodu, to ietekme uz studiju kvalitāti.

Lecturers L. Jonāne and P. Drozdovs have died, so the course "Physics of Open Systems" has been taken over by Valdis Mizers, and the course "Fundamentals of Industrial Robotics" by Dr. phys. Ēriks Sļedeviskis. Both lecturers are experts in their field, so these changes in the composition of the teaching staff in no way impair the quality of studies.

### **3.4.2. Analysis and assessment of the changes to the composition of the teaching staff over the reporting period and their impact on the study quality.**

Lecturers L. Jonāne and P. Drozdovs have died, so the course "Physics of Open Systems" has been taken over by Valdis Mizers, and the course "Fundamentals of Industrial Robotics" by Dr. phys. Ēriks Sļedevskis. Both lecturers are experts in their field, so these changes in the composition of the teaching staff in no way impair the quality of studies.

**3.4.3. Information on the number of the scientific publications of the academic staff members, involved in the implementation of doctoral study programme, as published during the reporting period by listing the most significant publications published in Scopus or WoS CC indexed journals. As for the social sciences, humanitarian sciences, and the science of art, the scientific publications published in ERIH+ indexed journals or peer-reviewed monographs may be additionally specified. Information on the teaching staff included in the database of experts of the Latvian Council of Science in the relevant field of science (total number, name of the lecturer, field of science in which the teaching staff has the status of an expert and expiration date of the Latvian Council of Science expert) (if applicable).**

**3.4.4. Information on the participation of the academic staff, involved in the implementation of the doctoral study programme, in scientific projects as project managers or prime contractors/ subproject managers/ leading researchers by specifying the name of the relevant project, as well as the source and the amount of the funding. Provide information on the reporting period (if applicable).**

**3.4.5. Assessment of the cooperation between the teaching staff members by specifying the mechanisms used to promote the cooperation and ensure the interrelation between the study programme and study courses/ modules. Specify also the proportion of the number of the students and the teaching staff within the study programme (at the moment of the submission of the Self-Assessment Report).**

The cooperation of the academic staff of the study programme is diverse, deciding on activities related to the organization and management of the learning process; considering questions about the content of studies; when planning scientific events; cooperating in the research field (conducting joint research within projects, writing publications, participating in scientific conferences, etc.). A joint Study Council of the academic master's study program "Physics" has been established, in which representatives of both Daugavpils University and the University of Latvia participate, which ensures cooperation between the teaching staff of both universities.

At the end of each study year, academic staff workloads for the next academic year are planned in structural units. Taking into account the results of the evaluation of the relevant study courses by the students of the programme and self-analysis of the academic activity performed by the instructors, the suitability of the academic staff for the development and teaching of the specific

study courses is evaluated. Approval of academic workloads is carried out in accordance with the "Procedures for accounting the workload of academic staff at DU".

The fact that MSPP representatives together with students actively participate in Daugavpils Science Festival, Scientists' Night events, have conducted DU Science School classes, as well as have been involved in advising and evaluating students' scientific research work (for example, V. Mizers; A. Vagalis, V. Paškevičs, I. Mihailova, A. Ogurcovs) has a positive impact on the study process.

MSPP faculty members have many joint publications, which confirms the staff cooperation in scientific activities. To ensure the interconnection of study courses, meetings of lecturers (both collectively and individually) are organised.

In 2022/2023, a total of 11 academic staff members are involved in the implementation of the master study programme. At the time of submission of the accreditation report, AMSP "Physics" has a total of 1 student.

# Annexes

III - Description of the Study Programme - 3.1. Indicators Describing the Study Programme		
Sample of the diploma and its supplement to be issued for completing the study programme	3.1.2.AMSP Physics_Sample of the diploma and its supplement_last.pdf	3.1.2.AMSP Fizika_Diploms un pielikums.pdf
For academic study programmes - Opinion of the Council of Higher Education in accordance with Section 55, Paragraph two of the Law on Higher Education Institutions (if applicable)		
Compliance of the joint study programme with the provisions of the Law on Higher Education Institutions (table) (if applicable)	3.1.5.AMSP Physics_Compliance of the joint program with the University Law_EN.docx	3.1.5.AMSP Fizika_Kopīgās programmas atbilstība Augstskolu likumam.docx
Statistics on the students in the reporting period	3.1.4.AMSP Physics_Statistical data on students_EN_DU.xlsx	3.1.4.AMSP Fizika_Statistikas_dati_par_studejosajiem_DU.xlsx
III - Description of the Study Programme - 3.2. The Content of Studies and Implementation Thereof		
Compliance with the study programme with the State Education Standard	3.2.1.AMSP Physics_Compliance with National Educational Standard.docx	3.2.1.AMSP Fizika_Atbitlība valsts izglītības standartam.docx
Compliance of the qualification to be acquired upon completion of the study programme with the professional standard or the requirements for professional qualification (if applicable)		
Compliance of the study programme with the specific regulatory framework applicable to the relevant field (if applicable)		
Mapping of the study courses/ modules for the achievement of the learning outcomes of the study programme	3.2.1.AMSP_Mapping of study courses.xlsx	3.2.1.AMSP Fizika_Studiju kursu kartējums.xlsx
The curriculum of the study programme (for each type and form of the implementation of the study programme)	3.2.1.AMSP Physics_Study plan.docx	3.2.1.AMSP Fizika_Studiju plāns.docx
Descriptions of the study courses/ modules	3.2.1.AMSP Physics_Descriptions of study courses.docx	3.2.1.AMSP Fizika_Studiju kursu apraksti.docx
Description of the organisation of the internship of the students (if applicable)	3.2.4.LU DU AMSP Fizika prakses apraksts.pdf	3.2.4.LU DU AMSP Fizika prakses apraksts.pdf
III - Description of the Study Programme - 3.4. Teaching Staff		
Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable)		
Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable)	3.4.1.AMSP Physics_Statement_Article 55_EN.docx	Apliecinājums par AMSP Fizika personāla atbilstību MK noteikumu 55.pantam.edoc