APPLICATION

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

Study field	*Physics, Material Science, Mathematics, and Statistics*
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Self-evaluation report

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

Riga Technical University

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1. Information on the Higher Education Institution/College

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

Riga Technical University was founded in 1862 as Riga Polytechnic, later Riga Polytechnic Institute, and is the oldest technical university in the Baltic States. Following the restoration of the Republic of Latvia in March 1990, Riga Polytechnic Institute was renamed Riga Technical University (RTU). Over years RTU has become the leading centre of higher engineering education and science in Latvia, obtained a positive assessment of international experts and has been accredited by the Supreme Education Council of the Republic of Latvia.

RTU values include sustainable development, quality, openness and cooperation, creativity, academic freedom, motivation to explore and discover.

At the beginning of academic year 2021/2022, an academic and scientific staff of 1,193 people work at nine faculties of RTU (Faculty of Architecture; Faculty of Civil Engineering; Faculty of Computer Science and Information Technology; Faculty of E-Learning Technologies and Humanities; Faculty of Electronics and Telecommunications; Faculty of Electrical and Environmental Engineering; Faculty of Engineering Economics and Management; Faculty of Mechanical Engineering, Transport and Aeronautics; Faculty of Materials Science and Applied Chemistry) and four RTU Study and Science Centres in Cēsis, Liepaja, Ventspils and Daugavpils carrying out high-quality academic activities and scientific research at a contemporary level. RTU is the second largest university in the Republic of Latvia in terms of student number and has educated and trained more than 160,000 graduates in total.

RTU carries out active study and research work, acquiring new partners worldwide, working together on project implementation, student exchange and the development of joint study programmes. Active development of a student campus is underway in Ķīpsala, where new faculty buildings are being built, while those built during earlier years are getting a new look, modern content and design.

Many research and scientific projects are being carried out in cooperation with RTU partners, which result in both new patents and successful business activities. RTU successfully develops cooperation to strengthen its role in the development of higher engineering education in the world and in the development of Latvia.

RTU has defined its mission – we are building a competitive, educated, innovative and creative future, the vision – an internationally competitive, dynamic and modern university of science and technology.

Accredited RTU study fields and number of study programmes in May 2022:

Study field	Number of study programmes
Architecture and Construction	20
Economics	3

Energy, Electrical Engineering and Electrical Technologies	15
Physics, Materials Science, Mathematics and Statistics *	9
Internal Security and Civil Defence	6
Information Technology, Computer Engineering, Electronics, Telecommunications, Computer Control and Computer Science	38
Chemistry, Chemical Technology and Biotechnology	10
Mechanics and Metalworking, Thermal Energy, Thermal Engineering and Mechanical Engineering	28
Manufacture and Processing	6
Translation	2
Management, Administration, Real Estate Management	21
Environment Protection	6
Total:	**164**

* Four study programmes are not subject to re-accreditation.

The offer of RTU study programmes is in compliance with the forecasts with regard to the needs of the labour market in both Europe and Latvia in the coming decade. The RTU study programme offer ensures education and training of the specialists in information and communication technologies (ICT), engineering, management and humanities, for which a significant shortage in the labour market is predicted.

In recent years, the number of foreign students studying to obtain a degree or qualification in Latvia has increased. In addition, international student mobility growth is projected to continue also in the future. In academic year 2019/2020, there were by 25% more foreign students studying at RTU in comparison with academic year 2018/2019. Taking into account the above mentioned, RTU has great opportunities to further increase the number of foreign students. It also provides an appropriate offer of RTU study programmes in English – 16 Bachelor study programmes, 27 Master study programmes, and 13 Doctoral study programmes, moreover, this list is updated from year to year.

Dynamics of the number of students in the RTU during the evaluation period:

Academic year	Total number of students
2013./2014.	14 452
2014./2015.	14 797
2015./2016.	14 997

2016./2017.	14 672
2017./2018.	14 322
2018./2019.	14 383
2019./2020.	14 006
2020./2021.	13 237 *

* In May 2022, 13,372 students studied at RTU – 9,719 studied at undergraduate study programmes, 3,128 studied at graduate Master degree programmes and 525 – at the Doctoral study programmes.

The guiding principle of RTU Strategy for 2021–2025 is the proactive link between the activity of the university and the needs of the national economy, focus on high quality and effectiveness. The basis for the activity of RTU is the study process built on science, innovation and in cooperation with the industry, which ensures preparation of specialists required by the Latvian national economy, thus serving as a foundation for sustainable growth of Latvia. The RTU's strategy for the new programming period is a consecutive continuation is the previous strategy of the university for 2014-2020. It has been developed in compliance with the objectives and priorities defined in Latvian development planning documents.

According to the National Development Plan for 2021-2027 of Latvia, fundamental changes are planned in the near future in four directions – Equal Rights, Quality of Life, Knowledge Society, and Responsible Latvia, in the achievement of which a high-quality study process, excellent research, as well as sustainable innovation and commercialization activities play an important role, which are important elements in RTU's vision to become an internationally competitive, dynamic and modern university of science and technology.

Keynote of the RTU Strategy: High quality and effectiveness – proactive link between the activity of RTU and the needs of the national economy. RTU is one of the leading science and technology universities of the Baltic and Nordic region, which is acting based on a study system built on research, innovation and cooperation with the industry. RTU prepares European and global-level engineers – leaders: developers of new technologies.

In order to implement RTU's vision to become an internationally competitive, dynamic and modern university of science and technology, RTU's strategy defines four main objectives for the next programming period, three of which are related to the implementation of basic university functions: excellent science, quality studies and sustainable valorisation. The fourth, institutional excellence, is related to the university support function and the development of internal governance in the six areas: digitalisation, sustainable development, effective financial and administrative action, internationalisation, communication and cooperation, human resources development. For all the objectives identified in the strategy define specific tasks to be performed and result indicators to make it possible to follow the implementation of the strategy so that RTU can realise its vision.

The implementation of the RTU Strategy is approved by a decision of the RTU Senate. Following the approval of the Strategy, RTU Rector once a year ensures definition of the annual RTU aims and tasks with clear performance indicators set at the level of each RTU unit. RTU Strategy is implemented, and the results achieved are analysed annually with regard to the defined tasks.

RTU Strategy is published at https://www.rtu.lv/en/university/strategy.

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.

The structure and administration of RTU are established in compliance with the University vision, mission and objectives and taking into account the specifics of the University management. The administrative structure is based on a decentralized decision-making process and obligations arising from the Law on the Higher Education Institutions, the Constitution of RTU, resolutions of RTU Senate, the orders issued by the Rector, as well as other RTU documents. The functions of various organizational units have been approved in their regulations approved by the Senate.

On 16 August 2021, the amending laws to the Law on Higher Education Institutions entered into force, which envisages changes in the internal management model and the procedure for electing rector, as well as defines a new typology of higher education institutions, setting specific eligibility criteria for each type. According to the new typology, RTU corresponds to the status of a university of science. Changes in the Law on Higher Education Institutions are one of the most important steps to create a modern, effectively managed higher education system in Latvia, based on science and research, oriented towards excellence, being internationally competitive and stimulating the country's economic development.

In view of this, during 2021/2022 academic year RTU is undergoing an intensive change process. On 31 August 2021, the new regulations of the RTU Senate were approved, on 20 September 2021 the new RTU Senate was elected. The RTU’s Council was established in March 2022, a new Constitutional Assembly and a new Constitution must be developed and adopted by summer of 2022. From the management point of view, the changes included in the amendments to the law concern the election process of a rector, the appointment/ dismissal of deans, the establishment / reorganization of structural units based on the proposal of the rector.

The council of the higher education institution is a collegial highest decision-making body responsible for the sustainable development, strategic and financial supervision of the university, but the senate will be responsible for the development of university’s studies and scientific processes. The council must also ensure the operation of the state higher education institution in accordance with the goals set in its development strategy. The RTU Council consists of five representatives nominated by the RTU Senate, five external representatives of society or industry, who are not professionally related to the university, but whose presence allows the university to respond more flexibly to external changes and expand its strategic vision. The election of external representatives takes place in accordance with the regulations approved by the Cabinet, which ensures the transparency and political neutrality of the process. The council also has a representative nominated by the President of Latvia, thus facilitating strategical focus of the university according to development goals of the state.

Overall, RTU management can be divided into three levels: university level, administration level and faculty level.

At the University level, there is the Constitutional Assembly (200 representatives – 120 academic personnel representatives (60% of the total number), 40 student representatives (20% of the total number) and 40 general staff representatives (20% of the total number). The Assembly includes all 35 members of the RTU Senate, the other 165 members are elected by the central administration, faculties, and institutes that are not part of the faculties, study and science centres and the

students' self-government in the amount to ensure proportional representation. The conditions for the formation of the Assembly are defined in Part II of the RTU Constitution – see the file of Annex 01 of the list of Internal regulations).

There are 35 senators in the Senate, of which 27 are representatives of the academic staff (not less than 75% of the representatives, including at least 14 professors or associate professors – not less than 50% of the total number of senators), seven students (not less than 20% of the total number of senators) and the Rector is a member of the Senate in accordance with the position. The conditions for the election of the representatives of the Senate are defined in the attached Article 7 of the Regulation of the Senate of RTU – see the file of Annex 02 of the list of Internal regulations).

RTU Scientific Council, which consists of Deputy Deans in for research, Vice-Rector for Research, Deputy Vice-Rector for Research; and representatives of doctoral students; the Rector, Vice-Rector for Academic Affairs, Vice- Rector for Strategic Development, Vice-Rector for Finance, and the Chair of the Senate also have the rights of membership of the Council.

At the level of administration, the operational management of the university is exercised by the Rector, whereas the Board of the Rector plays an advisory role in the adoption of such decisions, with the participation of the Rector, Chair of the Senate, Vice-Rectors, Administrative Director, Deputy Rector for Digital Transformation, Deputy Rector for International Academic Cooperation and Studies, Director of the Legal Department, Director of Infrastructure Development Department, President of the Student Parliament; the Deans Council comprising the Rector, Deans, directors of studies and research centres, Director of Riga Business School, Chair of the Senate, Vice-Rectors, Deputy Rector for International Academic Cooperation and Studies, Director of Infrastructure Development Department, President of the Student Parliament; operational management meetings uniting the Rector, Administrative Director, Deputy Vice-Rector for Research in Scientific Work, the heads of administrative departments (department directors, unit managers). At the faculty level, the highest decision-making bodies are faculty councils whose composition depends on the size of the faculty.

External partners and stakeholders are involved in the University management through the RTU Advisory Board (27 members). It provides an opportunity to receive independent opinion on important issues and possible solutions from various perspectives. Each faculty also has its own Advisory Board, which provides its own vision for improving the supply of study programmes in line with sectoral needs and market trends.

Each faculty also has its own student self-government, while RTU Student Parliament coordinates faculty student self-governments. Students are represented in all RTU decision-making bodies and can therefore participate in the University strategic decision-making.

The Rector, Vice-Rector for Research, Vice-Rector for Academic Affairs, Vice-Rector for Finance and Vice-Rector for Strategic Development are the senior officials of RTU. The Rector implements the general administrative management of RTU and represents RTU without a specific mandate. The Rector is elected by the Constitutional Assembly for a period of five years for no more than two consecutive terms for the same person. The Rector is elected, approved in office and removed from office pursuant to the regulatory enactments governing higher education institutions.

The operational management of RTU is exercised independently, in accordance with the delegation of the Rector, by the Vice-Rector for Research, Vice-Rector for Academic Affairs, Vice-Rector for Strategic Development and Vice-Rector for Finance. The Senate elects the Vice-Rector for Research, Vice- Rector for Academic Affairs, Vice-Rector for Strategic Development and Vice-Rector for Finance based on the recommendation of the Rector for the term of office of the Rector. The Rector may also delegate certain functions to other RTU officials and, on the basis of the Rector's proposal;

other Vice-Rector positions may be created by a Senate decision.

The Vice-Rector for Research supervises and is responsible for Doctoral study programmes and research work, including support to young researchers, research infrastructure, research funding, applied research, intellectual property protection, RTU scientific publications and scientific conferences. The Vice-Rector for Academic Affairs supervises and is responsible for the study process at the Bachelor, Master, first and second-level professional study programmes, further education, including training programs, security and quality assurance in studies, credit points, determination of academic staff positions and workload, as well as the selection and admission of students. The Vice-Rector for Strategic Development is responsible for the development strategy and its successful implementation, supervises the implementation of projects important for the development of RTU, and represents the interests of RTU in interaction with public authorities, partners and the public. The Vice-Rector for Finance is responsible for the financial management processes of RTU and for allocating and planning financial resources to ensure the functioning of RTU and implementation of the development strategy.

The accounting, study administration, science administration and human resources administration at the university are centralized. Other administrative processes, such as procurement and project management, are centralized to the extent necessary to avoid institutional risks. At the same time, a decentralized management system has been provided at a high level at RTU, with a certain degree of autonomy for each academic unit. This means they have their own budget and self-governing structure, which allows defining and meeting the objectives of the organizational unit. This approach motivates the heads of departments to be proactive, to plan the development of the unit, and to apply for funding.

RTU governance structure information is published at https://www.rtu.lv/en/university/structure-and-administration.

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.

The RTU has established an internal quality management system that respects the standards of Part 1 of the Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG).

RTU internal quality management system works in line with the “Excellence approach” (approved on 30 January 2017 at the meeting of the RTU Senate, Minutes No 606), as well as the “RTU Quality Policy” (approved by the Senate on 25 September 2017, Minutes No 612).

The Quality Policy is focused on the implementation of the RTU mission and the achievement of the strategic objectives. The Quality Policy lays out the framework and pathways for development and improvements of the RTU Strategy, research, study process and organization. The University Quality Policy is aligned with the European Association for Quality Assurance in Higher Education (ENQA) standards and guidelines. The RTU Excellence Approach and quality policy are mutually integrated documents which require RTU to use the quality model of the European Foundation for Quality Management (EFQM).

The EFQM quality model assumes cooperation with student representatives, partners, professional

associations, student organizations, other higher education institutions, businesses and organizations. RTU maintains an open dialogue to explore the needs of the parties involved and to respond appropriately by developing feedback to day-to-day and long-term cooperation.

By establishing links with the parties involved, the administration of RTU contributes to the development of excellence and ensures the clarity, unity, building of the work environment and diversity management of the objectives to be achieved.

RTU staff participates in quality assurance by providing suggestions and feedback to improve the RTU quality system. The heads of the RTU departments are responsible for carrying out internal quality assurance procedures and processes in their departments.

Based on the results of regular student and graduate surveys, improvements in the quality of the study process are being planned.

Cooperation with partners, suppliers and other stakeholders takes place in accordance with the RTU Strategy, establishing appropriate cooperation networks and identifying appropriate policies, activities and processes for effective cooperation aimed at ensuring the quality of the RTU and acquisition of feedback. To ensure the topicality and continuous development of existing study programmes and before the introduction of new study programmes the interests of all stakeholders in modern and interdisciplinary technology education are considered.

External stakeholders (public authorities, cooperation partners, representatives of the public) assess the study process and its results in State Examinations, practical placements (internships) and accreditation, and contribute to improving the content and quality of study programmes.

More on this point is set out in Section 2.1.1.

RTU Excellence Approach is published at https://www.rtu.lv/en/university/strategy/rtu-excellence-approach.

RTU Quality Policy in Latvian is published at https://www.rtu.lv/lv/universitate/dokumenti/kvalitates-politika (The English translation is in the file of Appendix 03 of the List Internal regulations).

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.	In line with the quality model introduced by RTU, process analysis and improvement are ongoing. Performance indicators and the results of the assessment of various surveys are analysed. The quality report data are compiled after the end of the academic year. Annual agreements on the target study process performance indicators are signed with the faculties; the quality is assessed by analysing the achievement of the defined objectives relative to the plan. For more details, see the 5th row of this table.

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.	The development of study programmes takes place in accordance with the “Procedure for the application, elaboration and amendment of the study programmes” (approved at the Meeting of RTU Senate on 26 April 2021, Minutes No 649). The departments and institutes implementing the study process, Faculty Councils, the Office of Vice-Rector for Academic Affairs, the Student Parliament and the Senate are involved in ensuring the internal study quality of RTU. These institutions carry out comprehensive assessment of the new study fields and study programmes, the changes to the study fields and programs and the annual reports of the improvement of the study fields. At RTU, the operation of the internal quality assurance mechanism takes place at the level of the Rectorate, faculties, study fields and study programmes. At the level of the Rectorate, the internal study quality control of RTU is carried out by the Office of Vice-Rector for Academic Affairs. The Study Department performs: (1) the maintenance and control of the Study Programme Register, which involves control of the conformity of the study curriculum to the aims, tasks and learning outcomes of the study programme, as well as the control of changes; (2) maintenance and control of the Study Course Register, which involves control of the conformity of study course descriptions with the learning outcomes, as well as quality control of study course descriptions; (3) periodical student polling at the University level.
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.	The evaluation of learning outcomes takes place in accordance with the “Regulation on the Assessment of Learning Outcomes” (approved at the Meeting of RTU Senate on 29 May 2017, Minutes No 610) and “Regulation on Final Examinations at RTU” (approved at the Meeting of RTU Senate on 26 April 2021, Minutes No 649).

4.	Internal procedures and mechanisms for assuring the qualifications of the academic staff and the work quality have been developed.	In order to ensure the qualification and performance quality of academic staff, professional advancement needs are regularly assessed when evaluating the results. Professional advancement training modules are developed by collecting information from: (1) academic staff surveys on professional advancement needs once in two years; (2) analysis of student polling results; (3) cooperation with student self-governments; (4) world trends and good practices of other Latvian universities in the field of professional advancement of academic staff; (5) information provided by academic staff on professional advancement topics of interest; (6) proposals from the heads of academic units for professional advancement of academic staff. The Centre for Academic Excellence (CAE), a teaching and learning centre, was set up at the end of 2018; its aim is to develop a strategy for the professional advancement of academic staff, including in line with Article 16 of Cabinet Regulations No. 569. Other tasks of CAE are detailed in Section 3.5. Academic units organize regular or one-time professional advancement activities having assessed the need for professional training of academic staff. The units assess whether it is more appropriate to participate in a particular event for certain representatives of academic staff, all members of the unit or to invite also members from other units.

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.	Student expectations and satisfaction with the curriculum and study process are identified in sequential and planned surveys at all stages of study. Student surveys are organized in accordance with the Regulations on “Student Polling for Assessment of the Study Process” (approved by the resolution of RTU Vice-Rector for Academic Affairs No 02000-1.1-e/8 as of 1 February 2021). The aim of polling is to clarify the adaptation of first year students to the university system and the satisfaction of all students with the study process, lectures, and practical classes after each semester, the satisfaction of students with the services offered by the University, and the overall satisfaction of graduates with the study programme. The results of the surveys are available to academic staff, heads of organizational units and students in a summarized form. Annually, the State Revenue Service provides information on employment of RTU graduates. The Total Quality Management System of RTU analyses performance results of the study process, comparing the characteristics of the study programmes, including the resulting performance indicators related to the study process in the overall EFQM quality model of RTU. At the beginning of September of each year, a faculty Activity Plan on study process indicators is drawn up: (1) number of students; (2) number of graduates; (3) number of graduates who complete their studies on time; (4) number of students expelled from University; (5) number of foreign students; (6) average age of elected academic staff; (7) number of study programmes implemented in English; (8) average indicator of the evaluation of faculty academic staff; (9) number of persons with a scientific degree elected to academic positions (%); (10) number of foreign guest lecturers. The established Faculty Study Activity Plans for the following year are drawn up by Faculty Deans, together with Deputy Deans for Academic Affairs and institute directors; they are approved by the Rector of RTU. RTU administration meets with representatives of faculties to evaluate the faculty activity plans on study process indicators, evaluating the progress in the previous academic year and defining the indicators to be achieved in the next two academic years. These indicators are used to monitor study process performance of the faculty. These indicators and other aspects influence the amount of performance-based funding allocated to the faculty and contribute to the achievement of the objectives set forward in the RTU Strategy. The study process funds are administered in accordance with methodologies approved by the Senate or as stipulated by the Vice-Rector for Finance. Principles of the methodologies motivate the heads of departments to be proactive, to plan the development of the unit, and to apply for funding. These methodologies are described in more detail in section 2.3.1. of the self-assessment report.

6.	The higher education institution/ college shall ensure continuous improvement, development, and efficient performance of the study field whilst implementing their quality assurance systems.	At the level of the faculty and study field, internal quality is ensured by the Faculty Council, the Study field Committee and Directors of the study field, Directors of the study programmes, administration of the institutes and chairs implementing study programmes. Within the framework of the study programme, internal quality is ensured by the program director and by the academic staff implementing the program. Internal quality control at the level of the study programme is carried out by the administration of the relevant institute or chair. In order to ensure continuous development of the study programmes, RTU Study field Committees monitor academic activities in the relevant study field and are responsible for the curriculum and quality of the study programmes within the study field, including the accreditation of the study field. Inclusion of employer representatives in the Study field Committee is a mandatory requirement. Study field Committee acts in accordance with the “Regulation of the Study field Committee” (approved by the Resolution of RTU Senate Meeting on 26 April 2021, Minutes No 649). The basic tasks of the Study field Committee are: (1) to analyse the situation in the labour market and make suggestions for the development of new study programmes as well as for the closure of the outdated study programmes; (2) to carry out expert assessment of the curriculum and quality of the study programmes, assess their compliance with the defined objectives and compliance with the research area represented and labour market requirements; (3) to organize and monitor the accreditation of the study field and the licensing of study programmes; (4) to analyse the assessment and recommendations made by external experts and organize elimination of identified shortcomings; (5) to carry out an analysis of the study field self-assessment report as well as the annual reports on study field development activities; (6) in order to achieve strategic objectives of the University, to assess the proposed changes to study programmes with a view to increasing the quality of all study programmes included in the study fields; (7) to analyse the results of student, graduate and employee surveys and organize elimination of identified shortcomings, as well as organize additional surveys.

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.

By decision No.75 of the Study Accreditation Committee of the Ministry of Education and Science of the Republic of Latvia of 31 May 2013, the study field “Physics, Material Science, Mathematics and Statistics” was accredited until 30 May 2019. In accordance with amendments to the Law on Institutions of Higher Education, the period of accreditation was extended until the decision on new accreditation is made, but no longer than until 31 December 2023. The study field is implemented by two faculties of RTU – institutes and departments of the Faculty of Material Science and Applied Chemistry and the Faculty of Computer Science and Information Technology: the Institute of Polymer Materials (IPM), the Institute of Technical Physics (ITP), the Institute of Materials and

Surface Engineering (IMSE), the Institute of Applied Mathematics at the Department of Probability Theory and Mathematical Statistics (IAM DPTMS) and the Center of High Energy Physics and Accelerator Technology subordinate to the Vice-Rector for Research. A total of 9 study programmes are implemented in the study field, 5 of which are directed for the accreditation. The study firld includes several study programmes that are unique in Latvia.

The existence of the study field "Physics, Material Science, Mathematics and Statistics" in the leading technical higher education institution in Latvia is an important precondition for the preparation of specialists in several areas (financial statistics, material science, physics) and the implementation of scientific projects in these fields of science. The study programmes implemented in the field focus directly on the achievement of Latvia's sustainability goals: smart energy, knowledge-intensive bioeconomy, as well as smart materials, technologies and engineering systems. The study programmes included in the study field cover 3 levels of studies (Bachelor, Master and Doctoral):

The academic bachelor's study programme "Materials Engineering" prepares highly qualified professionals for responsible work in the field of material science and engineering, with comprehensive theoretical knowledge, practical skills and competences suitable for both master studies and career development in sectors relevant to the national economy in accordance with the priorities defined in https://www.pkc.gov.lv/lv/nap2027 (in Latvian).

Academic master's study programme "Material Science and Nanotechnologies" prepares progressively thinking specialists, focused on the implementation of new technologies and knowledge, leading specialists fit for work in material science and high value added industries, including nanotechnologies, with specialisation in the following fields – Materials Physics, Biomaterials, Traditional Inorganic Materials and Nanomaterials and Polymeric Materials and Composites (including Nanocomposites), as well as doctoral studies.

Practices in the production or development of a scientific project, including in RTU partner universities within the framework of ERASMUS+ mobility, are an integral part of both study programmes.

Compared to the supply of foreign technical universities, each of these clearly interdisciplinary study programmes is unique in the mastering of the complex of study courses implemented within the provided specialisations, and it is therefore considered that they successfully complement the European area of higher education and lifelong learning, enabling graduates of the RTU study programme to obtain high quality higher education for competitive involvement in the European labour market.

The aim of the professional Bachelor study program "Financial Engineering" is to educate and train internationally competitive and dynamic specialists that meet the requirements of the national economy, who, using the latest information technology (IT) achievements, can perform work related to the management of financial activities, perform analysis of business processes; analyze, model and forecast financial flows; optimizing portfolios and investments in securities portfolios and investments through IT; identify problems, formulate objectives, anticipate pathways to achieve them and implement them.

The objective of *the academic master's study programme "Financial Engineering Mathematics"* is to provide deep knowledge in the fields of mathematics, financial and actuarial technologies, with a view to providing higher level technical education for graduates of the study programme who will work in the financial sector, including work in the analytical departments of credit institutions, financial consulting companies, financial management and financial advisory companies, insurance companies and companies engaged in investment in financial markets, as well as to continue

education by increasing professional competence, including in doctoral study programmes.

Doctoral study programme "Particle Physics and Accelerator Technologies" is implemented in cooperation with the University of Latvia (UL). Graduates of the study programme will acquire a scientific doctoral degree in physics and astronomy or mechanical engineering and mechanics. Its implementation started in the autumn semester of 2021. The development of the study programme and its content and structure have been developed in close cooperation with CERN Baltic Group. It is an official, statute-based, international group, in which leading Baltic universities and research institutes cooperate. The main objectives of the study programme are: to prepare internationally competitive researchers to work in universities and research laboratories, as well as a highly qualified and innovative workforce in general; to provide opportunities otherwise unavailable in Latvia for research in high energy physics and accelerator technologies, thereby providing a counterweight to the brain drain from the country; to grow Latvia's scientific capacity in high energy physics and accelerator technology research, as well as the capacity of natural sciences and engineering sciences in general.

The study programme is up-to-date, modern and relevant to developments in both European and global fields of science. The development of high energy physics and accelerator technologies is a modern field of science that is expected to be topical for a very long time. Therefore, this programme also has extremely high prospects for development and sustainability.

The uniqueness of this study programme in the regions of Northern Europe and the Baltic States is its interdisciplinarity within natural sciences and engineering sciences. The proposed specialisations of the study programme – physics and accelerators – are different but fundamentally linked. The training in these two specialisations in a single study programme, as well as the possibility of attending study courses of both specialisations for all enrolled students promote knowledge transfer and interdisciplinarity.

All five study programmes included in the study field are unique and, at the moment, the only ones in Latvia. In Latvia's current situation, the creation of innovative products with high added value and the start of their production along with the development of innovative financial engineering are very important. The study field, in which the study programmes are combined, is relatively largely based on natural sciences and mathematics, is one of the main sources of young specialists who are able to think exactly and technically and get creatively involved in addressing the mentioned developments. In Latvia, in the education of professionals capable of creating innovative materials and new material technology and in the creation of these innovative materials and technologies unique is the fact that the RTU Kipsala campus has in one place the creative engineering potential of physicists, chemists, chemical technologists, biotechnologists, textile designers, electrical engineers, builders, architects and the general creative engineering potential. Academic study programmes of both levels in material sciences, the doctoral study programme "Particle Physics and Accelerator Technologies" were most directly involved and the professional study programme "Financial Engineering" and the academic study programme "Financial Engineering Mathematics" were indirectly involved in one of the new priority fields of the Latvian science for 2014-2017 "Innovative and advanced materials, smart technologies – multifunctional materials and composites; nanotechnologies and photonics; informatics; computer science; information and communication technologies, signal processing technologies".

The increase in the number of financial products and market development lead to high demand for professionals able to create, evaluate and hedge derivative securities, manage financial risks in many areas of the national economy. In order to acquire such skills, knowledge of mathematics, management and computer technology is required. Today there is a great demand for good QUANTS in the world. These are specialists who can construct a new programme and an algorithm

for making financial decisions using modern economic and mathematical techniques.

In the world, financial engineers are prepared in faculties of mathematics, economics and information science. The professional bachelor's study programme "Financial Engineering" has been created as an interfaculty study programme, in cooperation with the Faculty of Computer Science and Information Technology and the Faculty of Engineering Economics and Management. The Department of Probability Theory and Mathematical Statistics is involved in the study programme, which is also responsible for teaching study courses in mathematics. In this respect, the RTU professional bachelor's study programme "Financial Engineering" together with the academic master's study programme "Financial Engineering Mathematics" are unique because only these study programmes, along with mathematics and economic study courses, offer to acquire computer technology study courses, such as Programming Languages, Database Management Systems, Introduction to Computer Networks, Application Software, Applied Computer Systems Software, Large Databases, Algorithmization and Programming of Solutions, Data Structures.

Consequently, the main difference between the study programmes "Financial Engineering" and the "Financial Engineering Mathematics" and other similar study programmes is that more information technology study courses are offered.

These achievements and descriptions of study programmes show the high level and the development potential of the study field at the Latvian, regional and international level and its readiness to extend the availability of its study programmes for export, as provided for by the National Development Plan of Latvia. The "Latvia 2030" development plan marks the increase in labour productivity as one of the targets for Latvia and its entrepreneurs. Graduates of study programmes of the field occupy executive positions in Latvian companies and state institutions, and therefore implement this setting directly.

Study programmes of the study field have both professional and academic orientation and prepare a broad range of specialists, both in the field of manufacturing and in the field of information processing and analysis, as well as for research activities. Specialists of study programmes of the study field work in manufacturing companies, the banking sector, as well as research institutes and higher education institutions by occupying managing and executive positions at all levels.

Joint study programmes of the study field were created and started at different times, in line with applicable regulatory documents. The professional study programme included in the study field corresponds also to the profession standards applicable to the qualification to be obtained as a result of mastering of the study programme.

Study programmes of both levels in material science are also offered in English. In the doctoral study programme "Particle Physics and Accelerator Technologies", thanks to its international nature and the recruitment of teaching staff from several higher education institutions, the entire study process is offered in English.

The development strategy of the study field is based on the RTU development strategy for 2021-2025, the main priorities of which are internationalisation and interdisciplinarity, and the strategic objectives of the study field are harmonised with the strategic objectives of RTU:

Excellence in studies – motivated, high-quality and internationally recognised studies, which guarantee the ability of students to acquire the latest knowledge and to learn the most advanced technologies and methods in the relevant sectors, to develop an independent, analytical and creative approach to solving any problem, and to develop the students' confidence that every problem can be solved and resolved;

- Excellence in scientific activity – scientific research integrated into the high-level study

process carried out within the framework of international, public and private organisation programmes, projects and contract work and promoting innovation and technology transfer;
- Infrastructure excellence – modern, international research and science infrastructure meeting international standards, which is concentrated at the Ķīpsala and Meža Street campus;
- Excellence and visibility of the organisation – democratic, efficient and modern university work organisation that promotes the excellence of studies and scientific activities, as well as the visibility of the RTU worldwide.

An important objective of the study field is to prepare internationally acknowledged, highly qualified specialists in different fields of physics, material science and statistics, therefore the general objectives and learning outcomes of the study field are formulated as follows:

- to develop analytical critical thinking in students and to promote interest in the processes taking place in society analysing the development trends in specific industries, analysing and evaluating the situation in companies, state and regional economy in general and in different fields of science;
- to master knowledge and improve professional abilities and skills in the selected study programme by demonstrating appropriate academic performance and learning outcomes in each course and integrating them into research;
- to foster mastering of research work skills by drafting study papers within different courses and graduation papers at the end of studies;
- to develop skills in identifying problems, formulating objectives and their resolution, offering practical solutions to individual problems within the scope of study courses and in the graduation paper at the end of studies;
- as a result of the study process to develop intellect of students, promote their improvement, foster the use of intellectual skills in the study process and in their practical activities.

In turn, the goals of the study programmes within the study field are subordinated to the goal of the study field, forming an integrated system, while at the same time reflecting the specificities of each study:

1) The objective of the academic bachelor's study programme "Materials Engineering" is to provide students with theoretical basic knowledge of material sciences, independent acquisition of professional work skills and basic research in design, production, quality assessment of materials and other related areas, as well as to prepare students for further master studies or obtaining higher professional qualification.

2) The objective of the academic master's study programme "Material Science and Nanotechnologies" is to prepare systemically and engineering-minded and capable specialists for independent creative work in the fields of design of materials, development and design of technological processes for manufacturing materials, testing and quality assurance of materials, certification and marketing of materials, nanomaterials and nanotechnologies, and specifically inorganic, organic and polymeric nanomaterials, nanobiomaterial, who know nanomaterials extraction technologies and know how to use them in scientific research activity, as well as for creative scientific activities and further doctoral studies.

3) The objective of the professional bachelor's study programme "Financial Engineering" is to prepare internationally competitive and dynamic professionals meeting the requirements of the national economy, who use the latest developments in information technology (IT) to carry out works related to the management of financial operations, to analyse business processes; to analyse, model and forecast financial flows; to optimise securities portfolios and investments using IT; to identify problems, to formulate objectives, to predict ways to achieve them and implement them.

4) The objective of the academic master's study programme "Financial Engineering Mathematics" is to provide deep knowledge in the fields of mathematics, financial and actuarial technologies, with a view to providing higher level technical education for graduates of the study programme who will work in the financial sector, including work in the analytical departments of credit institutions, financial consulting companies, financial management and financial advisory companies, insurance companies and companies engaged in investment in financial markets, as well as to continue education by increasing professional competence, including in doctoral study programmes.

5) The objective of the doctoral study programme "Particle Physics and Accelerator Technologies" is to ensure the possibility of performing doctoral studies and obtaining a doctoral degree in high energy physics and accelerator technologies in Latvia.

The development strategy of RTU is implemented as part of the process of building the future of European engineering education. On 9 October 2015, RTU became a member of the Conference of European Schools for Advanced Engineering Education and Research or CESAER, and the university is now cooperating in engineering education, research and innovation policy making, which is on the agenda of the European Commission (EC). RTU is currently participating in three CESAER expert task forces: Human Resources, Innovation and Scientific Engineering Education – TFSEE. The last one has been created for CESAER experts to proactively influence European policies in tertiary education in general, including by expressing their opinions and ensuring representation of interests of science and technology universities in the European Higher Education Area and in the initiative "New Skills Agenda for Europe", and in particular in STEAAM (Science, Technology, Engineering, Architecture, Arts and Mathematics) education. Expert task forces work in order to flexibly and quickly respond to the demand of European institutions and to offer support and solutions in different decision-making.

Tertiary education policies in Europe are created by collective decisions of countries and by international organisations. The European University Association (EUA) is one of the most important organisations shaping and influencing the European Higher Education Area. In 2017, RTU received the EUA evaluation for the second time and was awarded the right to use the logo of the Institutional Evaluation Programme (IEP) of the European University Association for 5 years.

Strategic objectives of the Faculty of Materials Science and Applied Chemistry (FMSAC) and the Faculty of Computer Science and Information Technology (FCSIT) relating to the RTU strategy:

FMSAC is an independent RTU structural unit, which, thanks to the potential of highly qualified teaching staff, provides not only high quality studies for bachelor, master, doctoral and engineering education and professional qualification in the priority sectors of Latvian higher education: in natural sciences, engineering, environmental protection and creative industries, in particular material science, chemical science, chemical technology engineering and material technology and design, but also provide basic education in chemistry, material science and physics for all RTU students. The RTU FMSAC is also an important national scientific research centre in chemistry and physics, material science and chemical technology, with a view to ensuring high-quality scientific research vital to the future of the Latvian economy.

Objectives of FCSIT for the period of the strategy are to achieve excellence in scientific research, high quality and sustainable innovation and commercialisation, as well as to make an excellent contribution to the implementation of the overall RTU strategy.

One of the most important indicators proving compliance of the study field with development needs and development trends of society and the national economy, as well as the needs of the prepared specialists in the market is employment of graduates. One of the ways for the management of study programmes of the study field to obtain information about the quality of the study

programme and its compliance with labour market requirements are close contacts with employers – companies, institutions and organisations, as well as graduates.

In the survey conducted by the Employer's Confederation of Latvia (LDDK) RTU was recognised as an institution that is most recommended and acknowledged by employers and it is on the honourable 1st place in this rating every year. This is an evaluation of Latvian higher education institutions created by the Latvian portal Prakse.lv and LDDK. It evaluated which professions were necessary on the labour market at that moment and which higher education institution was able to prepare the best specialists for competitive companies. Such an evaluation has been prepared for the purposes of helping graduates of basic schools and secondary schools to make the correct choice of their profession and higher education institution. It was recognised that RTU was an example of ensuring a real link between studies and the real labour market. In order to evaluate compliance of study programmes of the study field with labour market requirements and employment opportunities of graduates of the study programme, a survey of employers or focus group interviews were conducted in all study programmes. Respondents of the survey are CEOs of internship companies, who often also are graduates of study programmes and cooperation partners. They were urged to objectively evaluate the specific study programme, knowledge and skills of graduates of the study programme and their compliance with labour market requirements, as well as to forecast employment opportunities of graduates. The results of these surveys can be obtained from heads of study programmes and analysed in the description of the study programme.

Looking back at recent years and analysing information from industry partners, it is clear that demand for specialists in the field of material science in the world and Latvia has remained persistently high, which is linked to economic growth and production growth, which is largely driven by the development of innovative materials and technologies. Therefore, new material application solutions and technologies based on them are the basis for innovation, which is the driver of the long-term growth of the economy on a global scale (Materials for sustainable development, MRS Bulletin (Special Issue), April, 2012, Vol. 37, No. 4, www.mrs.org/bulletin). The main manufacturing industries of Latvia, including woodworking, food industry, metalworking, chemical industry, light industry, electrical and optical equipment manufacturing, machinery and equipment manufacturing, energy industry, transport industry, medical services, as well as competitive and sustainable development of other economic sectors is inconceivable without a well-founded choice of materials and the use of technology based on them. With the development of these sectors, particularly in the field of development of high value added products and services, the demand for qualified workforce is becoming increasingly more pronounced (N.Ozols, Analytics Service of the Ministry of Economics, System of labour market forecasts and better matching and anticipating labour market needs: Current situation and future developments). Thus, the competitive development of the economic sectors of industry, agriculture and services should be seen in a close context with the scientific, technological development and innovation guidelines, an integral part of which is qualified for manufacturer-oriented education and excellence in science, which is the basis for high future demand for graduates of the study programme in both the commercial and academic sectors (Indictive list of sectoral policy guidelines for the programming period 2021-2027; Informative report of the Ministry of Economics on medium and long-term labour market forecasts; Baltic International Bank, Latvian Barometer, Economy, No.110, January 2018; Science, Technology Development and Innovation Guidelines 2014-2020 (CM Order No. 685 of 28 December 2013); National Industrial Policy Guidelines 2014-2020 (CM Order No.282 of 28 June 2013); Energy Development Guidelines 2016-2020 (CM Order No.129 of 9 February 2016).

Along with the development of new materials for applications in innovative solutions, it is necessary to assess the state of materials in existing applications that are relevant in terms of safety, as well

as in historical applications that are relevant in the context of preservation of cultural heritage. The use of suitable, technically relevant and environment and health friendly materials is the basis for sustainable construction, which is also one of the main sectors in Latvia. According to the Ministry of Economics, "there is a need for change in the construction sector, increasing its productivity, innovation, export capacity, and highlighting the achievements of the sector", which is based on the importance of preparing high-quality specialists for each construction profession (https://www.em.gov.lv/lv/buvniecibas-nozare-attistiba-strategija-un-petijumi) (in Latvian). It can therefore be concluded that there will also be an increase in demand for qualified specialists in the development of innovative construction materials, which is one of the basic needs for local manufacturers of construction materials to ensure development and to remain competitive, not only on domestic but also on the international market.

On the other hand, the in-depth technical knowledge regarding the structure of materials and the protection against ageing processes necessary for the preservation of material cultural heritage is topical in the conservation and restoration sector, in parallel with the professional training already provided at the level of vocational schools on the one hand, as well as mainly in study programmes in humanities on the other, which are currently being implemented in Latvia. In order to ensure effective preservation of the national cultural heritage, specialists with sufficient theoretical knowledge of the dependence of the structure and properties of materials on the exposure to aggressive environmental effects, as well as the practical use of modern analytical methods, as a prerequisite for the development of effective methods of conservation and restauration of materials. The development of effective conservation and restoration techniques is particularly relevant in this context for the preservation of the most recent materials, including objects of art made of polymers, as well as commercial products served in the past for more than 100 years. This problem has recently been the focus of the growing attention of representatives of European academic environments and museum employees, by developing a COST mobility project "Plastics Heritage European Network (PHEN)" in this area.

The analysis of employment shows that new positions and categories of positions appear in the field of finances and insurance. The demand for such specialists will grow year on year. Such a conclusion can be made, when analysing the dynamics of job announcements in the field of finances and insurance. According to the data of *Forbes*, in the last 5 years 120 new positions and specialisations in the field of finances have appeared and approximately 4800 graduates have obtained bachelor and master degrees all over the world every year.

The interest for such specialists has been growing year on year. According to portals CV-Online and Prakse.lv (https://www.cv.lv and https://www.prakse.lv/) (in Latvian) the number of job announcements in the field of finances and insurance have not been less than 200 in the last 3 years. By demand, specialists of this sector are in the 3rd place after IT and transport/logistics specialists (approximately 200-250 requests per quarter). Therefore, our forecasts show that the number of vacancies for specialists with a "master's degree in mathematics" can reach 250 to 300 places over the next 10 years.

Doctoral studies create the necessary intellectual potential for economic and intellectual development of the state. Pursuant to the "Sustainable Development Strategy of Latvia until 2030", long-term investments in human capital are required to promote the renewal of human resources, therefore the demand for specialists with a doctoral degree in natural and engineering sciences and on the labour market in Latvia is very high.

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.

In order to ensure the quality of the study field, a report on the improvement of the study field was drafted annually (until 2018). The report was evaluated by an expert appointed by the Vice-Rector for Academic Affairs and approved by the RTU Senate. The annual reports on the study field improvement (until 2018) are available at https://www.rtu.lv/lv/universitate/dokumenti/studiju-virzienu-ikgadejie-parskati (only in Latvian). SWOT analysis is an integral part of the improvement report, which allows focusing on the achievements and highlighting the problems. It is an essential tool for achieving the aims of the study field. The development of the study field is part of RTU Strategy, which allows considering the aspects of the study field SWOT in the context of RTU Strategy, which examines the internal and external factors separately.

SWOT analysis of the study field.

Strengths:

- Interdisciplinary, unique and modern study programmes preparing Bachelor, Master and doctoral level specialists in sectors important for the economy;
- Developed research and teaching infrastructure, modern scientific laboratories and fully equipped auditoriums, excellent digital infrastructure (ORTUS, Use Science, databases of publications, E-resources, etc.) and the use of the ORTUS portal in the study process;
- Professional and qualified staff with both academic, practical and research experience in the field of studies, combining teaching work with research work in the respective field of science, who regularly improve their competences and ensure that the study process is provided also in English.
- Active cooperation with Latvian employers' unions and associations, businessmen and state institutions, which provide good career opportunities for graduates;
- Democratic relations between administration, academic staff and students, students participate in decision-making and the development and improvement of the study processes, there is academic fairness policy. Student Self-Governments of FCSIT and FMSAC are represented and actively participate in the activity of decision making institutions of faculties (faculty Council).
- Integrated research and study process, extensive opportunities to participate in local and international scientific conferences and seminars (for both students and staff). Extensive modern and accessible RTU library, which is accessible to students 24/7, latest sectoral research and learning literature in the study process.
- Governance of the study field ensures continuous development and quality control of the study process. The quality system at RTU has been created as an RTU excellence approach, which ensures qualitative studies and research, as well as continuous improvement.
- Extensive international partnership and cooperation with foreign universities, including universities accredited by EFMD *(European Foundation for Management Development)*.

Weaknesses:

- Different levels of initial preparedness of students and motivation of students. Part of students have insufficient motivation for studies, which leads to considerable student drop-outs in the first year of studies.
- Academic staff is loaded with work, thus insufficient capacity hampers strengthening of individual work with a student or hampers the implementation of the student-centred approach;
- Insufficient level of state budget funding, which hampers the flexible and effective involvement of foreign teaching staff and industry professionals in the study process and research;
- Insufficiently developed international brand of RTU to successfully compete with universities of the same level in other countries in attraction of foreign students.

Opportunities:

- Extensive opportunities for studies in a foreign higher education institution within exchange programmes, participation in academic staff mobility programmes, gaining international experience in different research and teaching projects, etc.
- Applied and fundamental research in physics, material science and mathematics, extensive involvement of students of all levels of study programmes in research;
- Interest of active and successful entrepreneurs and professionals in sharing their experience and knowledge, enabling them to engage in the implementation of the study process and creating all types of cooperation (visiting lectures, field trips to companies, contract research, etc.) opportunities;
- Possibility to offer qualification improvement courses to companies in line with the specifics of the sector;
- Digital infrastructure and its use allow to teach both full-time and part-time students, including the opportunities provided by videoconferencing in auditoriums, can help to improve the range of services and attract students who cannot attend lectures on a regular basis

Threats:

- Lack of a sustainable development strategy in Latvian higher education policy;
- Insufficient public funding for the implementation and development of study programmes;
- Heavy, administratively complicated and bureaucratised system for the absorption of EU Structural Fund project funding, which can create significant challenges to participate in these projects in the future; it limits the possibility of using funds of the Structural Funds to carry out the activities really necessary for the training process and requires a big contribution of teaching staff to the preparation of reports and fulfilment of other administrative formalities;
- By combining full-time studies with work, students cannot be fully involved in the study process, this causes problems in achieving the planned learning outcomes, as well as problems of not completing their studies;
- Insufficient amount of scholarships offered by mobility programmes to make full use of mobility programmes can reduce student mobility, since the costs of living in many European countries are very high.
- A wide range of study programmes in Latvia and, at the same time, the growing supply of foreign universities, as well as the migration of young people and the demographic situation lead to a reduction in the number of applicants;
- Rapidly evolving technologies create potential for violations of academic integrity and their

failure to restrict them may lead to a decline in the quality and prestige of studies;
- The expanded availability of MOOCs (Massive Open Online Courses) and their recognition in workplaces contribute to changing student choice and switching from face-to-face studies to distance or virtual studies which can have a significant impact on future investments in higher education infrastructure.

To prevent weaknesses, matters of interest for students and staff are addressed in line with their significance and objectives pursued in the study field in general and in each study programme separately. There is a regular exchange of experience. For example, by specifying the minimum enrolment requirements defined in programmes of the study field, as well as by setting up the Engineering High School. RTU services of the vice-rector for research and the vice-rector for development carry out regular activities to reduce shortcomings in research and in the study process.

To avoid the identified threats, the competitiveness of RTU in Latvia and beyond is increased. To avoid a reduction in the number of students, the planning of the study programme is optimised on a regular basis (at least once a semester), as well as study courses are updated and improved in line with world and local industry developments. Involvement of new teaching staff in international academic and research projects. In cooperation with industry representatives and associations, society and, in particular, pupils of senior years, are informed about the importance of STEM areas in promoting the well-being of the state and each individual. FMSAC is involved in the Latvian education reform by offering cooperation in the acquisition of the Chemistry II and Physics II courses and in the development of the Project work. In this way, pupils of grade 12 will be presented with study opportunities at RTU and, in particular, in the study programmes provided by FMSAC.

To take advantage of the identified opportunities, all activities of the study field are organised, to strengthen the reputation of study programmes and to establish cooperation with other countries' organisations and universities. The involvement of students and staff in mobility projects, as well as the establishment of new cooperation contacts, provide opportunities for new research projects and exchange of experience.

The prospects of the development of the study field are linked to the continued provision of high quality, prestige, internationally recognised study programmes, which teach critical perception and creative processing of information, analytical thinking, development of engineering capabilities and lifelong self-education by preparing competitive professionals for the international labour market. The study process of the study field is linked to scientific research in the field of industry. The prospects for the development of the study field stem from the significant importance of the economic sector of this direction in the development of Latvia's economy. The development of innovative products to boost the economy is gaining increasing demand for both manufacturing and services. So there are intentions to include in study programmes of the study field studies promoting innovative and research activities through mastering a wide range of synergistic natural sciences and engineering sciences.

Development measures, as well as measures to address weaknesses and threats, are appended in "Development plan".

The study direction development plan is developed for the accreditation period and study program directors and leading academic staff are involved in its development. The development of the study direction development plan includes several stages: development of the plan, gathering information on study program development and improvement measures, discussion of the plan in the study direction commission and its approval at the level of university structural units involved in the implementation of the study direction.

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.

The management of the study field and the corresponding study programmes is generally provided by the Council of the FMSAC, the Council of the FCSIT, the Study field Committee and the director of the study field, the directors of the study programmes, the administration of the institutes or departments, implementing the study programme, and the Student Self-Government of FMSAC and FCSIT. The study field "Physics, Material Science, Mathematics and Statistics" at RTU is implemented in three structural units: at the Faculty of Material Science and Applied Chemistry, the Faculty of Computer Science and Information Technology, as well as the Center of High Energy Physics and Accelerator Technology, which, in cooperation with the University of Latvia, implements the doctoral study programme "High Energy Particle Physics and Accelerator Technologies". The study field has 5 study programmes in total and they are led by 3 directors of study programmes. The Study field Committee includes directors of all study programmes, leading teaching staff, representatives of employers and a representative of students (see annex "RTU Study Field Management Structure"). The structure indicates that the Study Direction Committee shall supervise the activities of the Study Direction, performing an examination of the content and quality of implementation of study programmes of the study direction at the end of each academic year, evaluating their conformity with the objectives of the study direction, the requirements of the represented science sector and labour market, as well as taking into account the opinion of graduates and students regarding the quality of programmes. The Study Direction Committee initially take decisions on different types of issues, which are further approved by faculty councils, while further communicating with the Study Department, which prepares Senate projects (with the basis of decisions of both the Study Direction Committee and Faculty Councils) for examination by the Senate Study Quality and Programs Committee, where RTU Vice-Rector for Academic Affairs also participates and engages in discussion on relevant issues. Once the Senate Study Quality and Programs Committee has reviewed and approved the project's consideration in the Senate, only then does it advance to the RTU Senate hearing.

2 of the programmes included in the study field are implemented at the Faculty of Material Science and Applied Chemistry in cooperation between several institutes of the faculty:

Institute of Polymer Materials; Institute of Materials and Surface Engineering; Institute of Technical Physics; Institute of General Chemical Engineering and the Rudolfs Cimdins Riga Biomaterials Innovations and Development Centre included into it, Biomaterials Research Laboratory, Department of Composite Materials and Structure of the RTU Faculty of Civil Engineering, RTU Institute of Energy Systems and Environment. Visiting lecturers from other scientific institutes, as well as representatives of manufacturers (TENACHEM, KINTEICS NAIL SYSTEMS, etc.) are involved in the study process and practical training as far as possible.

Two study programmes are implemented at the Department of Probability Theory and Mathematical Statistics of the Institute of Applied Mathematics of the Faculty of Computer Science and Information Technology and one at the Center of High Energy Physics and Accelerator Technology, where the doctoral study programme is implemented in cooperation with the

University of Latvia.

The professional bachelor's study programme "Financial Engineering" has been created as an interfaculty study programme, in cooperation with the Faculty of Computer Science and Information Technology and the Faculty of Engineering Economics and Management, as well as several faculty institutes and departments:

Faculty of CSIT:

Institute of Applied Mathematics – Department of Probability Theory and Mathematical Statistics, Department of Engineering Mathematics.

Institute of Information Technology – Department of Management Information Technology, Department of Modelling and Simulation.

Institute of Applied Computer Systems – Department of Artificial Intelligence and Systems Engineering; Department of Software Engineering.

Institute of Smart Computer Technologies – Department of Computer Control and Computer Networks.

Faculty of EEM:

Institute of Business Engineering and Management – Department of Corporate Finance and Economics; Department of Innovation and Business Management; IBEM Division of Continuing Education.

ICEREE Institute of Economics – Department of the Territorial Development Management and Urban Economics.

Institute of Occupational Safety and Civil Defence – Department of Occupational Safety and Civil Defence.

International Business and Customs Institute – Department of International Business, Transport Economics and Logistics.

Other RTU structural units:

Institute of Humanities – Department of Social Sciences; Department of Engineering Pedagogy and Psychology.

Institute of Applied Linguistics – Department of Languages for Special Purposes.

Research Center for Engineering History – History Research and Scientific Publications Unit.

Department of Engineering Pedagogy and Psychology.

Department of Semiconductor Physics of the Institute of Technical Physics; Department of Optics.

Riga Business School.

The centre, institutes and the departments included in it ensure teaching and methodological work: create and update study courses, ensure appropriate teaching of study courses, supervision and defence graduation papers and perform other activities related to teaching, methodological and scientific work. In order to ensure the quality of the study programmes included in the study field and provide the necessary support to teaching staff and students, all the structural units involved have professional teams for fullfilment of these functions.

Internal quality control at faculties and at the level of the study field is ensured by vice deans for academic affairs of faculties. The quality of the study programme is ensured by the director of the

study programme and the academic staff involved in the implementation of the study programme, whereas the whole process is controlled by the administration of the responsible institute or department: in the case of the doctoral study programme “Particle Physics and Accelerator Technologies” these functions are performed by the Center of High Energy Physics and Accelerator Technology, its director and the Division of Doctoral Studies.

Once in the academic year, annotations of study program study courses and study course programs, methodological materials, the latest study literature and methodological instructions for study papers (reports, study papers, practice reports and final papers) are reviewed. The academic staff and the administration of the study programme participate in various experience exchange events, cooperating with universities of other countries, meeting with representatives of relevant institutions and entrepreneurs, as well as discussing current issues in the field, students' research works and projects, analysing their results.

For example, the management and the leading teaching staff of the study programme “Particle Physics and Accelerator Technologies” analyse on a regular basis the latest news in the study programme in the association of Latvian, Estonian and Lithuanian scientific institutions “CERN Baltics Group” and CERN Latvia Group, which is the CERN National Contact Point support instrument, with the help of which the Latvian academic environment and respective industry representatives are informed about CERN activities in high energy particle physics and accelerator technologies, industrial research and development projects, IT solutions, data processing projects.

Foreign visiting lecturers are involved in the implementation of the study programmes “Material Sciences”, “Nanotechnologies of Materials”, “Materials Engineering” and “Material Science and Nanotechnologies” to the extent possible. Thus, in the academic year 2021/2022 lectures on the physical chemistry of polymers were read by Dr. Emiliano Bilotti (Queen Mary University of London). In the academic year 2020/2021, lectures in the field of recycling of polymers read by Dr. Paulius Danilovas from the Kaunas University of Technology (Kauno technologijos universitetas). At the same time, the teaching staff of the university had traineeship and read lectures at foreign higher education institutions, e.g. S. Gaidukovs read visiting lectures at the University of Dubrovnik, the Kaunas University of Technology, the Polytechnic University of Catalonia, the Cracow University of Technology, the National Science Council of Spain, R. Merijs-Meri – at the National Science Council of Spain.

The responsibilities and duties of the Head of the study programme are provided in the job description. The most important of them include: management of study programme development, improvement of the curriculum in compliance with the requirements of the scientific fields or the sectors of the national economy, implementation of quality assurance, supervision of study plan development, promotion of internationalization, cooperation with RTU Study Department providing the input of data in the Information system, as well as the cooperation with other departments of RTU that are involved in the implementation of the study programme. The administration of the faculty constantly monitors the compliance of the premises and technical equipment with the modern quality requirements, and appropriate classrooms have been created with the necessary multimedia equipment, for example, the Faculty of Material Science and Applied Chemistry has an auditorium with more than 100 seats for students (auditorium 101), which can provide the training process on site and online at the same time, using modern virtual aids. The auditorium is technically supplied with all the technical novelties needed at the moment enabling teachers to use the standard presentation environment and digital whiteboards, and in the context of the spread of Covid-19, it is possible to record and broadcast the content of lectures on the internet, providing lectures to students in the auditorium and remotely. At the same time, the faculty has a conference hall, as well as several smaller-sized audiences equipped with the necessary infrastructure to organise both on-site and remote classes at the same time). Support functions for the development

and implementation of study programmes are provided by RTU Study Department. RTU Programmes Management and Curriculum Design Unit plays an important role supporting the improvement of the study programme.

RTU has a stable system for the management and improvement of study programs. Proposals for changes in study programs are developed by the study field commission, based on the recommendations of the teaching staff, feedback from employers, student self-government, as well as the latest trends in the national economy and labour market. The study field commission asks the councils of CSIT and MSAC faculties to review and approve them. Based on the decision of the council, changes in the study field are directed, which are approved by the RTU Senate. Changes in the structure of study programmes are approved by the order of RTU Vice-Rector for Studies. The technical support of the study field is provided by the study programme record keeping, as well as the IT service. Such co-operation in the implementation of the study programmes of the study field can be assessed as effective and promoting the development of the study field.

Duties of the study and teaching staff support teams include organisation and maintenance of record-keeping of organisational units, support in the process of enrolment of students, preparation of timetables of classes, informing of students on changes in the study process, as well as serving of visitors and students and resolution of problems. Team members may provide consultations and information on matters related to the study process, study opportunities and continuing education. These specialists summarise necessary data, analyse them, as well as prepare necessary reports, they perform other duties at the assignment of the head of the organisational unit. The faculty employs several study process planning and coordination specialists, who are responsible for planning of classes and premises for the study programmes and coordination and supervision of changes. Planning of an individual study programme also takes place in organisational units, however, the entire process is supervised by the planner of faculty classes to ensure effective use of premises and optimal work of academic staff.

In its activities, the Student Self-Government of the RTU Faculty of Material Science and Applied Chemistry (FMSAC SSG) follows the Rules of Procedure adopted at the meeting of the self-government and approved by the Council of FMSAC. These Rules of Procedure define the procedure of admission and exclusion of members of FMSAC SSG, the structure of FMSAC SSG, the decision-making procedure, etc. RTU FMSAC SSG represents interests of students of FMSAC, consults and provides answers to questions of students, helps to resolve problems that have occurred, organises study, cultural and sports activities, promotes creative and modern environment that is favourable for studies at the faculty. Educational evenings, pre-examination seminars are observed, as well as there is close cooperation with faculty management in the study and organisational matters.

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.

The admission process and procedure of students’ matriculation is stipulated in the RTU Admission Regulations, which are elaborated based on the Law on Higher Education Institutions and Cabinet Regulations No. 846 issued 10 Oct 2006 ''Regulations on Requirements, Criteria and Procedures for

Enrolment in Study Programmes'', as well as the specific requirements of study programmes and the industry. The RTU Admission Regulations are approved by the RTU Senate and published on November 1 each year (see the files of Appendix 29-35 of the list of Internal regulations).

Admission requirements are logical, understandable, and linked to the goals defined in the RTU Strategy. Admission system is state-of-the-art, easily accessible, logically structured, and is evolving in line with today's digitalization trends, providing the potential students with the convenient and easy to use application to university registration tool.

Applicants are admitted to full-time and part-time undergraduate programmes based on the results of the Centralized Examinations (CE) in Mathematics, the Latvian language and the Foreign Language, and the final grades in individual subjects obtained in the Secondary Education, and the entry test results. If, in addition to these CEs, the applicant has a CE in Physics or Chemistry, the results of these CEs are taken into account in the ranking calculation.

In order to participate in the competition for the state budget funded seats, the rating in Mathematics CE is calculated as the average value of all Mathematics CE rating sections and must be at least 15 percent. An applicant with a CE in mathematics of less than 15 percent may apply only for a tuition fee. Until year 2022 the CE rating minimal value was set at 12 percent.

To determine the candidate's rank in the competition, each CE rating, calculated as an average of all CE evaluation sections, and each entry test (if any applies) is multiplied by the appropriate weighting factor and the resulting multiplications are added together. Some study programme applicants must pass an entry test, the result of which shall be multiplied by an appropriate weighting factor and summed up in the total calculation of rank.

Persons, who have received secondary education prior to 2009 (including), as well as persons, who have received secondary education abroad, or persons, who were exempted from passing the secondary education state examinations in accordance with the procedure set by regulatory enactments, may be admitted to the study programmes based on their year grades in the secondary education document in the subjects mentioned in the RTU Admission Regulations, which must be successfully passed. Up to 2019, the admission based on the secondary education year grades was attributed to persons who completed secondary education prior to 2004. In general, the RTU Admission Regulations follow the Cabinet Regulations No. 846.

Persons who have completed secondary education and have not passed any of the CEs mentioned in the RTU Admission Regulations or have failed the year grade, shall pass the CE in accordance with the Cabinet Regulations No. 335 "Rules on the content and procedure for centralized examinations".

Persons who have not passed CE in Latvian and who do not meet the requirements of RTU Admission Regulations, shall pass the entrance examination in Latvian as prescribed by RTU. The result is evaluated in percentage.

In compliance with Cabinet Regulations No. 543 adopted on 29 September 2015 “Regulations on Replacement of the Foreign Language Centralized Examination in the General Secondary Education Program by Foreign Language Examinations Conducted by International Testing Institutions”, CE in the foreign language can be replaced with a foreign language examination conducted by an international testing institution the certificate of which must be presented to the RTU Admission Committee.

The applicants who have acquired a bachelor’s degree in a field relevant to the study programme are enrolled to the graduate study programmes. The applicants take part in the competition with a weighted average grade from the Bachelor or professional study programme records. The weighted

average grade is calculated as the sum of all the grades received in each study course multiplied by the credit points acquired in the study programme and is divided by the total number of credit points within the study programme. If credit points are not verified, the number is calculated as the multiplication of the grades and contact hours obtained in each study course divided by the total number of contact hours.

The academic Bachelor's study programme "Materials Engineering" enrols applicants, who have successfully completed general or vocational secondary education corresponding to at least level 4 of the Latvian Qualifications Framework.

The academic Master's study programme "Material Science and Nanotechnologies" enrols students, who have successfully completed a Bachelor's study programme in engineering in material science or chemical technologies, or a Bachelor's study programme in natural sciences in chemistry or physics, or biology, or acquired equivalent education.

The academic Master's study programme "Financial Engineering Mathematics" enrols applicants with a Bachelor's degree in finances, mathematics or engineering, or equivalent education, if study courses in mathematics (analysis and algebra) have been mastered in the amount of at least 8 CP, as well as study courses in computer science in the amount of at least 6 CP.

The doctoral study programme "Particle Physics and Accelerator Technologies" uses a different enrolment process, because it is a joint study programme with the University of Latvia (the Study Programme Council includes representatives from RTU, UL and CERN), as well as the Center of High Energy Physics and Accelerator Technology and the Division of Doctoral Studies, which are not structural units of faculties, departments, are responsible for its implementation.

Before applying for the doctoral studies, the candidate and the Head of the Doctoral Study Programme must agree upon the possible scientific advisor / consultant and receive his/her written consent. The Doctoral Thesis scientific advisor may be from another scientific establishment; however, the applicant must also choose the scientific advisor / consultant from RTU. Every year, the RTU Senate approves the regulations for the admission of doctoral students for the study year, which set deadlines for the submission of admission documents. The applicants for Doctoral study programmes, can submit application for full-time studies by arriving at the Doctoral Studies Unit, bringing the required documents, within the admission deadlines. Documents necessary for the competition are compiled by RTU Doctoral Studies Unit. After the collection of documents, the Doctoral Studies Unit submits them to the Scientific Committee of the respective Faculty, which draws the Ranking table of the applicants according to the evaluation criteria set by the Faculty Scientific Committee and approved by the order of RTU Vice Rector for Research. The Ranking table is submitted to Admission Committee of doctoral students. The Admission Committee is approved by an order of RTU Vice Rector for Research.

Taking into account the spread of Covid-19 and in order to facilitate the admission process of applicants for studies at RTU, starting from the summer of 2020, the admission process was improved.

There are two ways to apply for the state budget funded seats in undergraduate study programmes:

- Electronically in the Joint Enrolment Undergraduate Study Programme information system, using the e-service portal (https://www.latvija.lv). Given the spread of Covid-19, with the summer 2020 admission, secondary school graduates of the 2019/2020 school year can approve the electronic application remotely without arriving in person. If the secondary education was obtained abroad or until 2019/2020 school year, the applicants must confirm their electronic applications by arriving at the designated locations within the deadlines and

presenting the originals of the required documents;
- Arriving at the RTU Admission Committee in person, presenting the originals of the required documents.

To apply for the state budget funded seats in the graduate study programmes RTU undergraduate study programme graduates can submit their applications online on RTU portal ORTUS. Taking into account the spread of Covid-19, with the summer 2020 admission, also graduates of other Latvian state-accredited higher education institutions' undergraduate study programmes can submit applications electronically on the RTU website, or by visiting RTU Admission Committee.

Applicants who do not qualify for the state budget funded seats and applicants who have received their education outside Latvia, as well as in other specific cases, must appear in person at the RTU Admission Committee within the admission deadline, with the required documents.

Taking into account the spread of Covid-19 and in order to improve the RTU admission process and make it easier for applicants to apply for studies at RTU, the electronic application also for tuition fee studies with the summer of 2021 is introduced.

Recognition of previously acquired formal and non-formal education at RTU is carried out in accordance with the "Regulation on the Recognition of the "Courses Completed at Other Universities and RTU Study Programmes" (Resolution of RTU Vice-Rector for Academic Affairs No 02000-1.1/29 as of 4 April 2016) and the "Procedure for Recognition of Competencies Developed Outside Formal Education or From Professional Experience and Learning Outcomes Achieved in Previous Education at Riga Technical University" (approved at the Meeting of RTU Senate on 23 September 2019, Minutes No 632) (available at https://international.rtu.lv/study-regulations/ and in the file of Appendix 09 of the list of Internal regulations).

RTU Admission Regulations are published at https://www.rtu.lv/lv/studijas/uznemsana/uznemsanas-noteikumi (in Latvian) (for local students) and at http://fsd.rtu.lv/ (for foreign and exchange students).

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.

Assessment of student learning outcomes is carried out in accordance with the "Regulation on the Assessment of Learning Outcomes" (approved at the Meeting of RTU Senate on 27 May 2017, Minutes No 610), which is available on Studies Regulations page of RTU web page (https://www.rtu.lv/writable/public_files/RTU_studiju_rezultatu_vertesanas_nolikums.pdf (in Latvian)); the English translation is in the file of Appendix 04 of the List of Internal regulations). Summative assessment system is used in appraisal of student achievements, it implies that the final grade is composed of numerous components.

In the course descriptions of the study programme there is a set of relevant knowledge, skills and competences and their evaluation system, defined learning outcomes for the achievement of which credit points are awarded.

Pedagogical methods used in the implementation of study courses, as well as assessment forms and methods are selected by the instructors responsible for the study courses in compliance with

course curriculum and specifics of the programme, as well as student needs. A member of academic staff should inform students about particular assessment criteria at the fist lecture/practical class.

The main advantage of the summative assessment system is that the final grade is made up of several components. Therefore, the students may contribute to their final grade working during semester. Criteria for assessment of the study courses and individual/home tasks are published on ORTUS e-study system beforehand. During semester, the assessment for each home task, test, report, presentation and any other task is ascribed certain weight in the final grade. Exam grade may not exceed 50% of the final grade. Academic staff may take into consideration and also assess student attendance. Assessment structure for the study course is determined by the academic staff themselves, abiding the resolution of RTU Senate that the exam grade may not contribute more than 50% to the final grade. Selecting assessment criteria and methods for evaluation of student achievements, specifics of each study programme and learning outcomes are taken into consideration.

In order to advance professional pedagogical competences of the academic staff, courses and seminars on the newest pedagogical methods are organized regularly. Qualification advancement is provided at both the University and faculty level, organizing academic conferences and methodological seminars. The Centre for Academic Excellence has been established and successfully operates at RTU; it organizes various events aimed at professional advancement of academic personnel at the University level.

(In addition, see the description of each study programme.)

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.

Since 2010 all students that gradate from any RTU study programme should upload electronic versions of their graduation papers in ORTUS portal in order to improve the quality of graduation papers, create a bibliographic database of the graduation papers and introduce an automated control system for detecting plagiarism. RTU uses two major plagiarism control tools in the study process:

1. Since 2015 graduation papers of study programmes of the study field have been checked in the joint computerised plagiarism control system (JCPCS), which unites numerous Latvian universities and colleges. RTU uses the system in cooperation with the University of Latvia. This system is used to check graduation papers after their uploading to the ORTUS environment. JCPCS complements and extends plagiarism identification opportunities.
2. Starting from 20 December 2017, RTU has been having TurnitIn®, the world's leading tool for the correction of written papers and combating plagiarism that is used daily by millions of students and academics around the world. TurnitIn® tool is integrated with RTU ORTUS e-study system and provides full service of submitting, correcting, verifying the originality (plagiarism) and return of the submitted papers. TurnitIn® offers two main platforms: a platform that automatically checks for the percentage of non-genuine content (plagiarism) and a platform that allows to electronically correct the submitted papers. This tool is used to check all the electronic versions of graduation papers submitted for defence and further

control measures are operatively implemented for potential plagiarism detection.

Graduation papers are checked in both systems in parallel, thus using the advantages of both systems. The developed Doctoral Theses are in a similar way controlled with extreme scrutiny. Since 2005, the Code of Ethics of RTU Students, Academic Personnel and Staff has been effective at RTU (see the file of Appendix 19 of the list of Internal regulations). Academic Integrity Code, approved at the RTU Senate meeting of 29 February 2016. The aim of the Academic Integrity Code is to strengthen academic culture and integrity in the academic environment of RTU, to explain the concept of academic integrity and related actions, to define main procedures in examination of academic fairness violations (in Latvian available at https://www.rtu.lv/writable/public_files/RTU_rtu_studiju_reglaments_7.1.1.4..pdf, English translation is in the file of Appendix 38 of the list of Internal regulations).

There are procedures defined, how the report on the violation of the student's academic integrity is filled, registered, reviewed, and appealed. Informing and educating students about the aspects of academic integrity takes place both within the study courses and in specially organized seminars.

Both students and academic staff have access to the book “Glossary for Academic Integrity” published by RTU publishing house (available at http://www.academicintegrity.eu/wp/glossary/).

In addition, RTU participates in different initiatives that bring forward and solve academic integrity related issues. RTU is a member and one of the founders of the European Network for Academic Integrity (ENAI), where it is involved in active work sharing experience, keeping updated about academic integrity related issues, and organizing conferences. The Dictionary of Academic Integrity Terms and Guidelines is one of the newest aids that has been developed and published by RTU Press. In the framework of Specific Support Objective (SSO) 8.2.3 of the project “Development of Efficient Management of Riga Technical University”, RTU, in cooperation with the University of Latvia (UL) and Rīga Stradiņš University, develops educational aids, as well as participates in the establishment of the Latvian national academic integrity organization and development of plagiarism control tools.

The organisational units implementing the study programme have developed a control mechanism, i.e., the initial check is performed in the process of interim assessment, which is performed by the work of the Advisory Examination Commission. When the student comes to these examinations, he or she should submit the electronic version of the performed work and the paper is checked in free plagiarism control tools in presence of the student. When students draft their graduation papers, they are instructed about plagiarism and its consequences several times. Methodological materials contain detailed instructions on correct presentation of references. This process allows to reduce plagiarism and highlights faults in the student’s paper, which needs to be rectified. The generally accepted “good practices” show that more attention should be paid to the papers showing 20 percent or more matches. A message is received from the system, when the match level is higher than 20%. The papers are examined, reasons of matches in the text are evaluated and a decision is made whether the student should be allowed to defend his or her thesis.

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.

RTU operates pursuant to “Constitution of Riga Technical University” which was approved by RTU Constitutional Assembly on 23 May 2022 (see the file of Appendix 01 of the list of Internal regulations).

In order to efficiently control implementation of RTU Strategy, RTU Strategy Management System has been established, which provides that strategic aims, activities and tasks are cascaded to the level of definite organizational units and their staff.

RTU has an internal quality management system in place in accordance with the RTU Quality Policy updated and approved at the meeting of RTU Senate on 25 September 2017, Minutes No 612 (see: RTU Quality Policy) and the RTU Excellence approach approved at the meeting of RTU Senate on 30 January 2017, Minutes No 606 (see: RTU Excellence Approach). Since the study field is one out of 12 study fields implemented by RTU, and its internal quality system is closely related to RTU Quality Management System.

RTU Quality Policy is aimed at implementation of RTU mission and achievement of strategic aims – scientific research, academic, infrastructure and organizational excellence, and recognizability. The Quality Policy provides the framework for implementation of RTU Strategy, and the paths for development and improvement of research, study process and organization. RTU Quality Policy is reconciled with the ENQA standards and guidelines. RTU Excellence Approach and Quality Policy are reciprocally integrated documents, which determine that RTU employs the EFQM quality model.

Starting with December 2018, RTU has been a member of the European Foundation for Quality Management, having joined the global quality cooperation network.

RTU Excellence Approach (see the figure in file "RTU Excellence Approach") has been elaborated in order to promote purposeful development of the University as an excellent organization, and RTU Constitution, Strategy and Quality Policy are integrated therein; it is based on the Standards and Guidelines for Quality Assurance in European Higher Education Area (ESG) developed by the European Association for Quality Assurance in Higher Education and the basic principles of the EFQM Excellence Model.

The structure of RTU Excellence Approach (see the figure in file "Structure of RTU Excellence Approach") is designed in accordance with the criteria of the EFQM Excellence Model and forms the basis for the maintenance of performance at a high level, a prerequisite for its continuous improvement, as well as for achievement of sustainable results of RTU activities and excellence. Student results are a separate criterion, they are also in part transferred to the main activity results; thus, the quality of the study field is closely related to RTU quality management.

To promote introduction of the model of the EFQM total quality management system, as well as to assist in the compilation of a self-assessment report, a working group was established at RTU on 29 September 2017 (Rector’s order No 01000-1.1/225), which comprised representatives of RTU administration, faculties and Student Parliament (18 in total).

Potential problems were identified and suggestions for improvement of RTU Quality Policy, including improvement of academic quality, were made at the meetings of the working group. In the period of one year, the working group considered compliance to nine criteria of the EFQM model and analysed 101 sub-criteria, having identified 133 problems in total and having made 146 suggestions. The priority problems were included in RTU Development Plan as tasks set for a definite term to be solved by the respective organizational units. Quality model review report is drawn up with regard to the Quality System, which identifies the areas that should be improved. Performance indicators and results of student polling are integrated in RTU Quality System.

Application of RTU Excellence Approach is based on process-oriented activities and includes clear process flow and their interaction. Striving for excellence, RTU actively works on process planning, definition of its aims and interaction analysis. RTU has developed criteria and methods for ensuring efficient process operation and management. RTU conducts the process analysis and provides recommendations and suggestions on process improvement, which are discussed with process managers and persons responsible for process procedures; later they are approved as performable tasks with a definite completion term. Task creation and control tools inbuilt in the Document System, reports on task performance at the organizational unit level provide the necessary support for achievement of performance indicators of the annual aims and tasks set in RTU Strategy. For example, development of the uniform study programme application structure and assessment criteria is one of the tasks for the process "Provision and Organization of Studies" approved in the system with the completion term set until 31 December 2020; they were developed and approbated on the study programmes developed within SSO 8.2.1 project.

The departments and institutes, faculty councils, the service of the vice-rector for academic affairs, the service of the vice-rector for development, the student parliament and the RTU Senate are involved in ensuring internal quality of studies at RTU. These institutions comprehensively evaluate the study fields and programmes to be newly created, as well as changes to study fields and programmes, evaluate annual self-assessment reports of study fields. The internal quality assurance mechanism of studies at RTU is functioning at the level of administration, faculties, study fields and study programmes of the university.

Study field Committees at RTU supervise academic activities in the respective study field and are responsible for curriculum of the study programmes within the study field, including accreditation of the study field. Members of student self-government are involved in ensuring the quality of the study field and study programmes implemented therein; they actively participate in the work of the decision-making bodies of the University: RTU Constitutional Assembly, RTU Senate, RTU Senate commissions and faculty councils.

At the level of faculties and study field, internal quality is ensured by the faculty councils, the Study Field Committee and the director of the study field, directors of study programmes, administrations of the institutes or departments implementing the study programme, as well as the student self-governments. Untill 2018 study programmes of the study field "Physics, Material Science, Mathematics and Statistics" were evaluated and an annual self-improvement report was prepared, which was discussed, evaluated and approved at Councils of FCSIT and FMSAC and at the RTU Senate. It is planned to resume the preparation of the self-improvement reports with the acquisition of accreditation.

Each semester, twice a semester the polling of the students at study programmes is conducted to find out student opinion about lecturer's work quality and obtain evaluation of the study programmes. The polling is conducted electronically on the ORTUS portal, the results are received by each instructor personally and the director of the programme. The summary of the results are summarised at department meetings, the most important matters – also at meetings of heads of structural units of faculties of CSIT and MSCC. After each graduation round, polling of the graduates is conducted, polling of employers and graduates of previous years takes place once in two years. The results are taken into consideration in the improvement of the study programmes and discussed at meetings of departments and the institute. Representatives of employers participate in defence of graduation papers, who express their opinions on the quality of knowledge of graduates and recommend necessary improvements to study programmes and processes. Employees of faculties constantly monitor the compliance of the premises and technical equipment with the quality requirements, and appropriate classrooms have been created with the necessary multimedia equipment. Deficiencies found in the implementation of the study process, in the

content of study programs and material and technical support are promptly identified and eliminated. At the time of writing the report, the known but not eliminated deficiencies that would significantly affect the quality of the study process have not been identified.

Members of student self-governments of faculties are involved in ensuring the quality of the study field and study programmes implemented therein; they participate in the work of the decision-making bodies of the University: RTU Academic Assembly, RTU Senate, RTU Senate committees and faculty councils.

The above-mentioned set of activities ensures the quality of the study process at a high level, which is confirmed by the high assessment of study quality in student and graduate questionnaires, as well as the assessment of employers of graduates of study programs, as well as the increase in the number and quality of scientific publications, in the creation of which students participated.

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).

Study programme development and revision processes are regulated according to the "Procedure for Application, Elaboration and Amendment of the Study Programmes" (published at RTU_studiju_reglaments_4.6._programmu_izstradasanas_kartiba.pdf (in Latvian); the English translation is in the file of Appendix 06 of the Internal regulations), which in detail specify activity sequence and parties involved, starting with drawing up an application for new study programme elaboration and finishing with study programme closure. Procedures are reconciled with the effective national regulatory enactments pertaining to study programme licensing and amendment.

Revision of the study programme curriculum is the responsibility of the Study field Committee. The responsibilities and activities of the committees are regulated by the “Regulation on the Study field Committee” (approved at the RTU Senate on 26 April 2021, Minutes No 649; published at RTU_studiju_reglaments_4.7._studiju_virziena_komisijas_nolikums.pdf, (in Latvian); the English translation is in the file of Appendix 07 of the Internal regulations).

Study program development and review processes are regulated by RTU "Study program application, development and amendment procedure". The procedure is coordinated with the laws and regulations in force in the country regarding the licensing of study programs and making changes. Reviewing the content of study programs is within the competence of the study direction committee.

As an example of the process of creating new study programs, the creation of the "Materials Engineering" study program is described below.

The development of the "Materials Engineering" study program actually started at the end of 2018 with the Specific Support Objective (SAM) 8.2.1 2nd round of the project "Reducing the fragmentation of study programs of Riga Technical University and strengthening the sharing of resources" application.

From that moment on, the offer of study programs in the fields of materials science and materials

engineering was identified and analyzed, paying special attention to the study programs implemented in leading European universities, the national interests of Latvia, the requirements of employers, as well as the opinion of graduates and students. Therefore, in the process of developing study programs, several discussions were held, in which RTU teaching staff, employers, and student representatives were involved.

The experienced and young specialists of the Faculty of Materials Science and Applied Chemistry (hereinafter - MLĶF) involved in the implementation of the study program "Materials Engineering" expressed and argued their vision about the content of the included study courses, their necessity in the new Study Program and their practical implementation. The content of the specialization courses planned for the study program was publicly discussed and approved at the meetings of the structural units implementing this course. At the same time, other RTU structural units were also involved in the implementation of the Study Program in order to ensure the inclusion of programming and material properties modeling study courses in the Study Program being developed, as well as the uniform requirements set by the RTU Senate for study programs regarding mathematics, civil defense, environmental protection, entrepreneurship, as well as humanitarian and balanced inclusion of social science study courses in the study program.

In the development of the study program, the members of the Council of Advisors of the MLĶF, representatives of employer groups actively participated, after consulting with them, the necessary skills and competences that are expected from the graduates of the Study Program were identified. The achievable level of the discussed skills and competencies was incorporated into the Study Program. The involvement of industry representatives in the development of the Study Program took place by participating in the meetings dedicated to the development of the Study Program and providing a professional opinion on the structure of the Study Program, the usefulness and content of the study courses to be included.

The role of students and graduates in the development of the study program began with the analysis of survey results of the existing RTU academic bachelor's study program "Materials Science". The results of the annual survey analyses, as well as individual discussions with student representatives, indicated an increase in the proportion of practical training, as well as an increase in the choice of study courses to be taken in the study process. Subsequently, in the newly developed Study Program "Materials Engineering", emphasis is placed on the promotion of students' practical work (including specialized practice in cooperation with manufacturers) and the inclusion of more specific study courses specific to the direction of materials science and engineering, including programming, modeling of physical processes of materials and calculations. An important role in the development of the Study Program "Materials Engineering" was played by the involvement of both the student employees of the RTU structural units providing the study process and the activists of the MLĶF student self-government, in which the students shared their vision and offered proposals on the study courses to be included and the ways of their implementation.

Taking into account the opinions expressed in these public consultations, the study program "Materials Engineering" was developed under the supervision of the Director of the Study Program, Remo Merijs-Meri, which was successively publicly presented and discussed 1) at the public consultation of MLĶF employees and student representatives, 2) at the meeting of the MLĶF Advisers' Convention, 3) at the meeting of the study direction "Physics, material science, mathematics and statistics", 4) at the meeting of the MLĶF Council, 5) at the meeting of the Study Quality and Program Commission of the RTU Senate and 6) at the meeting of the RTU Senate. After the successful approval of the Study Program in these institutions, it was submitted for licensing to the Higher Education Quality Agency (AIKA). The visit of the licensing experts of the "Materials Engineering" study program to MLĶF took place on June 2, 2021. After the implementation of the

short-term recommendations of AIKA and licensing experts, during the meeting on June 30, 2021, a positive opinion was received regarding the licensing of the "Materials Engineering" study program, which will start in 2021/2022.

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.

In order to promote continuous improvement of the quality of studies and provide students with the opportunity to submit proposals and complaints on various study-related issues in accordance with the ESG, in the reporting period from 2013 to mid-2019, at RTU, the examination of students' recommendations and complaints was carried out; this was done by involving the structural units to which the applications related, as well as the student self-government of the respective faculty.

A new document was approved in 2019 and now students' complaints and proposals are considered in compliance with "Procedure for Submission and Examination of RTU Students' Proposals and Complaints" (published at https://www.rtu.lv/en/university/proposals-and-complaints and attached in the section "Other Annexes").

The procedure stipulate how RTU students can submit suggestions and complaints concerning the study process and other issues, determine the terms for consideration and reply to applications (if the applicant has provided contact details) and prepare a summary of application statistics.

A total of 43 complaints/proposals have been received between September 2021 and May 2022, none of which were submitted anonymously. Of the submissions 32 were complaints and problems, and 11 were suggestions across six topics (subject: the number of complaints or problems / the number of proposals):

- Study process: 13 / 6
- Maintenance of infrastructure issues: 1 / 0
- Accommodation related: 3 / 0
- Foreign students' questions: 8 / 1
- Information flow: 2 / 0
- IT issues: 9 / 2

Evaluating the submitted complaints about the study process, six of them are related to the unavailability of lecture schedules in the ORTUS e-learning environment, late posting of information on the final thesis and / or homework, often no links to connect to a specific lecture in a distance learning format. Four of the complaints and problems are related to the constraints of the Covid-19 pandemic. Complaints have been received that teachers do not attend classes or cancel very shortly before they take place. There are several complaints about specific lecturers and their work, about poor quality lectures and in cases when several lecturers are involved in the implementation of the study course, there is no consistency about the requirements for students; there are no specific criteria for the final works. Complaints have been received that lectures take longer than

indicated in the schedule, as well as students' health problems during the study process and final examinations are not taken into account. It is not clear to young students what to do next after signing the study agreement. Proposals have been received to organize certain study courses only in a remote format, as well as to be more flexible and to respect the free choice to obtain a vaccination certificate. The proposal is to move to a single remote lecture platform, where calendar-scheduled lectures can be automatically linked to the person's calendar, making it easier to notice changes when they occur. The opportunity to see the recipients of their course scholarships and their success could increase the competition and motivation of other course students.

In the economic sector, a complaint has been received about the lack of heating and hot water at some faculty. Student hostels have several complaints about poor sound insulation and noise from neighbors at night. International students often disregard ethical and cleanliness standards, leaving unpleasant environment for the rest of the residents.

International students have asked for more support in the study process and provision of information in English, as well as to expand the possibilities of psychological support. A frequent complaint is about the length of time required to complete the documents in order to start studies and stay in Latvia. Complaints have been received that the schedule of lectures is often not available, and, especially for the autumn semester, becomes available delayed. Several complaints have been received about the attitude of teachers - they do not give access to course materials, regularly change the dates of exams and tests, do not indicate connection links to lectures, poor quality and indifferent study process, are often inaccessible and do not respond to students' e-mails. There has also been a complaint that Erasmus+ students do not have another European student on their course when they arrive to the university.

Complaints received about the exchange of information are mostly related to the lack of information at all or very late publication. RTU websites have outdated entries and are no longer relevant.

Five IT issues are related to the correction of the calendar study schedule. Complaints have been received that the newly introduced compulsory student emails edu.rtu.lv are not working, problems with accessing MS Office services through the ORTUS system. It is also not possible to access the RTU cloud, from which the student cannot receive materials for the study course. Suggestions have been made for creating a more convenient electronic scholarship form to make it easier for the user to transfer information with a copy function. The recommendation is to provide students with access to the Stimul8 program, which could improve the study process.

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.

RTU Quality Policy provides the framework for implementation of the Strategy, the paths for development and improvement of research, study and organization processes. RTU Quality Policy and implementation thereof employ a fact-based approach – decisions are based on the acquired objective data, information analysis and monitoring.

RTU draws up quality reviews based on the analysis of processes and their results. Quality reviews

are drawn up once a year, summarizing the data on performance indicators of RTU administration, core activities and support processes.

28 performance indicators characterizing process quality are set for one of the RTU core activity process "Organization and Management of the Study Process". The data are summarized once a year for the previous academic year by study level and study programme.

Performance indicators characterize the quality of entrant enrolment process, study process planning and the quality of implementation of studies - implementation of the initial admission plan, number of matriculated entrants vs. number of entry applications, number of entry applications with RTU as the first priority vs. all matriculated students, number of graduates vs. total number of students, number of exmatriculated students (except for graduates) vs. total number of students, number of students with academic arrears vs. total number of students, number of students exmatriculated due to academic failure vs. total number of exmatriculated students, number of timely signed learning agreements vs. all signed learning agreements, etc.

Observing the current study programme performance, reachable qualitative or quantitative aims are set for the indicators, when possible, e.g., 65 percent of graduates of RTU undergraduate study programmes continue studies at graduate study programmes.

The data in the quality review that is submitted to RTU administration are analysed by study level, by faculty and study field. Indicators of numerous study programmes are compared with the general average RTU level.

The Study Department organizes further review and data forwarding to the faculties and directors of the study programmes, whereas process managers introduce the necessary improvements. Changes to the approved processes occur in cooperation with quality management specialists.

In addition to performance indicators characterizing study process quality, which are summarized in the review, a study programme quality visualization tool has been created in Power BI environment, which will be used to reflect Bachelor and Master study programme performance in an academic year with the help of radar chart. In the chart, study programme results at each study level will be presented comparatively - in relation to the best performance at the respective level. The tool is envisioned for the directors of the study programmes and faculty administration to facilitate collection of transparent information on each study programme performance considering numerous indicators simultaneously, as well as to rank the programme in relation to the best performance. It will be also possible to compare the programme performance in several academic years. The tool is currently at the development and test phase. Performance indicators of 11 study programmes are planned to summarize in the radar chart: academic staff vs. number of students, academic staff with scientific degree, ratio of graduates to the number of matriculated students, number of students who continue studies (not exmatriculated), proportion of foreign students, number of outbound mobility students, Bachelor programme graduates who continue studies at RTU, number of matriculated students from the respective Bachelor study programmes, average assessment of the study programmes in student polls, number of study materials published on ORTUS e-study system and applicability thereof, as well as financial revenue generated by study programmes per student. Comparative reviews of the study programmes results will be available to directors of all RTU study programmes. It is planned to develop and improve the tool for collection of statistical data necessary for evaluation of the study programme performance and data visualization within the framework of SSO 8.2.3 project.

In addition, RTU Study Department summarizes and annually submits until 15 October to the Central Statistical Bureau and the Ministry of Education and Science a statistical review "Review of the University, College at the Beginning of Academic Year 20_/20_" (Cabinet Regulations No. 812 of

20 December 2016, Appendix 5 (https://likumi.lv/doc.php?id=287576 (in Latvian)). The Review contains the following information (sources of information and/or RTU employees responsible for data collection are indicated in parentheses).

- Distribution of students by study programme (Study Management System| Reports | University Review at the Beginning of the Academic Year).
- Enrolment results (University Review at the Beginning of the Academic Year).
- Students having obtained a degree or qualification in the academic year (University Review at the Beginning of the Academic Year).
- Distribution of enrolled students by age (University Review at the Beginning of the Academic Year).
- Distribution of students by age (University Review at the Beginning of the Academic Year).
- Distribution of students having obtained a degree or qualification by age (University Review at the Beginning of the Academic Year).
- University staff in the reporting year as of 1 October (Administrative Office);
- Premise floor area (the Unit of Legal Provision in Real Estate Issues).
- University revenues in the previous year (Planning and Economic Analysis Unit).
- Budget expenditure of the University in the previous year (Planning and Economic Analysis Unit).
- Number of students, who reside in student hostels (Study Organization Unit).
- Number of students by the language of instruction.
- Distribution of enrolled students by place of residence (University Review at the Beginning of the Academic Year).
- Number of mobility students in the total number of students (University Review at the Beginning of the Academic Year).
- Number of mobility students in the total number of students who have obtained a degree or qualification (University Review at the Beginning of the Academic Year).
- Own revenue from allocation of the mobility student tuition fees by country in the previous year (International Cooperation and Foreign Students Department.
- Revenue from allocation of foreign financial study grants by country in the previous year (Project Financial Management Unit).

Summarized statistics on the number of students/graduates is used for the following purposes:

    - Improvement of the study field. For example, if at some study programme the annual number of student dropouts is much higher than the number of graduates who obtained degree/qualification, the causes of such a situation are sought for with scrutiny.
    - If at some study programme the number of enrolled students decreases annually, the cause should be identified, and potential programme closure should be considered.
    - Allocation of financing (for state budget funded seats).
    - RTU informative materials, press, etc.

In order to analyse study fields and to receive feedback, RTU has developed a polling cycle:

- When starting studies at RTU, a survey of students is conducted about expectations from studies, availability of information, admission process. The survey is conducted electronically on the portal ORTUS.
- Each semester, the polling of the students at a study programme is conducted to find out student opinion about instructor’s work quality and obtain evaluation of the study programme. Polling is conducted electronically in portal ORTUS, the results are received by each instructor personally and the head of the organizational unit. The summary of the

results is summarised at department meetings, at the meeting of the Study field Committee and the meeting of the Faculty Council.
- After each graduation round, polling of the graduates of Bachelor and Master programmes is conducted. The results are taken into consideration in the improvement of the study programmes within a study field and discussed at methodological seminars.
- Annual polling of Doctoral students and Doctoral alumni has been introduced, it is also planned to conduct surveys of Doctoral entrants. The polling on the admission procedure and study process has been launched. The summaries of results are published on portal ORTUS. The results are taken into consideration in the improvement of Doctoral study process and the quality of support provided to doctoral students.
- It is also planned to run regular centralised polling of RTU employers. Polling of employers presently takes place at the end of internship of each student, as well as within the scope of development of study programmes.

From the spring semester of academic year 2020/2021, a mid-semester questionnaire has also been introduced.

The following mechanisms are used to obtain feedback from employers.

RTU Council Convention, composed of representatives of different sectors, advises RTU Senate and Rector on the RTU Development Strategy. It has the right to propose an issue to the Senate and the Constitutional Assembly. The RTU Strategy and its development program are presented in the RTU Council Convention, the decision-making bodies, as well as to cooperation partners, industry associations and leading companies, with feedback and suggestions being incorporated into the RTU documents.

The involvement of stakeholders and the realization of major projects is the responsibility of the Vice-Rector for Strategic Development. He clarifies existing needs, coordinates key priorities and activities, implements recommendations and promotes the sustainable development of the RTU.

Employers, as providers of the internship of RTU students, after completing the practice, prepare online feedback on the knowledge and skills of the student, thereby also assessing the relevance of the knowledge provided by the study programme to the needs of the industry.

Employers' feedback is obtained also from the Council Convention, composed of representatives of different sectors and industry associations, as well as from the assessments provided by employers on the portal prakse.lv (RTU is the most recommended university at https://www.prakse.lv/top for several consecutive years (information available only in Latvian)).

Feedback within study programmes is received through every semester student polling, regulated by the “Regulation on Student Polling for Assessment of the Study Process” (approved by the resolution of RTU Vice-Rector for Academic Affairs No 02000-1.1-e/8 as of 1 February 2021; published at https://www.rtu.lv/writable/public_files/RTU_anketesanas_nolikums.pdf (in Latvian); the English translation is in the file of Appendix 20 of the list of Internal regulations).

Study programme study course abstracts and course programmes, methodological materials, newest educational literature and methodological instructions for study papers (reports, study papers, internship reports and graduation papers) are reviewed once an academic year.

Courses and seminars on latest teaching methods are organised for academic staff, as well as attendance of courses to improve qualification is promoted. Academic staff and heads of study programmes participate in different experience exchange activities cooperating with universities of other countries, meeting representatives of respective institutions and businessmen, as well as discussing among themselves latest developments in the sector, research papers and projects of

students by analysing their results.

The Study field Committee analyses recommendations from employers and external experts, which are used as the basis for improvement of the study programmes.

In order to receive feedback from RTU graduates, RTU Alumni Association has been established. It actively operates at the University (http://alumni.rtu.lv/, https://www.facebook.com/RTUAlumni/ (information available only in Latvian)) and runs an online community platform (https://rtuconnect.net/), which aims at developing alumni traditions. In order to ensure the transfer of experience from graduates, the RTU Alumni Association provides mentor training, database maintenance, as well as mentors and mentee matching. The RTU Alumni Association organizes various events, which bring graduates back to the University, allow for networking, cooperation among the graduates and with the University, and integration in University activities. RTU Grand Graduation Ceremony is a major event introduced by the RTU Alumni Association; it gathers the respective year graduates from all nine RTU faculties, academic and general staff, as well as guests.

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).

Detailed information on the study field and the study programmes pertaining to it with the indication of the languages of instruction is available at RTU web page:

1. RTU web page in the section on education opportunities in the Latvian language (https://www.rtu.lv/lv/studijas) (responsible person – I. Bušovska, Head of the Admission Department);
2. RTU web page in the section containing comprehensive information on education opportunities in the English language (https://www.rtu.lv/en/studies) (responsible person – I. Tipāns, Director of the International Cooperation and Foreign Students Department);
3. Interactive web pages dedicated to RTU study fields, study programmes therein, as well as the detailed description of the offered study courses in the Latvian and English languages (https://stud.rtu.lv/rtu/vaaApp/sprpub and https://stud.rtu.lv/rtu/discpub/list?english=true) (responsible person – G. Alksnis, Head of the Program Management and Curriculum Design Unit);
4. Web page designed for the foreign student target audience on RTU study programmes implemented in English and student mobility opportunities (https://international.rtu.lv, https://apply.rtu.lv) (responsible person – I. Tipāns, Director of the International Cooperation and Foreign Students Department);
5. Higher Education Quality Agency E-platform (responsible person – G. Alksnis, Head of the Program Management and Curriculum Design Unit);
6. State Education Information System (responsible person – I. Pujats, Project Manager of the Information Technology Department);
7. Study programm "Material engineering: https://www.rtu.lv/lv/mlkf/toposajiem-studentiem/mlkf_studiju_programmas/materialzinatnes (in Latvian, responsible person prof. R.Merijs Meri, Institute of Polymer Material);

8. Study program "Material Science and Nanotechnologies" https://www.rtu.lv/lv/mlkf/toposajiem-studentiem/mlkf_studiju_programmas/materialu-nanotehnologijas (in Latvian, responsible person prof. R.Merijs Meri, Institute of Polymer Material).

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.

According to the Conceptual Report “Introduction of a New Higher Education Financing Model in Latvia” approved by the Cabinet on 29 June 2015 (http://likumi.lv/ta/id/274944-par-jauna-augstakas-izglitibas-finansesanas-modela-ieviesanu-latvija, in Latvian), Latvia has introduced structural reforms in the sector to ensure the development of an efficient and sustainable higher educational system. A three-pillar funding model has been introduced to reconcile the supply offered by higher education with the needs of Latvia's economic development and labour market, high-quality research-based higher education content and performance management in higher education institutions. The base funding for the provision of the study process is the 1st pillar, performance funding is the 2nd pillar, and development funding is the 3rd pillar.

The first pillar, or base (base funding), is implemented through state budget funded study seats. Determination of the number of state budget funded study seats are regulated by Sections 51 and 52 of the Law on Higher Education Institutions (http://likumi.lv/ta/id/37967-augstskolu-likums#p-50515, in Latvian).

RTU funding from the basic state budget is made up of the study base financing corresponding to the list of study programmes and the number of students; it is used to cover such expenses as utilities, taxes, infrastructure maintenance (including data for the Student and Graduate Register), purchase of equipment and supplies, staff remuneration, and funding for research activities.

The number of study seats is allocated after discussions with the Ministry of Education and Science. Funding from the state budget is allocated for full-time studies.

The amount of study base funding is determined on the basis of the number of study seats determined by the state at RTU, as well as the state-defined study seat basic expenses and study cost coefficients in the thematic areas of education.

Study cost coefficients for thematic areas of education are indicators that determine the amount of study seat costs in the respective thematic area of education in relation to the basic costs of the study seat.

The cost coefficients for the study programmes in the thematic areas of education for Bachelor and professional study programmes are set by in Appendix 1 of Cabinet Regulations of 12 December 2006 “Procedure for Financing Higher Education Institutions and Colleges from the State Budget” (https://likumi.lv/doc.php?id=149900, in Latvian) (further in the text - the Regulations).

Values of study cost coefficients are 1.5 times higher for Master study programmes and three times higher for Doctoral programs than the study cost coefficients specified in Appendix 1 to the Regulations for the respective thematic area of education.

The amount of the study funding granted to the institution of higher education or college from the state budget for the implementation of Bachelor, professional and Master study programmes is calculated using the following formula:

Fs = Tb x [S(ki x ni) + 1,5 x S(ki x mi)] + Sb x S(ni + mi), where

Fs – the amount of study financing;

Tb – basic costs of the study seat;

ki – coefficient of the study costs in the relevant field of education (Appendix 1 to the Regulations);

ni – the number of study seats for a higher education institution or college at undergraduate and professional study programmes in the relevant thematic area of education;

mi – the number of study seats at the Master study programmes in the relevant thematic area of education;

Sb – study seat social security expenses at undergraduate, professional and Master study programmes (Appendix 2 to the Regulations).

The basic costs of a study seat and the social security expenses of a study seat are determined in accordance with Appendix 2 to the Regulations.

Each year, the Ministry of Education and Science calculates the basic costs of a study seat for the following budget year and, by November 1 of the current year, coordinates the calculations with the Ministry of Finance and those Ministries which have higher educational institutions and colleges subordinated to them.

RTU funding from the state basic budget for the provision of study seats in the respective academic year is distributed in accordance with the decision of RTU Senate “Methodology for the distribution and use of funding for the structural units of RTU in academic year 2020/2021” (see the file of Appendix 16 of the list of Internal regulations; hereinafter – the Methodology). The Methodology is reviewed and revised every year and is subjected to any necessary changes.

RTU has a decentralized budget, and each organizational unit is allocated a separate budget. In a general sense, a budget is a plan of revenues and expenditures for a specific period of time, work, event or function. The revenues and expenditures of RTU shall be administered in accordance with principles approved by the Senate or as stipulated by the Vice-Rector for Finance.

According to the Budget Allocation Methodology, the financing is allocated to the organizational units either according to the financial or budget year or immediately after receiving the financing. The financial or budget year of RTU organizational units is from October to September of the following year, and for this period the financing is calculated and distributed:

- Subsidy or basic budget funding (training of state budget funded students) is divided into monthly limit – 1/12 of the estimated annual funding per month is allocated to the organizational unit;
- Tuition fee funding (training of tuition fee-paying students, including funding paid by students for settling academic arrears) is allocated twice a year (in October and April) as a monthly limit – 1/6 of the estimated funding per semester is allocated to the unit monthly;
- Performance funding (research support funding) is allocated as a monthly limit – 1/12 of the estimated annual funding is allocated to the unit per month;

- Research base funding (research support funding) is allocated as a monthly limit – 1/12 of the estimated annual funding is allocated to the unit per month;
- funding for foreign student fees is distributed four times a year, taking into account that the largest amount of the planned workload is allocated to the structural unit at the beginning of each semester (October and April), the remaining part of funding - at the end of the semester.

Each head of the RTU organizational unit is provided with remote access to operational financial information on the unit's budget, including the envisaged workload and correspondingly allocated funding for the implementation of study programmes and study courses in subsequent periods. Based on this information, the head of the organizational unit plans the work of the unit at the beginning of each financial or budget year, including remuneration issues for academic staff members who are subordinate to the head of the unit, and develops a procurement plan for the following year in compliance with the implementation and development of the study programme or study course, etc.

According to the World Bank research on higher education governance in Latvia, which was conducted in 2017 and 2018, the World Bank concluded that RTU used the opportunities offered by the system-level funding model reform to gradually adjust the internal distribution of decision-making powers by strengthening the position of deans. Prior to the introduction of the second pillar of the state funding model, RTU funding was provided to units below the level of faculties. To address the issue of weak positions of deans, more than half of the new 2nd pillar performance income is used to provide funds to faculties where the dean is the budget holder. First, it opens up new opportunities for faculty-level strategic development. Second, deans now have greater opportunities to ensure the development of faculties, which is their responsibility. Third, since the academic year 2019/2020, deans of the faculties have additional funding from the tuition fees of foreign students.

Funding from foreign fee-paying students in a respective academic year is allocated in accordance with the Resolution of RTU Senate On Approval of the "Methodology for Allocation of Funds for Study Process Provision at the International Cooperation and Foreign Students Department" in the Respective Academic Year (see the file of Appendix 41 of the list of Internal regulations; hereinafter – Methodology2). Methodology2 is revised and approved every year taking into account necessary changes.

In the academic year 2019/2020, RTU has made changes in the Methodology to ensure that the basic state budget funding for the provision of study seats is distributed by study programmes and thematic areas of study courses, ensuring precise distribution of funding according to the indicators by which RTU receives the state budget funding. In addition to the seats financed by the state basic budget, the study programme financing also consists of tuition fee revenue from the resources of natural or legal persons, which can be divided into two subgroups:

1. revenue from local fee-paying students;
2. revenue from foreign fee-paying students.

Funding from local fee-paying students is allocated in compliance with the Methodology where, in order to provide greater opportunities for the development of fee-based study programmes, for several academic years, a significant amount of the funding received has been channelled to the head of study programme, who may appropriately use this funding to renew facilities and attract higher-level specialists for the implementation of the study process, etc.

Funding from foreign fee-paying students in a respective academic year is allocated in accordance with the Resolution of RTU Senate On Approval of the "Methodology for Allocation of Funds for

Study Process Provision at the International Cooperation and Foreign Students Department" in the Respective Academic Year (see the file of Appendix 41 of the list of Internal regulations; hereinafter – Methodology2). Methodology2 is revised and approved every year taking into account necessary changes.

In the academic year 2019/2020, RTU made significant changes to Methodology2 with an aim to bring it closer to the Methodology governing budget allocation, thus facilitating the work process of the persons responsible for the implementation of the study programmes – both by aligning funding allocation periods and principles. The new Methodology2 provides funding for the structural unit responsible for the implementation of the study programme for its development similarly as in Methodology. However, two new coefficients are introduced in the calculation of study course funding - the correction factor for the number of students and the sustainability coefficient of the study programme, as well as whether foreign students acquire the study course together with local students. The financial surplus, which is formed from the application of both coefficients and the acquisition of joint study courses, is directed to the structural unit responsible for the implementation of the study programme.

Analysing the financing procedure of the study programmes and the study fields at RTU as a whole, it can be seen that the state basic budget and local fee-paying student funding, in the long run, are determined taking into account the basic principles established by the state. In the process of determining the amount of funding, the study cost coefficients of the thematic areas of studies and the values of the study cost coefficients according to the level of the study programme, as well as the number of students at the study programme and the study courses implemented therein are taken into account. As mentioned above, by using study cost coefficients of the thematic areas of studies, it is possible to determine the amount of financing required for the implementation of a particular study programme and study course. In the Methodology for the academic year 2018/2019, RTU Senate approved that in the future the study cost coefficients of the thematic areas of studies would be applied individually to each study course of the study programme, thus ensuring an even more appropriate amount of financing for the implementation of study courses included in the study programmes. In order to implement this system, the Expert Committee was established by order of the Vice-Rector for Academic Affairs, who determined thematic areas of studies for each study course. RTU has the following thematic areas of studies and the applicable coefficients:

Thematic area of RTU study courses	**RTU coefficient**
Architecture and urban planning	3.5
Aviation transport	4.2
Construction	2.9
Civil engineering and real estate management	1.71
Civil and occupational safety	2.9
Civil defence	4.2
Computing	2.9
Computer training	2.42

Economics	1.4
Electronics and telecommunications	2.9
Power and electrical engineering	2.9
Physics	3.2
Geodetics and cartography, geomatics	2.9
Innovation	2.9
Engineering drawing	2.9
Quality management	2.9
Chemistry and chemical technology	3.2
Applied arts and design	3.5
Mathematics and statistics	2.42
Material sciences	3.2
Medical engineering	2.9
Mechanics, mechanical engineering, construction of machines and mechanisms	2.9
Internal security and customs	4.2
Pedagogy	1.67
Heat engineering, heat, gas and water technology	2.9
Social sciences	1.4
Sports	2.0
Textile technology	2.9
Law	1.4
Transport	2.9
Management and administration	1.4
Languages	3.2
History and philosophy	1.4
Environmental engineering and management	3.2

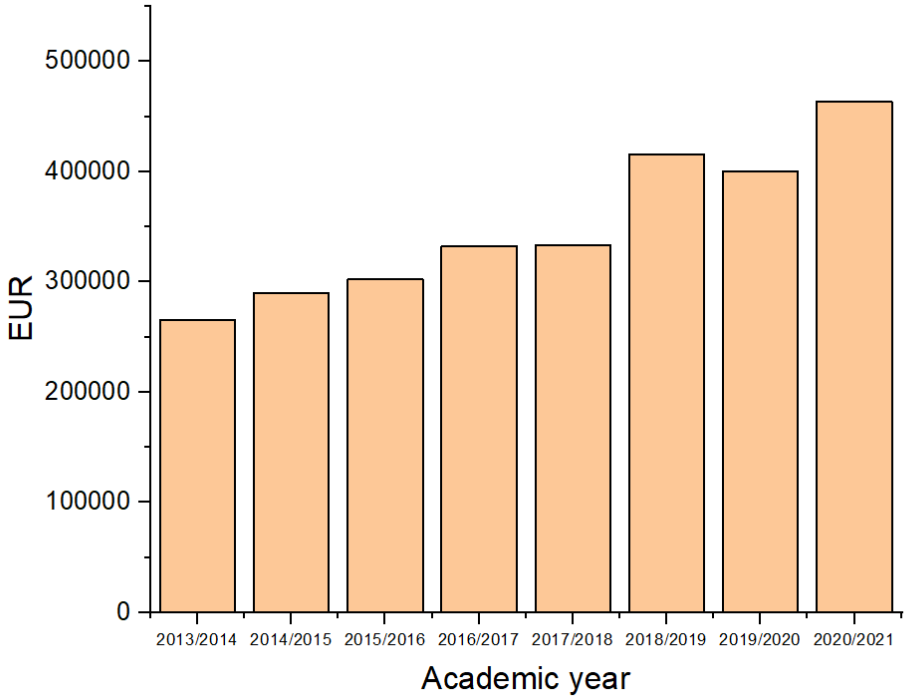
Logistics	1.8

From the academic year 2019/2020, similar principles are introduced also in Methodology2 and applied to study programmes, where the total number of foreign students in all academic years is greater than or equal to 90. The study programmes with less than 90 foreign students have a support mechanism, which envisages financing from the total funding of the foreign students, in order to ensure an adequate amount of funding for the implementation of the study courses of the study programmes.

In order to ensure the functioning and sustainable development of study programmes, RTU has been improving the Methodology and Methodology2 for each academic year in accordance with changes in the external and internal environment, thus also eliminating possible risks in the implementation process of the study programme or its study courses. The transition process involves all stakeholders, thus ensuring transparency, as well as a transparent decision-making process. The required changes are at first initiated by RTU Vice-Rector for Finance, and additional changes can be initiated by any RTU employee by submitting a request to RTU Vice-Rector for Finance or to the Finance and Budget Committee of RTU Senate. The Finance and Budget Committee of RTU Senate consists of 20 senators (the count might vary) - deans, heads of organizational units of faculties, professors, as well as student representatives, who have voting rights, as well as nine RTU Senate advisors, who are mainly representatives of various administrative units, such as vice-rectors, heads of departments etc. Once the Finance and Budget Committee of RTU Senate has considered and evaluated the proposals, it shall propose amendments to the Methodology or Methodology 2 or develop a new version of the document(s) for the next academic year for approval by the RTU Senate 35 senators. It should be noted that historically changes in the Methodology or Methodology2 have been proposed after performing a thorough analysis, including mitigation of their possible negative impact on the implementation of study programme courses.

Funds for research activities are allocated from the RTU Science Development Fund. For example, they are allocated for the organization of the section of the RTU International Conference "**Materials Science and Applied Chemistry".** At the implemented events, researchers and students have the opportunity to gain new knowledge, share experiences and make contacts for new research.

Information on the financial resources of the RTU study programme included in the study field "Physics, Materials Science, Mathematics and Statistics" in the period from 2013-2020. shown in the graph below. The total funding of the study field in the reporting period from 2013 to 2021 has been 2804979 EUR. This funding is mainly made up of government grants. Only less than 3% of the total funding is foreign student fees. During the reporting period, the amount of funding for the study field showed an upward trend, which is related to both the increase in general funding and the opening of new study programmes:



Research base funding (base funding provided by the state) is allocated among faculties according to the performance-based output indicators, i.e., number of publications (weighted by impact and citation), money attracted by research projects and industry contracts, and defended Doctoral Theses (considering also the time it takes to complete Doctoral studies). The calculation is made based on the transparent methodology, which was approved by the Scientific Council (the document: "Methodology for Allocation of Research Base Funding to RTU Organizational Units") on 20 November 2018. A decision regarding allocation of the budget among faculty institutes is made within faculties (by the Faculty Councils).

RTU also makes three project calls a year with internal funding. The 1st project call aims at supporting publication activities of young scientists. The 2nd call supports projects where RTU cooperates with industry partners, and this call is aimed at promoting inter-faculty and inter-disciplinary research within six research platforms of RTU. The goal of the 3rd call is to involve graduates in the research process. The regulation documents are usually approved by the Scientific Council of RTU. However, the decisions regarding selection of particular researchers or projects are made by expert groups organized by the Office of Vice-Rector for Research, on the faculty level or the research platform level (Council of Coordinators of Research Platforms; decision of RTU Senate No. 600 "On Approval of the Regulation of Coordinators' Board of the Research Platform at Riga Technical University" as of 23 May 2016. Projects are administered by the Office of Vice-Rector for Research. The Office also coordinates administration of the externally funded research projects, e.g., within Horizon 2020 program and other. Research projects funded by the EU Structural Funds are administered by the Office of Vice-Rector for Strategic Development.

The Internal Research Excellence Grant for young scientists is a new initiative, with an aim to attract talented young researchers to RTU and provide with funding, which allows establishing new research groups in a prospective research field. Funding for a 3-year period is based on international competition under conditions similar to EC ERC grant, and international call and evaluation performed by external, i.e., foreign well-recognized researchers. The final decision for awarding the grant is made by the Scientific Council of RTU.

RTU Research Support Fund (decision of RTU Senate No. 585 "RTU Regulation of Research Support

Fund" as of 15 December 2014) aims at providing financial support for various research related activities, such as support for maintenance of research equipment, protection and licensing of intellectual property, covering of expenses related to the Doctoral study process, publishing of scientific journals, participation and organization of scientific conferences, support to researchers in establishing new laboratories in a prospective research field. The Research Support Fund is an instrument to support research activities, which foster the development of the strategically important research fields. 10 % of the research base funding (state budget funding) is allocated to the Research Support Fund every year. Establishment of seven new laboratories or centres has already been supported by the Fund by June 2020, e.g., RTU High Energy Particle Physics and Accelerator Technology Center (for cooperation with CERN), Biochip Laboratory, Scientific Laboratory of Experimental Mechanics of Materials, Scientific Laboratory of Electromechatronics, Research Center of Communication System Technologies. Research Laboratory of Technologies of Electrical Engineering and Ergonomics. Scientific Council has decided to support on competition basis at least one new prospective research direction every year (decision of RTU Scientific Council No. 04000-3/09 dated 21.09.2020.

In the academic year 2019/2020, 54 RTU doctoral students received a doctoral research grant. Financial amount for one doctoral grant was 10,000 EUR. Beneficiaries were elected to the position of research assistant or researcher. The aim of RTU doctoral grants is to support research related to the doctoral thesis and to promote the defence of the doctoral thesis and to promote the defence of the doctoral thesis in the 4th year after the commencement of doctoral studies.

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.

The construction of RTU Ķīpsala campus began in 1965 with the aim to create a unified study and research centre. The construction process is underway, and it is envisaged to host the majority of university students in Ķīpsala from 2021. After completion of the construction, RTU Ķīpsala campus will become the most modern engineering study centre in the Baltic States.

The issue of sustainable development is taken into account in the construction process of the campus. Recognizing its concern for sustainable development and demonstrating its willingness to engage in the promotion of sustainable development, RTU has joined the Sustainable Development Solutions Network, which seeks to achieve the 17 UN Sustainable Development Goals (SDGs) by 2030. RTU is currently the only organization in the Baltic States that has been admitted to the network.

Through its networking activities, RTU, as a higher education and research institution, has prioritized the achievement of seven UN SDGs that coincide with RTU research platforms. RTU considers the provision of quality education and the promotion of lifelong learning to be its primary goal. RTU also intends to contribute to research and innovation in sustainable and modern water technologies, power systems, infrastructure and urban environment. The University is also committed to promoting the creation and distribution of sustainable products.

RTU buildings are equipped with state-of-the-art climate control equipment, technical solutions that are remotely controlled and provide the opportunity to track energy consumption to make buildings more comfortable for students, academic staff, researchers and guests. One of the results achieved

in the development of RTU infrastructure is the participation in the Green Metric Ranking (https://greenmetric.ui.ac.id/rankings/overall-rankings-2021/rtu.lv), which recognizes RTU Ķīpsala campus as the 40th greenest campus in the world and RTU – as the 50th greenest university in the world. In the Baltic region, RTU is a leader in terms of green thinking infrastructure.

To reduce human impact on the environment and climate change, RTU is committed to introducing the concept of Green Ķīpsala at its campus by 2023. To achieve the goal, RTU is improving its infrastructure in compliance with sustainability principles, changing student and staff habits, and using innovative green products and technologies developed by RTU researchers in Ķīpsala campus infrastructure.

The infrastructure of Ķīpsala campus provides students, staff and guests with all the necessary services and utilities, e.g., it is possible to park a bicycle and a car, quench one's thirst at water drinking points. Developing the infrastructure, care is taken of all groups of people, including people with disabilities: each building has parking lots, easy access to classrooms, laboratories and other facilities, the use of Braille to provide essential information, as well as all sanitary facilities are designed according to the requirements. The association of people with disabilities and their friends APEIRONS (https://www.apeirons.lv/; in Latvian) commends RTU for its achievements in infrastructure related issues for people with disabilities.

In RTU Ķīpsala campus, there are currently 54 classrooms, 187 laboratories, 19 special training rooms, 10 computer classrooms, 12 workshops and several research centres of national importance. The campus also houses a hostel with 950 beds and a special area for people with disabilities.

Foreign students, visiting lecturers and university guests can use the renovated RTU student accommodations (Āzenes 22a, Riga).

Other elements of RTU infrastructure are also available for the needs of students and lecturers - canteens and cafes located in each of the RTU complexes, photocopiers, hostels, RTU sports and recreation centres, swimming pool, etc. RTU premises are equipped with drink and snack vending machines.

Wi-Fi is provided in all classrooms of the campus which allows students to access study materials placed on the RTU study portal ORTUS.

The management and administrative staff of FMSAC and FCSIT constantly monitor the compliance of the premises and technical equipment with the quality requirements, and appropriate classrooms have been created with the necessary multimedia equipment (see table).

The infrastructure available for the study process in the educational building at **P.Valdena 3/7 (FMSAC)** is summarised in the table below:

Type of use of the room	Number of rooms	Total area, m^2
Meeting / Conference hall	3	239
Computer class	2	74
Auditorium/classrooms	16	1139
Offices/Premises for teaching staff	64	1801
Premises of study and scientific laboratories	106	19232
Auxiliary room	16	308

Warehouse	7	171
Library	1	540
Educational building at Zunda krastmala 10 (FCSIT)		
Type of use of the room	**Room No.**	**Area m²**
Auditorium	331	102
Academic staff room	321	36
Academic staff room	322	35
Academic staff room	323	17
Computer class	330.	102
Computer class	120	106
Auditorium	104	94
Auditorium	205	71
Auditorium	206	76
Auditorium	305.	103
Auditorium	306.	102
Auditorium	405.	101
Auditorium	406	101
Computer class	430	102
Computer class	431	102

Heat insulation of the facade, as well as overhaul of the ventilation, sewage and water supply system of buildings of FMSAC at P.Valdena iela 3/7 was completed in 2014. In addition, every year, funds for repair and equipment of auditoriums and laboratories are allocated centrally. 8 MEUR in total were invested in renovation in the reporting period. A new building at Zundas krastmala 10 was built for the Faculty of CSIT in 2021-2022. Infrastructure in all buildings is fit for studies and research, and also for their interlinking. Every year funds are invested in the repair of study and research laboratories and improvement of their equipment. Due to the need for a transition to a remote study process due to the epidemiological situation, an auditorium was equipped for ensuring an interactive online study process in 2021. Over 20000 EUR were invested in purchasing of equipment and it provides the possibility to stream lectures, record them and interact with students.

The annex lists the most important equipment used in the study process. This is equipment used for laboratory work in study courses and equipment for drafting graduation and scientific papers. Part of the equipment is included in the UseScience online database (https://scientificservices.eu/) for wider access. We also use this database, if some equipment is not available in structural units of the faculty for drafting a graduation paper or a research paper. The biggest investments in purchasing of equipment in the reporting period were made in 2018-2020, when excellence equipment purchased for 9 MEUR. The implementation of the Horizon 2020 project “Baltic Biomaterials Centre of Excellence” (BBCE) started in 2020, which provides for investment of 3.5

MEUR in equipment and 4 MEUR in the construction of BBCE building.

In the study programme “Particle Physics and Accelerator Technologies”, students get full access not only to the infrastructure of RTU and UL, but also to the necessary experimental infrastructure, as well as human resources of UL and CERN. In the high energy physics specialisation, students join one of CERN experiments with Latvia’s involvement, currently, CMS or AEgIS. The student has access to the infrastructure of the respective experiment, as well as full dataset of this experiment. Students of the accelerator technologies specialisation are involved in accelerator technology projects related to CERN and get the opportunity to conduct research activities, using CERN laboratory infrastructure and software, like, for instance, CATIA computer modelling programmes. All students get a CERN User status and are assigned a CERN IT account, incl. CERN e-mail. With these data students are provided access to different IT resources and applications, including the professional version of the ZOOM videoconference platform. Finally, all students have access to huge amount of knowledge from human resources and CERN scientific library.

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.

Library plays an important role in the provision of methodological guides and educational resources to students. RTU Scientific Library (SL) (https://www.rtu.lv/en/studies/scientific-library) is a library of national importance, which has acquired its status in the process of library accreditation. The SL provides the necessary information to ensure RTU study process and research activities, as well as provides library, bibliographic and information services to RTU students, academic and general staff. The Library holds more than 1.3 million printed documents and e-resources in RTU industry specific databases. The Library stock is located at the Central Library, the Study Material Subscription, the Chemistry Branch, the Transport Branch and Study and Research Centres in Daugavpils, Liepāja, Cēsis and Ventspils.

In 2016, significant investments were made in the development of the SL infrastructure by building additional premises (2240 m^2). The total area of the SL premises is 6393 m^2, of which 3417 m^2 are reader service premises. There are 713 working places for SL users. The SL has four group rooms and six individual booths, a rare book reading room and a conference room. The library is equipped with self-service facilities. The SL is accessible for users with disabilities.

In order to improve the SL activities and to meet the information needs of academic and research staff, the Library Council has been established, which decides on replenishing the library collection with printed publications and subscribing to the necessary databases. The Library Council has approved the Compilation Policy of RTU SL Collection, which sets the basic principles of the collection development in accordance with the areas of RTU academic and research activities.

After the SL receives its funding from RTU, it calculates funding for the information resources for

each study programme. The collection is replenished taking into account the recommendations of the heads of the study programme and researchers, in compliance with the allocated funding. By contacting the SL Collection Development Department regarding replenishment of collection, the desired editions can be ordered at the Library website by filling out an order form (https://www.rtu.lv/lv/studijas/biblioteka/pakalpojumi-3 (in Latvian)) or an application form, contacting by phone 67089353, or visiting the Library at 5-105 Paula Valdena Street. The SL offers a guide, which includes websites of various Latvian and foreign publishing houses and bookstores for searching publications and e-resources.

Database subscription agreements are concluded both directly with the supplier and through the Cultural Information Systems Centre, which is the Latvian national representative for the international non-profit organization Electronic Information for Libraries (EIFL, http://www.eifl.net/). The EIFL Licensing Programme offers libraries of state importance to subscribe to internationally recognized databases at a significantly reduced subscription fee that is not offered to individual subscribers, thus saving the financial resources of libraries.

At the request of the academic staff of the study field “Physics, material science, mathematics and statistics”, 106 new books were purchased by the SL amounting to 9023,18 EUR in the period of 2013 – 2021.

- At the request of the academic staff of the study programme “Material nanotechnologies”, 11 new books were purchased by the SL amounting to 1597,54 EUR in the period of 2013 - 2021.
- At the request of the academic staff of the study programme “Financial Engineering”, 62 new books were purchased by the SL amounting to 4180,46 EUR in the period of 2013 - 2021.
- At the request of the academic staff of the study programmes “Material Sciences”, 33 new books were purchased by the SL amounting to 3245,18 EUR in the period of 2013 - 2021.

Every month, the list of the newly-received literature is published in the SL newly-received literature bulletin ((https://www.rtu.lv/lv/studijas/biblioteka/jaunieguvumi) (in Latvian&English)).

Subscribed databases (https://www.rtu.lv/en/studies/scientific-library/electronic-resources):

- ProQuest Ebook Central Academic Complete, Wiley Online Library, SpringerLink e-books, ACM Digital Library, IEEE Xplore Digital Library, Academic Search Complete EBSCOhost, Applied Science & Technology Source EBSCOhost, Business Source Ultimate EBSCOhost, eBook Academic Collection EBSCOhost, MasterFILE Reference eBook Collection EBSCOhost, MasterFile Premier EBSCOhost, eBook Open Access Collection EBSCOhost, Open Dissertations EBSCOhost.
- The SL also has access to databases funded by the Ministry of Education and Science: ScienceDirect Freedom Collection, SCOPUS (Elsevier), Web of Science (Clarivate).
- Latvian databases: LETA, Letonika, Latvijas standartu datubāze (available only on library premises).

The most appropriate e-resources for the study field “Physics, Material Science, Mathematics, and Statistics” are:

- **E-books:** Proquest Central Academic Complete, eBook Academic Collection EBSCOhost, SpringerLink, eBook Open Access Collection EBSCOhost, ScienceDirect handbooks (Elsevier).
- **E-journals:** Academic Search Complete EBSCOhost, Wiley Online Library, Applied Science & Technology Source EBSCOhost, ScienceDirect Freedom Collection (Elsevier), IEEE Xplore Digital Library, Business Source Ultimate EBSCOhost, MasterFile Premier EBSCOhost.

The use of RTU SL databases has been growing since 2016. Number of downloaded full texts in

2021 – 418103.

The SL new premises have made it possible to expand the range of services available to users. Since the opening of the new premises, the number of library visits increased from 103,825 to 691,200. The SL Central Library is open to users from Monday to Friday (https://www.rtu.lv/writable/public_files/RTU_2_rtu_library.pdf). There is a 24h reading room. At the request of students, during the session in December 2019 and January 2020, five central Library floors with a collection were available to users 24h. During the summer the Central Library is open every working day with reduced opening hours.

The SL information sources are open access resources. Books and periodicals relevant for the study field "Physics, Material Science, Mathematics, and Statistics" are located in the main building of the SL (5 Paula Valdena Street) in compliance with UDC indexes. The basic indexes for this study field are:

51 Mathematics

512 Algebra

514 Geometry

517 Analysis

519.1 Combinatorial analysis. Graph theory

519.2 Probability. Mathematical statistics

53 Physics

53(03) Dictionaries, manuals, lexicons, encyclopaedias of physics

530 Theoretical foundations of physics

531 General mechanics

532 Mechanics of liquids (hydromechanics)

533 Mechanics of gases. Aeromechanics. Plasma physics

534 Vibrations. Waves. Acoustics

535 Optics

536 Heat. Thermodynamics. Statistical physics

537 Electricity. Magnetism. Electromagnetism

539 Nuclear physics. Atomic physics. Molecular physics

539.2 Properties and structure of molecular systems

539.3 Elasticity. Deformation. Mechanics of elastic solids

539.4 Strength. Resistance to stress

62 Materials science

62-1/-9 Characteristics and details of machines, equipment, plant, processes and products

620.1 Materials testing. Defects of materials. Protection of materials

620.2 Commercial materials. Goods. Wares

311 Statistics as a science. Statistical theory

The last copy of the oldest editions that comply with RTU profile is stored in the SL repository. They are always available to users.

The on-duty librarian helps find the necessary resources. More detailed information and consultations are provided by bibliographers (information specialists). The SL has librarians responsible for particular fields of science (https://www.rtu.lv/lv/studijas/biblioteka/nozaru-informacija (in Latvian)).

Searching for SL resources is ensured by the PRIMO Discovery search tool). It allows searching for the information in the library catalogue, subscribed databases, as well as in databases created by the SL. Searching for the information in the Union catalog, one can simultaneously obtain information about the available resources in 13 libraries in Latvia.

Both the electronic catalogue and RTU portal ORTUS can be used to reserve the library resources remotely. Remote access to databases is also provided. Since the introduction of RFID technology, users have been able to use five book-dispensing self-service vending machines and return books to a book-sorting vending machine around the clock.

The SL provides students, academic staff and other interested parties with different types of individual consultations and group training in information literacy (https://www.rtu.lv/lv/studijas/biblioteka/lietotaju-apmacibas (in Latvian)).

Editions that are not available in the SL are delivered through an interlibrary subscription or international subscription. Internet access is provided throughout the SL. The SL provides copying, scanning, printing and binding services, as well as there is a self-service canteen.

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.

Owing to a high level of digitalization, the available infrastructure and material and technical facilities for the implementation of the study field and corresponding study programmes provide an opportunity to increase the University’s competitiveness, improve operational quality and efficiency, as well as to make information available by integrating IT solutions into administrative, academic and research processes of the University and providing administrative and academic staff with modern, reliable, secure and unified IT infrastructure and quality IT services.

The Information Technology Department works in three areas:

1. Creation, development and maintenance of an integrated information system of RTU providing support for administrative, academic and research work of RTU;
2. Provision of high-quality and uninterrupted voice and data communication services throughout the territory under the control of RTU, as well as maintenance of RTU data centres and key network resources;
3. IT service support, incl. providing information on new IT solutions, giving necessary consultation and organizing IT training.

To ensure easy and efficient identification of IT users, an IT user identity management system has

been introduced; as a result, each IT user has a unique electronic identity that is valid in all information systems. In addition to the aforementioned, a user session management system is ensured in IT systems, which means that there is no need for IT users to re-authenticate when logging in to RTU information systems. It gives the experience of using a unified integrated information system without having to memorize different identification data and re-enter them, implementing different IT application scenarios.

All IT users are provided access to the centralized portal ORTUS (https://ortus.rtu.lv – screenshots of the interface are attached in "RTU IT sistēmu saskarnes / Screenshots of RTU IT systems"), which functions as a single digital gateway, combining information from all RTU information system components and providing users with an easy-to-use way of accessing the directory of all IT services in one place.

The Centralized Study Management System is used for efficient administration of the study process, which ensures digital provision of the study life cycle, incl. Electronic Register of Study Programmes (its public part is available at https://stud.rtu.lv/rtu/vaaApp/sprpub – screenshots of the interface are attached in "RTU IT sistēmu saskarnes / Screenshots of RTU IT systems"), drawing up learning agreements and enrolment of students in study programmes, Register of Study Courses (its public part is available at https://stud.rtu.lv/rtu/discpub/list?english=true – screenshots of the interface are attached in "RTU IT sistēmu saskarnes / Screenshots of RTU IT systems"), designing student's individual study plans, drawing up orders, implementing study courses and study process, registering grades, recognizing study courses, awarding qualifications, administering payments, hostel information, gathering information to issue diploma supplements, etc. This system is one of the main cornerstones in the administration of RTU study process.

To ensure effective implementation of the study process, Moodle e-learning system is used, where all relevant information is compiled in an automated way (study courses, users, groups, access rights, etc.). This system ensures student-instructor communication. The academic staff members place various electronic materials, assessment tests, homework assignments, information on a particular study course, etc. in the system. Students can also view their financial information on the ORTUS portal, as well as make request for documents (references, transcripts of records, copies of a learning agreement, etc.). For online distance learning RTU academic staff has options to use *Zoom* or *Microsoft Teams* video conferencing platforms.

Since 2007, more than 130,000 unique study course sites have been generated in the e-learning environment of RTU. Students can access electronic learning resources anytime and anywhere.

Digitization of classrooms and schedules has been carried out to ensure efficient premises management and study planning (https://telpas.rtu.lv (in Latvian); https://nodarbibas.rtu.lv/ – screenshots of the interface are attached in "RTU IT sistēmu saskarnes / Screenshots of RTU IT systems"). Each RTU student and academic staff member can access their schedule, which provides information on the venue, time, instructor, room, title and type of lecture. In addition, for user's convenience purposes, the system greatly facilitates lecture planning and scheduling, as well as optimizes the use and efficiency of premises.

Electronic Staff Management and Record-keeping Systems, which cover the circulation of record-keeping and personnel documents at RTU (https://docs.rtu.lv/ – screenshots of the interface are attached in "RTU IT sistēmu saskarnes / Screenshots of RTU IT systems"), are also used to ensure the efficient administrative work. Electronic document coordination and document e-signing functionality have been introduced, thus reducing print-based document circulation and significantly increasing document circulation speed. Since autumn semester 2019, students have been provided with electronically signed learning agreements. Since 2016, RTU graduates have been receiving electronically signed transcripts of records.

In terms of quality assurance, a digital student survey system is used, with the help of which the quality control of study courses and study programmes is implemented each semester. Based on the results of quality control, regular measures are taken to improve study programmes and the study process, in general.

For the additional convenience of RTU students, academic and general staff members, RTU leases Microsoft Windows and Microsoft Office software, which provides all IT users with access to the latest Microsoft software. RTU students can use the licensed Windows operating system and the Microsoft Office productivity suite provided by RTU for study needs. All IT users have access to Microsoft Office 365 cloud computing platform with one terabyte of storage space available to each user and access to a variety of additional collaboration and productivity tools (Microsoft Teams, SharePoint Online, Forms, OneNote, OneDrive, Outlook, etc.). RTU students, academic and general staff have access to the University's email system.

To support research activities, RTU has developed the Centralized Research Support System, which records all information on publications, patents, commercialization applications, Doctoral Theses, RTU scientific journals, research staff, etc. The system provides access to information according to Open Access principle (https://science.rtu.lv – screenshots of the interface are attached in "RTU IT sistēmu saskarnes / Screenshots of RTU IT systems"). RTU students and academic staff also have centralized access to research software.

RTU has high-speed fibre optic Internet and extensive wireless network infrastructure with over 400 access points, including the international *Eduroam* service. In addition, desk phones and mobile communications are provided for fast and easy communication.

To ensure a stable and secure operation of the information technology infrastructure, continuous monitoring of the IT infrastructure and systems is performed, resulting in proactive incident control. Data backup is also ensured.

The Information Systems Security Policy has been developed and implemented with the primary goal of ensuring the secure use of RTU information systems by establishing and maintaining a sufficient set of measures to reduce or prevent potential or resulting harm. Implementation of the Information Systems Security Policy envisages security checks, data transmission network monitoring, as well as preventive measures. Regular IT security and personal data protection training is organized for IT users. Automated security incident management and risk management have been implemented. Statistics demonstrate that the number of IT security incidents dropped significantly over the last five years.

The IT User Support Centre provides IT user support, by applying a one-stop approach to process applications based on ITIL guidelines. Since 2007, the IT User Support Centre has processed and resolved more than 160,000 IT user applications.

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.

The implementation of RTU personnel policy is stipulated in the Human Resources Development Plan, which focuses on three main goals within the professional development of the academic staff: renewal of the academic staff, by promoting academic work of Doctoral students, improvement of the professional competence of the existing academic staff and attraction of foreign academic staff.

The action plan sets out, for each goal, the activities and sub-activities to be carried out, defines the results to be achieved, the responsible organizational units and the implementation schedule.

Elections of RTU academic staff are held in accordance with the requirements of the Law on Higher Education Institutions and Cabinet regulations based on the recommendations of the Council of Higher Education, in accordance with the Constitution of RTU and the regulations approved by the Senate "On the Procedure of Electing Professors and Associate Professors" and "On the Procedure Of Electing Assistant Professors, Lecturers and Assistants" (publicly available at https://www.rtu.lv/lv/universitate/vakances-rtu/personalatlases-dokumenti (in Latvian); the English translation is in the file of Appendix 42-43 of the list of Internal regulations), as well as in compliance with other internal laws and regulations.

At the proposal of organizational units, the faculty council or the institute board shall consider and approve a reasoned proposal made by the head of a respective organizational unit for announcement of the competition for vacant academic positions, which expire in the respective academic year. The faculty council or the institute board shall submit the proposal under consideration to the RTU Personnel Department together with the job description and qualification requirements, including the workload (full-time or part-time).

Regarding academic positions for professors and associate professors, where the term of election expires in the respective academic year, periodic evaluation of scientific and pedagogical qualifications is performed in accordance with the Procedure for Election of a Candidate for the Position of Professor or Associate Professor and the Procedure for Assessing the Qualification of an Existing Professor or Associate Professor approved by the RTU Senate meeting on 29 June 2020 (published at https://www.rtu.lv/writable/public_files/RTU_par_profesoru_un_asocieto_profesoru_periodisko_novertesanu_apstiprinasanu.pdf (in Latvian); the English translation is in the file of Appendix 45 of the list of Internal regulations).

The Personnel Department informs the head of the structural unit of the professor or associate professor about the need to organize the evaluation of the professor or associate professor. The evaluation is performed by the Board of professors of the field in accordance with the Law on Higher Education Institutions, the Regulations of Councils of RTU professors and the Regulations on periodic evaluation of professors and associate professors approved by the RTU Senate. After the evaluation, the Council of the professors of the field submits an opinion on the result of the evaluation to the Rector and the Personnel Department. Taking into account the evaluation of the Board and the procedures and criteria set by the higher education institution, the employment contract with the associate professor or professor may be extended for a definite or indefinite term. If, as a result of the evaluation, the scientific and pedagogical qualification of a professor or associate professor meets the evaluation criteria set by the higher education institution, the employment relationship is continued. If, as a result of the evaluation, the qualification of a professor or associate professor does not meet the evaluation criteria set by the higher education institution:

- the relevant employment contract of the professor or associate professor is terminated;
- the department may decide to announce a new vacancy.

The Personnel Department announces a competition for academic staff positions at RTU website, the *Euraxess* vacancy portal and at least in one mass medium distributed throughout Latvia. The applicant shall personally submit or send by email the signed application documents no later than one month after the date of competition announcement.

The employment relationship shall be established by means of a written employment agreement

between the Employer and the Employee at least two working days before the commencement of employment. The employment agreement shall be drawn up in duplicate. One copy shall be kept by the Personnel Department of the Department of Personnel and Working Environment (in accordance with RTU File Nomenclature) and the other shall be issued to the Employee. Prior to entering into the employment agreement, the applicant is acquainted with RTU Rules of Procedure.

Employee's duties are defined in accordance with the Classification of Occupations of the Republic of Latvia and RTU Position Catalogue, Unified Work Remuneration Procedure at RTU (see the file of Annex 44 of the list of Internal regulations), RTU Rules of Procedure and the requirements laid down in the job description, which is an integral part of the employment agreement. Job description shall be presented to and signed by the Employee. Job description shall be drawn up in duplicate; one copy shall be issued to the Employee and the other shall be kept according to RTU Case Nomenclature.

Before taking up the employment, the Applicant shall present an identity document – passport or identity card, the Foreigner shall additionally present a visa or residence permit, as well as a work permit if such a permit is required in accordance with regulatory enactments.

Visiting academic staff shall be employed in compliance with:

- Law on Higher Education Institutions (https://likumi.lv/doc.php?id=37967 (in Latvian));
- Labour Law (https://likumi.lv/ta/id/26019-darba-likums (in Latvian));
- Immigration Law (https://likumi.lv/ta/id/68522-imigracijas-likums (in Latvian));
- Cabinet Regulations No. 568 "Regulations Regarding the Procedure by which a Research Institution Concludes and Terminates Employment Agreements with a Foreign Researcher" as of 21 July 2008 (https://likumi.lv/doc.php?id=178749 (in Latvian));
- Cabinet Regulations No. 225 "Regulations Regarding the Amount of Financial Means Necessary for a Foreigner and the Determination of the Existence of Financial Means" as of 25 April 2017 (https://likumi.lv/doc.php?id=290808 (in Latvian));
- Cabinet Regulations No. 25 "Implementing Regulations for the First, Second and Third Project Applications Selection Round of Specific Objective 8.2.2 "To Strengthen Academic Staff of Higher Education Institutions in the Areas of Strategic Specialization" of the Operational Programme "Growth and Employment"" as of 9 January 2018 (https://likumi.lv/doc.php?id=296513 (in Latvian));
- RTU internal regulations "Procedure of Involvement and Employment of Visiting Academic Personnel at RTU" as of 26 November 2018 (see the file of Annex 25 of the list of Internal regulations);
- RTU internal regulations "Unified Work Remuneration Procedure at Riga Technical University" as of 27 April 2020 (amendments on 28 September 2020, 21 December 2020, 25 January 2021, 31 January 2022) (see the file of Annex 44 of the list of Internal regulations).

According to the results of the applicant selection competition, the employment agreement with the visiting academic staff is signed within a month, specifying an hourly rate. Job description is also provided, which includes specific job responsibilities (delivering lectures, designing study courses, lecture cycles, supervising study papers, etc.). The workload of the visiting academic staff member may include the provision of face-to-face work (delivering lectures, providing tutorials, conducting seminars, supervising graduation papers, etc.) and remote work if it complements the face-to-face work (video lectures, tutorials, supervision of graduation papers). If the work is to be carried out remotely, face-to-face visits (e.g., tutorials) should be provided at the organizational unit.

The visiting academic staff member shall enter into the employment agreement in compliance with the requirements of the Latvian regulatory enactments. During the term of the employment agreement, all assignable copyrights for the work created by the visiting academic staff member,

including curricula, materials, and any other teaching aids developed by the visiting academic staff member, shall pass to the Employer. The visiting academic staff member, upon termination of the employment agreement, shall be obliged to transfer the work created within the framework of the employment agreement, including study materials, to RTU. Before terminating the employment agreement, the visiting academic staff member shall submit to the head of a respective organizational unit the reports and other documents stipulated in the employment agreement.

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.

At the end of 2018, the Centre for Academic Excellence (teaching and learning centre) was established at RTU in order to support RTU academic staff (in the areas of pedagogical, intercultural communication and self-development). The main tasks of the Centre for Academic Excellence are as follows:

- to organize various educational events, such as seminars, thematic series of events, guest lectures, conferences, discussions with the participation of the Latvian and foreign specialists;
- to coordinate experience exchange activities within faculties and other organizational units;
- to inform (including posting to ORTUS) the academic staff about the latest teaching and learning trends that are appropriate for RTU;
- to provide guidance to academic staff on the use of teaching and learning methods, as well as on the assessment of students' knowledge, skills and competence;
- to inform students about learning opportunities, such as platforms, systems, applications, effective methods and forms of learning that can be used both in the study process and individually.

Each semester, a core set of activities is offered taking into account the professional competence and needs of the academic staff, which are identified through a survey, in which the lecturers indicate the most important topics and areas in which they want to improve themselves. Student surveys data and information from student self-governments are also evaluated, to gain some topics which should be improved for lecturers from students' point of view. At the same time, proactive actions are being taken to assess the potential needs of academic staff.

The Centre for Academic Excellence organizes two methodological conferences a year. The conference organized in the autumn semester is dedicated to the modern content of the study courses, while the conference held in spring focuses on modern teaching and learning methods. Materials of all events are available on ORTUS within the study course "Materials of the Centre for Academic Excellence".

For an overview, let's list the topics offered recently: "Teaching and learning methods for modern students"; "Communication skills (public speaking)"; "Improving the study process in the digital age"; "Methodology of distance learning and recommendations for organizing the distance study

process"; RTU methodological conference "Technology studies - benefits for students or teaching staff?"; "Using IT programs in the remote study process"; "Practical tips for conducting interactive lessons in the Zoom learning environment"; "Competence-based studies at university"; "Impact of the crisis on communication? How to spare your nerves?"; "Diversity among students"; "Screen recording and processing"; "Data Security"; "Conflict resolution, generational conflicts, equality"; RTU methodical conference "10+ ideas for raising professional competence" etc.

After each professional development event, participants complete assessment questionnaires, which enable organizers to improve the range of offered events. In order to promote the development of competences of the academic staff, the student surveys are analysed each semester, as well as discussions with the representatives of faculties, student self-governments and the instructors themselves take place. In general, the qualification raising measures are highly appreciated by the academic staff, the benefit is appreciated and they are considered useful in the professional growth of teaching staff.

Lecturers have the opportunity to improve their English language skills by applying to the courses offered by the RTU Institute of Applied Linguistics or by the RTU Riga Business School, which are organized thanks to SAM 8.2.2 project funding.

With the emergency situation and lecturing switching to the remote mode, the CAE on the ORTUS portal prepared a site “Support in the provision of remote courses”. The site consists of six sections: General Information, Technical Assistance, Pedagogical Assistance, Experience Stories, Distance Exams and Mutual Support. Each section is regularly updated with relevant resources. Lecturers appreciate such a resource, and also suggest what other materials should be included.

Since March 2020, almost 80 webinars have taken place (both organized by CAE and international partners, in which RTU lecturers were invited to participate). Webinars organized by the CAE were recorded, with more than 400 participants participating online, and the recordings were viewed more than 650 times.

Educational events are also organized by the Career Support and Services Unit, providing regular seminars to RTU academic and general staff on the following issues:

- cultural diversity;
- critical thinking;
- youth psychology;
- team management;
- virtual processes and cybersecurity;
- burnout at work, etc.

For participation in seminars, employees receive professional development certificates issued by RTU Department of Further Education.

The themes of seminars and classes are offered taking into account the results of RTU staff surveys, as well as current trends at foreign universities. Information on seminars organized over the years is available at https://www.rtu.lv/lv/studentuserviss/karjeras-centrs-ssc/projekti-un-seminari/seminari-un-vieslekcijas (in Latvian).

RTU IT User Support Centre regularly organizes training on IT systems and the latest technology tools for RTU academic and general staff. Training is organized on the following topics:

- e-learning environment (Moodle) for beginners;
- e-learning environment (Moodle) for advanced users;
- MS Outlook email and calendar;

- Office365 Teams and OneDrive;
- searching in subscribed databases;
- record-keeping systems;
- basic IT security issues working with RTU information systems.

In May each year, the Student Parliament of RTU organizes the contest "Annual Award of the Student Parliament of Riga Technical University". During the event, RTU staff and members chosen by the students are awarded the honorary titles "Instructor of the Year" and "Student Support of the Year".

To recognize and appreciate RTU academic staff, since 2018, RTU has been organizing contests "Annual Academic Excellence Awards" and "Young Academic Staff Member of the Year" in cooperation with the foundation "Riga Technical University Development Fund" and Industry Service Partner Ltd. The aim of these events is not only to award the best academic staff members, but also to promote creativity in the academic environment.

Many members of teaching staff of the study field have received university, state and foreign awards. For example, in 2018, Professor Jevgeņijs Carkovs was awarded the Cross of Recognition. In 2020, Professor Kārlis Šadurskis was awarded a diploma of the Order of the Three Stars and was appointed a commander of the Order of the Three Stars. Awards of *Professor N. Budkina*: Certificate of acknowledgement from the RTU Rector – 29.03.2021, Acknowledgement of the UL Rector – 20.03.2021, annual award of the RTU Student Parliament "Most Active Teaching Staff of the RTU Faculty of Mechanical Engineering, Transport and Aeronautics of 2015" . For example, awards of prof. N. Lāce (Department of Corporate Finance and Economics): *Certificate of acknowledgement for a multiauthor monograph (co-author) in the contest of scientific achievements of the Latvian Academy of Sciences of 2021* "Latvian Economy in the Shadow of Pandemic and Opportunities of the Post-Crisis Recovery". Rīga, LU Akadēmiskais apgāds, 2021, ISBN 978-9934-18-687-5, 360 p. (in Latvian). Productivity Research Institute of the University of Latvia "UL think tank LV PEAK"; Award of the Faculty of Business and Management of Brno University of Technology for contribution to the development of long-term relations (2017); Award of the Faculty of Management of the Technical University of Sofia for contribution to the development of long-term relations (2018); Acknowledgement of the Minister of Education and Science for contribution to holding of the IV World Congress of Latvian Scientists (2018); Acknowledgement of the LLU Rector for contribution to the promotion of cooperation in science and research between the LLU Faculty of Economics and Social Development and the RTU Faculty of Engineering Economics and Management (2016). In 2019, the RTU Student Self-Government granted the award "The Most Motivating Teacher" to Assistant Professor Evija Liepa.

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.

214 teaching staff members, of which 182 (85%) are elected to an academic position at RTU, while 32 (15%) are employed temporarily for the implementation of the study process, are involved in the implementation of the study field "Physics, Material Science, Mathematics and Statistics". Professional qualifications of the academic staff are fully compliant for the implementation of study programmes of the study field and 88 (67%) of elected RTU academic staff members hold a

doctoral degree, other teaching staff holds a Master's degree. 50 (28%) have been elected as professors or associate professors. The study field currently employs 24 professors and 26 associate professors, whose main responsibility is development and improvement of the study process, work with doctoral students and Master students, as well as they have higher workload in scientific research work and projects.

Extensive information on all the teaching staff of the study field is available in the annex: List of academic staff and CVs.

When determining the remuneration and the workload for academic (teaching) work, administrative and research (including project) work, the basic principle of integrated planning is used, taking into account the planned amount of work for the current reporting period (semester or academic year) and making an adjustment for what has been done during the previous period.

Academic (teaching) work includes contact hours in auditoriums and laboratories, tutorials, supervision and reviewing of study and graduation papers, work in examination commissions, methodological work and activities that improve the quality of studies, etc.

Administrative (organisational) work includes the management of study programmes, work in councils/committees/council/senate, management of structural units, etc.

Research (scientific) work includes the attraction and management of projects, the execution of research tasks, which are paid from development funds or through third-party funding (including contracts, contract work with legal persons in Latvia/abroad, etc.), the preparation of publications, the supervision and reviewing of doctoral theses, work with doctoral students, tutorials.

In most cases it is impossible to strictly separate and define academic and research workload, because daily duties of staff overlap and all elected academic staff representatives have both academic and research workload, and in individual cases also administrative work. RTU does not strictly distinguish academic and research workload, its proportion is determined for each academic staff representative individually when planning the workload of the employee at the structural unit, as well as taking into account their positions, involvement in the implementation of projects, professional competence and experience.

In line with the needs and specifics of each course, high-level specialists (visiting lecturers) from industry, public authorities, non-governmental organisations, etc. may be involved in teaching. This will also ensure close cooperation with the sector and reduce the gap between the topics and development. The involvement of industry representatives varies every year. It depends on course planning and specialisations chosen by students. It should be noted that a large part of the visiting lecturers are partners in RTU's scientific research activities as well as former graduates.

Teaching staff of other universities are purposefully involved in study courses in the compulsory part of the study programmes, who complement or fully provide teaching for these study courses. The recruitment of such teaching staff is carefully evaluated, taking into account the ability of students to participate in the teaching process in English. For this reason, the majority of visiting teaching staff involved participated in teaching of master level study courses.

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.).

RTU Career Support and Services Department provides students with a wide range of career and psychological support services.

Career development support involves:

For prospective students:

- consultation on study programme selection;
- consultation on study selection and skills profiling;
- career choice seminars within RTU Open Days and upon request.

For current students:

- regular seminars and individual consultations on the development of career management skills, writing CVs and cover letters, job interview process;
- seminars on the development of entrepreneurial skills;
- project "RTU Golden Fund" to honour the best graduates and to promote new opportunities in the labour market;
- student summer camps for the development of career management and social skills and competences;
- online resource https://ekarjera.rtu.lv/ (in Latvian);
- an annual career day aimed at informing students majoring in engineering, natural and social sciences about the best and leading companies in the respective fields and bringing them closer to potential partner companies for undertaking internship and employers.

Psychological support involves:

- individual consultations and support in case of difficulties with studies (time planning, lack of motivation, social anxiety, adaptation difficulties) and individual psychologist consultations on personal issues and difficulties (including crisis intervention).

Seminars and workshops on the following topics:

- adaptation events for first-year students - informative classes within the study course "Introduction to Study Field", seminars on the development of learning and communication skills;
- stress management methods;
- time planning methods;
- self-motivation;
- emotion management and development of emotional intelligence;
- public speaking skills.

Support is differentiated by the target groups (https://www.rtu.lv/en/studentservice/career-centre/psychological-support):

- prospective students (secondary school pupils, vocational school graduates, other prospective students): consultations concerning the studies are available, including skills diagnostics.
- first-year students: informative classes within the framework of the study course "Introduction to Study Field"; seminars on the development of learning skills; information letters on career and psychologist support opportunities; individual career and psychologist consultations; and other activities in cooperation with businesses and non-governmental organizations.

- all RTU students: individual career and psychologist consultations, seminars and classes, guest lectures, RTU Career Day.
- foreign students (Erasmus+ mobility and full-time): individual and career support consultations are available in English; wherever possible, seminars and classes are conducted in English, such as seminars on writing CVs and cover letters, time management.
- students with special needs: psychological and career support consultations are provided upon request; physical access to the room; opportunity to come with one's mentor or interpreter.
- graduates: career support consultations are provided if necessary; consultations on writing CVs and cover letters, job interview process, career opportunities.
- staff: consultations on work and study related issues are provided to RTU academic and general staff members, if necessary.

As a result of pandemic, the offer has become even more accessible, as counselling and also career classes can be offered remotely.

In 2014, the Student Services Centre was opened in Ķīpsala campus. It provides day-to-day support under the supervision of the Career Support and Services Department:

- provides answers to various questions that students may have;
- provides printing, copying and binding services;
- issues identification cards;
- draws up references and transcripts, if necessary.

Further information is available at: https://www.rtu.lv/en/studentservice/student-service

In 2019, work was started on strengthening support for students with disabilities and in 2020 guidelines were issued with recommendations for effective communication and improvement of the study environment for people with disabilities and special needs: https://www.rtu.lv/lv/studentuserviss/par-mums-ssd/noderigi-ssc/noderigi-materiali-1/ka-komunicet-un-nodrosinat-piemerotu-studiju-vidi-personam-ar-invaliditati-un-specialam-vajadzibam (in Latvian).

By promoting and ensuring the availability and free access of higher education to all students and visitors with reduced mobility, the RTU buildings where the programmes included in the study field are implemented (P.Valdena 3/7, Āzenes 12a building and Meža Street 1 building) are adapted for persons with disabilities:
• Access to the building by a ramp (wheelchair accessible road);
• There is an elevator in the buildings;
• Stairs are equipped with lifts.

RTU International Cooperation and Foreign Students Department has academic consultants who consult foreign students on studies and practical issues. Academic consultants keep track of the students' academic performance and attendance, as well as meet students on a regular basis to make sure their studies are successful, both in and outside the classroom. Shortly after the arrival of students, academic seminars are held, which are compulsory for all new students. Academic seminars are held approximately twice a week at the beginning of each semester, in line with the student influx. During these seminars, academic consultants introduce students to RTU internal rules, their responsibilities and rights, academic integrity, and various other practical aspects. In the future, it is planned to divide the students into groups according to the study programmes and to involve the heads of the study programme in the seminars so that the students would get acquainted with the management of the programme in due time. If during the semester a student is observed to face difficulties with the study process (attendance, academic arrears), the student is invited to an individual meeting with his/her academic consultant to discuss the best possible

solutions to the problem. Each academic consultant has to arrange meetings with 2-5 students per week. After a month, students are invited to the meeting again to discuss their progress and make sure the situation has improved.

At RTU International Cooperation and Foreign Students Department, students have a contact person for facilitating the immigration process. The contact person organizes immigration seminars and document examination at the beginning of the semester. The Department arranges an appointment for students with the Office of Citizenship and Migration Affairs of the Republic of Latvia and verify the compliance of the submitted documents with the requirements specified in regulatory enactments.

RTU ICFSD foreign student admission team organizes introductory or orientation virtual seminars for foreign students, which take place before the beginning of the academic year / semester and students' arrival in Latvia, to inform students about practical issues related to entry and stay in Latvia (entry requirements, vaccination, self-isolation). , accommodation, etc.)

ICFSD in cooperation with the Student Service provides its students with a career counselor, who explains employment-related issues to students and introduces them to available vacancies, thus facilitating students to gain work experience and develop their skills and abilities.

For students, various types of support and counselling are also provided by the RTU Student Parliament, whose structure includes all faculty Student Councils and the International Students Council (ISC), which also represents the rights and interests of foreign students. Every RTU student in all level study programs have the right to get involved in Student Parliament, as well as faculty Student Council's and ISC, both extramural and intramural, as well as full-time and part-time students. Student Parliament and faculty Student Council's organise study evenings where students can help each other learn different topics together; promote involvement in science and student clubs in order to develop different practical knowledge in the study field; organize various academic-type events, such as panel discussions and guest lectures, excursions with collaborators from different sectors, providing students with the opportunity to explore different future potential jobs and to further develop understanding between acquired knowledge in lectures and in the specific work environment.

Further information is available at: RTU Student Parliament | Home

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).

RTU academic staff is actively involved in research work in addition to study work. Professors and associate professors are elected and evaluated every six years. Candidates for the position are obliged to observe and meet certain criteria for scientific activity, i.e. the number of publications or patents, the number of doctoral theses supervised, etc. (RTU Senate decision No.649; “On the

Procedure of Election of Candidates to Positions of Professors or Associate Professors and the Procedure of Evaluation of an Existing Professor or Associate Professor" entered into force on 27.04.2021). The right to supervise doctoral theses is awarded, if academic staff has the status of an expert in a specific field of science (RTU Senate decision No.602 "On Amendments to the Regulations for Doctoral Studies at the Riga Technical University", adopted on 26.09.2016), which is possible only if criteria with regard to the number of publications/patents are met. The status of an expert is awarded by the Latvian Council of Science. The database of experts is published in the National Information System of Scientific Activity (NZDIS; http://sciencelatvia.lv).

Every year, the rector and faculty deans sign contracts under which each faculty commits to achieving certain key performance indicators, many of which are based on research results, such as the number of publications/patents, the funding obtained from research projects, etc. The indicators influence the funding that the faculty receives from performance funding.

Scientific work in the study field is organised in administrative sub-units – RTU institutes:

- Institute of Applied Mathematics
- Institute of Polymer Materials,
- Institute of Technical Physics
- Institute of General Chemical Engineering
- Institute of Materials and Surface Engineering,
- Center of High Energy Physics and Accelerator Technology

The teaching staff implementing the study field is working in the following fields of science (in accordance with SciVal data):

- Material science (~ 28%),
- Engineering in context with material science (~24%),
- Physics (~ 33%),
- Mathematics (~ 15%)

These fields are related to state-defined "smart specialization" areas "Science, Technology Development and Innovation Guidelines 2014-2020" (1. Knowledge-intensive bioeconomy; 2. Biomedicine, medical technologies, biopharmacy and biotechnologies; 3. Smart materials, technologies and engineering systems).

Teaching staff of the study field is involved as scientific staff in several multisectoral and interdisciplinary projects, which are implemented at the level of the above-mentioned institutes:

The **Institute of Polymer Materials** (IPM) mainly focuses on:

1) Adaptation and optimisation of boundary processes during the development of polymeric composite materials, nanocomposites and hybrid composite materials.

2) Technological research and development of bi-phased polymeric composites / hybrid composites / functional polymeric nanocomposites / multi-component hybrid systems with different anisodiametric nanostructured additives;

3) Polymeric fibre chemical technologies;

4) Polymers and composite materials recycling strategy and technological solutions.

IPM has an excellent balance between fundamental and applied research. It is a national polymers testing centre and it operates an accredited "Polymer Testing Laboratory" (ISO/IEC 17025), thus providing extensive consultations to the polymers sector.

The **Institute of Technical Physics** (ITP) focuses on materials physics: holographic grid spectroscopy, chalcogenide glasses and electro-optical crystals, semiconductor research in unbalanced conditions in heterogeneous electrical, magnetic and temperature fields, formation of nanostructures on a semiconductor surface with laser radiation, development and research of intelligent polymer nanocomposites, transformation of human and environmental movements and heat energy into usable electricity. ITP cooperates closely with physicists in many EU and Asian countries. ITP has established cooperation with CERN (ARIES project). It cooperates extensively with IMSE, IPM.

The **Institute of Materials and Surface Engineering** (IMSE) operates a number of multidisciplinary research fields. It develops functional materials for detection, environmental purification, alternative energy and conducts studies in material science and inorganic compound nanotechnologies. This includes photochromic energy-saving smart windows, triboelectric nanogenerators, photocatalytic nanoheterostructures, antibacterial coatings, electrochemistry, etc. IMSE develops plasma and chemical synthesis techniques for the extraction of oxide, boride, carbide and nitride nanoparticles or their composite materials and their use in high temperature and functional materials for energy, solid-state electrolytes, fluorescent devices, photocatalysts and catalysts, microelectronics. IMSE has experience in commercial production technology for refractory nanopowders, also studies the preparation of solid-state electrolytes and phosphate-based battery cells. The institute also has a group of scientists conducting studies on calcium phosphates, though from a different perspective than IGCE. Their contribution to research of biomaterials complements the contribution of IGCE.

IMSE also specialises in the extraction, research and technology development of multifunctional nanostructured and ceramic materials (including composite materials) for improving environmental quality, health protection, the sustainable use of alternative energy and Latvian mineral resources. The institute conducts active analysis within the framework of contract work and consults companies working with geo-polymeric natural resources and construction chemicals. The institute cooperates extensively with ITP and University of Tartu

The **Institute of General Chemical Engineering** (IGCE) and its research centre “RTU Rudolfs Cimdins Riga Biomaterials Innovations and Development Centre” focuses on biomaterials for bone tissue replacement and regeneration, the development and research of eco materials/environmentally friendly materials, including the exploration of Latvian natural resources, as well as the design of biotechnologies and bioreactors. Close cooperation has been established with doctors and pathologists in Latvia and abroad. High-level research in this area is further confirmed by the recently acquired project Horizon H2020 Teaming2 BBEC (>30 MEUR), and this institute is its project coordinator. It will further develop the Faculty of Material Science and Applied Chemistry (FMSAC) as the Baltic regional biomaterial research centre.

Institute of Applied Mathematics (IAM) focuses on mathematical modeling: linear and weakly nonlinear stability of fluid flow, non-destructive testing methods for direct current, direct and inverse problems in heat transfer modeling, stochastic modeling in transport logistics, dynamic control models in economics, optimal dynamic control. LMI works closely with mathematicians and engineers in Hong Kong, Sweden and Estonia. LMI participates in the cooperation project of Latvian Science Council with Daugavpils University.

The **Center of High Energy Physics and Accelerator Technology** is responsible for Latvia’s cooperation with CERN.

The Center’s activities are carried out in three main fields:

1. To increase the competence of particle physics in Latvia.

2. To coordinate and participate in research of high energy particle physics and particle accelerator technologies.
3. To establish and implement interdisciplinary international master and doctorate level study programmes within the framework of CERN Baltic Group.

Students of the doctoral study programme conduct important fundamental and applied research during their studies, the results of which have a serious impact on the development of the sector. For additional information on the doctoral study programme see Part 3, description of the study programme “Particle Physics and Accelerator Technologies”.

Teaching staff of study programmes of this study field also act in Doctoral Councils and as reviewers in Doctoral Councils of other higher education institutions, e.g. prof. J.Blūms at the University of Latvia and at the Kaunas University of Technology, prof. R. Merijs-Meri at the Kaunas University of Technology and at the Tallinn University of Technology, prof. S. Gaidukovs at the Kaunas University of Technology. Professor Andrejs Koliškins is a member of the UL Doctoral Council in mathematics and a member of the council of UL professors of mathematics.

Professor Maija Šenfelde is a member of the RTU Doctoral Council in the field of Economics and Business, as well as in February 2016, in April 2017 and in April 2021 participated in the Doctoral Council of Klaipeda University, in June and October 2016 participated in the Doctoral Council of the Kaunas University of Technology, in April and December 2016, in March 2017 and in April 2021 participated in the Doctoral Council of the University of Latvia.

Professor N. Lāce is a member of the RTU Doctoral Council P-09 and also a member of the Doctoral Council of Agricultural Economy and Regional Economy Subsectors of the Sector of Economic Sciences at LLU. Professor Nataļja Lāce is also a member of the Council of Professors RTU “Economics and Business”; a member of the Council of Professors of three higher education institutions (RSEBAA, VeA, BA); a member of the Council of Professors of Agricultural Economy and Regional Economy Subsectors of the Sector of Economic Sciences at LLU.

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.

RTU structural units, in which programmes of the study field are implemented, have set the following objectives related to scientific research in their strategies:

1. **Quality studies**. Focus on attracting well-prepared students for studies. Differentiated education supply. More flexible approach to the choice of study courses and the possibilities of students to move from one study programme to another during studies. Development of new perspective directions – lifelong learning and digitalisation.
2. **Excellent science.** Promoting and improving the quality of international competitiveness of scientific activity. Improving the support system and promoting investment in equipment, ensuring an increase in scientific effectiveness and achieving an internationally high level of results.
3. **Sustainable valorisation.** Proactive, clear and inclusive cooperation with industry. Involvement of academic staff and students in establishing high-tech start-ups. Improvement of the support model and mechanisms for the involvement of students and staff in valorisation. Development of innovation skills in all RTU staff.

Strategic areas are also defined, on which long-term research objectives are based:

- Emphasis on high-level internationally accepted (quoted) publications
- Supplementing the academic staff career roadmap with the position of a tenured professor and a support model for doctoral students
- Increasing the competitiveness of academic staff and promoting growth of scientific results
- Focus on projects that meet the strategic, study and scientific priorities of RTU
- Renewal of scientific infrastructure.

All these objectives and strategic areas are aimed at promoting successful research, its link it to academic studies and integration into them, and helping early-stage researchers to successfully enter the profession.

The link of scientific research to the study process is ensured using potential knowledge transfer principles and continuous improvement of competences, which manifest in integration of research results in study courses and study process, involvement of students in research, familiarising of students with latest research results, enabling them to conduct research work independently or in cooperation with experienced researchers. The link of science and research to the study process is ensured also by involving visiting lecturers in lectures and practical classes, active participation of students in international and local conferences and seminars, preparation of scientific publications and participation in international cooperation research projects.

Students of FMSAC and FCSIT are involved in research as researchers and assistants in different research programmes and processes, and are also offered to draft Bachelor and Master theses in the defined research directions important for the faculty.

Currently, all the scientific directions and their interlinking with the study process at faculties are implemented by 4 FMSAC institutes and their staff; 1 FCSIT institutes and staff of the Center of High Energy Physics and Accelerator Technology.

Institutes and the centre involve students in research, thus developing their research skills during all studies, at the same time fostering that students become young scientists. Students of bachelor, master and doctoral study programmes of the structural unit were involved in the implementation of scientific projects of IPM, including: A.Gaile, O. Platnieks, M. Žiganova, A. Barkāne, S. Beļuns, R. Saldābola, G.Vugule, M. Zālītis, R. Makars, Z. Iesalniece, S. Briede, M. Bleija, M. Jurinovs, R. Grāvītis, J. Jasevičs, E, Kampe, A. Krikovs and others. Bachelor student S. Ščegoļeva and doctoral students: Santa Stepiņa, Astrīda Bērziņa, Linards Lapčinskis, Sandra Guzlēna un Edvīns Ļetko are actively involved in study and research work at ITP. Bachelor students Mārīte Skrinda, Anna Makņa, Ilze Kalniņa, Pauls Pāvils Ārgalis and doctoral student Jana Vecstaudža were involved in research works at IGCE.

Doctoral students – L. Nola, O. Rubenis; and Master students of IAM DPTMS – J.Petrova, I.Daņilovs. The doctoral student of the Department of Engineering Mathematics M. Žigunovs participates in the project of the Latvian Council of Science (LCS) No. lzp-2020/1-0076 “Analysis of Complex Dynamic Systems of Liquid Mechanics and Heat Conduction ” (from January 2021 to December 2023).

Master student of the Institute of Silicate Materials (now - Institute of Materials Surface Technology) R. Eglītis drafted a Master’s thesis “Low-temperature synthesis of ZnO and CuxO-ZnO heterostructures on glass and fabric substrates”. Part of results of the scientific paper are included in the publication: R. Eglītis, G. Mežinskis. Comparison of treatments of a cotton fabric modified with a low temperature TiO2 coating. Proceedings of the Estonian Academy of Sciences, 66. 4 (2017) 473–478.

Several scientific publications were created with participation of students, as well as reports were

made at several international conferences in Latvia and abroad.

Individual students of the master study programme (M. Žiganova, A. Barkāne, S. Briede, M. Jurinovs, M. Bleija) received students' grants, which contribute to professional growth and understanding of students of the application, implementation and reporting processes of applied research.

At the same time, the best students successfully applied for and receive scholarships of manufacturers (SIA Sakret, SIA Kinetics Nail Systems).

The effectiveness of interlinking of the scientific research and study process is characterised by the strengths of scientific activities, among which the most significant are that experienced, competent and internationally recognised research staff has a high potential to attract national and international funding and cooperation; prospective research directions corresponding to internationally justified priority research directions defined by the Latvian government; stable publication statistics in *Scopus* / *Web of Science*-indexed journals in all areas of research; the importance of studies proposed by the Latvian Government and the EU within the framework of RIS3 and other strategies; high-level fundamental scientific directions. The involvement of research staff in a number of multisectoral and interdisciplinary projects; institutes and laboratories have permanent staff which maintains the research infrastructure and ensures its availability to students and researchers.

It is important to note that the results of research projects, as well as projects implemented in cooperation with a manufacturer (SIA "MILZU!", SIA "Nipon", M. Radwański "Ekotex" (Poland), SIA "DTJ Sp. z o.o." (Poland), SIA "Latvijas finieris", SIA "Ceļu būves sabiedrība "Igate", etc.) are integrated in student training by including the information on latest trends in the industry in the content of lecture materials and implementing practical works in relation to the problems faced by manufacturers. So, for example, by cooperating with the Institute of Technical Physics and the Institute of Material Surface Technologies and implementing several projects related to the operation of tribielectric energy converters (ERAF "Hybrid energy converters, LZP grant "INTERMOLECULAR H-BOND STRUCTURE DESIGN IN POLYMERS FOR MORE POWERFUL TRIBOELECTRIFICATION", etc.), in which they participated several students of the master's program "Materials Science and Nanotechnology" (L. Lapčinskis, L. Ģermane, R. Eglītis, etc.) only obtained data on the relationship between the degree of electrification and the type and strength of chemical bonds in contact materials, which further supplemented the course of the master's program "Materials Science and Nanotechnology" content, such as "Solid State Physics" and "Modern Nanostructured Materials". As another example, one can mention the bachelor level study courses Composite Materials and Technology and Master level study courses Advanced Materials, Advanced Material Technologies, Recycling of Polymer materials, Selection of Polymer Materials and Design of Products. At the same time, graduation qualification papers are drafted on topics that are topical for manufacturers and state institutions (Latvian State Forests, National Archives of Latvia, Latvian National Museum of Art).

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.

The most important forms of implementation of scientific and research works are conducting research ordered by the state, participation in international projects, as well as research contract work ordered by companies.

Project results have a significant impact on all study programmes of the study field, as research results and lessons are integrated into study courses. The projects mainly involve academic staff and doctoral students, most of them prepare and read study courses. Participation in projects makes it possible for doctoral students and scientists to provide latest and up-to-date knowledge to students and others involved in scientific research. It helps to develop skills to analyse independently and critically the results of projects and the solutions developed to be used in the relevant research directions to address major challenges and to create and manage independent projects.

The most important research projects implemented within the study field, in the implementation of which the teaching staff of the field participates and the students are listed in the appendix "Scientific projects with the participation of the teaching staff of the study field".

Information on post-doctoral research projects is summarised here:

https://www.rtu.lv/lv/zinatne/pecdoktorantura/pecdoktoranturas-petniecibas-projekti (in Latvian).

Future plans for the development of international cooperation are related to the development of existing research directions, taking into account the areas of specialisation of the structural units implementing the study programme in the study field. Each of these structural units has specialised in a number of research areas. Over the next few years, FMSAC, FCSIT and the Center of High Energy Physics and Accelerator Technology are planning: (1) targeted work with scientific staff groups, including professors, researchers, young scientists to improve the motivation for publishing the results of ongoing studies and to increase citation; (2) capacity building of institutes by organising research groups around specific scientists to carry out cross-disciplinary studies, organising doctoral seminars and cooperating in specific international networks, as well as optimising the internal structure of faculty; (3) more active research in international circulation through the participation in research projects, including COST actions or similar focused on networking and cooperation in the creation of project applications and high-quality publications; (4) participation (as a partner) in one of Horizon 2020, Horizon Europe 2027 call projects; and (5) more active use and development of existing research infrastructure and instruments, including improvement of laboratory equipment and software, as well as scientific journals and projects to improve the scientific process and valorisation indicators.

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.

RTU Research Support Fund (decision of RTU Senate No. 585 “RTU Regulation of Research Support Fund” as of 15 December 2014) aims at providing financial support for various research related activities, such as support for maintenance of research equipment, protection and licensing of intellectual property, covering of expenses related to the doctoral study process, publishing of

scientific journals, participation and organization of scientific conferences, support to researchers in establishing new laboratories in a prospective research field. The Research Support Fund is an instrument to support research activities, which foster the development of the strategically important research fields.

Six research platforms in the main strategic research areas of RTU were established in 2013 as an instrument for fostering inter-disciplinary and inter-faculty cooperation of researchers in the areas of importance for industry and society. These platforms are as follows: “Energy and Environment”, “Cities and Development”, “Information and Communication Technologies”, “Transport”, “Materials, Processes and Technologies”, “Security and Defence. Each platform has a dedicated coordinator, and they comprise the Council of Coordinators responsible for implementing the activities within platforms. The Council is supervised by the Office of Vice-Rector for Research (Decision of RTU Senate No. 600 “On Approval of the Regulation of the Council of Coordinators of Research Platforms at Riga Technical University” as of 23 May 2016). Similar to the faculties, the platforms have the Research Program (Decision of RTU Senate No. 590 “On Authorization to Approve RTU Research Program by RTU Scientific Council” as of 27 May 2015; “Research Program of Technical University 2016–2020”), annual action plan and dedicated funding from the Research Support Fund. Internal project calls within the platforms are organized every year, allocating 90–120 thousand EUR in total to six projects selected on a competitive basis. A mandatory requirement for the projects is a minimum 20% industry co-financing and participation of more than one faculty. In the period of 2016–2020, 16 projects were supported and nearly 300,000 EUR of funding was allocated to the projects. Regular series of seminars and visits to companies are also organized by the research platforms to stimulate networking and cooperation with industry.

Efficiency of these mechanisms can be illustrated by growth of SCOPUS indexed publications in the period of 2013–2019. The total number of the publications increased from approximately 440 publications per year in 2013 to 865 in 2018. Number of SCOPUS publications per researcher (expressed in full-time-equivalent (FTE)) increased from circa 0.9 in 2013 to circa 1.5 publications/FTE per year in 2018 (the data were obtained from Elsevier “SciVal” database on 17 June 2019).

The teaching staff involved in the implementation of study programmes “Materials Engineering” and “Material Science and Nanotechnologies” participated in the Baltic Polymer Symposium international conferences organised together with the Tallinn University of Technology, the Kaunas University of Technology, the Vilnius University since 2001 (R. Merijs-Meri, A. Ābele, I. Bočkovs). Emphasis in conferences of this series is made on reports of students along with plenary reports of global level scientists.

Teaching staff of material science in this study field actively participate in the conferences organised by the Latvian Materials Research Society. Thus, for instance, the leading researcher of the RTU Institute of Technical Physics Dr.phys. PĀVELS ONUFRIJEVS speaks at the conference organised in 2021 with a report “Prospective directions of laser technologies: structuring of the surface of materials and modification of the chemical composition”.

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.

RTU has mechanisms for involvement of students from all study levels and programs in research activities. There are activities aimed at strengthening the Doctoral studies and providing career opportunities during the post-doctoral period to young researchers.

Doctoral grants are provided to Doctoral students on a competitive basis. International calls are made to attract to post-doctoral projects. In addition, the internal Research Excellence Grant for young scientists was established in 2018 as a new initiative, providing 270 000 EUR for 3-year period based on international competition (conditions are similar to EC ERC grant with international call and evaluation performed by external, i.e., foreign well-recognized researchers). The grant allows young and talented researchers to establish their own research groups and make research career at RTU. Internal project calls provide additional funding for publishing articles in SCOPUS/WoS indexed editions, and internal projects within 6 research platforms stimulate involvement of Doctoral and Master students in multi-disciplinary and inter-faculty research projects in cooperation with the industry. The Research Support Fund (10% of the research base funding is allocated to this fund) provides support to Doctoral students (attending conferences, publishing papers and thesis, etc.). Employment of Doctoral students and post-doctoral researchers at RTU went up from 0 FTE in the period of 2013-2016 to 88 FTE (Doctoral students) and 97 FTE (Post-doctoral researchers) in 2018. 17 post-doctoral 3-year long projects with total funding of 2.28 million EUR were launched in 2017. The funding covered salaries, costs of materials and mobility, as well as support for further development of research skills (circa 134,000 EUR are allocated to one project). 16 post-doctoral 3-year long projects were launched in 2018 and 12 post-doctoral 3-year long projects were launched in 2019 with total funding of 3.7 million EUR. 18 post-doctoral 3-year long projects with a total funding of 2.4 million EUR have been launched in 2020. In 2021, at least 10 projects should be launched The post-doctoral projects allow attracting new researchers to RTU from abroad and other Latvian research institutions, and providing academic career opportunities to Doctoral students who graduate from RTU.

Internal project calls within the six research platforms, which are organized every year, have criteria regarding the involvement of students in the project, giving an additional score if students at the Bachelor, Master or Doctoral level are involved in the project.

The Design Factory (DF) of RTU (see additional information about the DF below) organizes the study course "Vertically Integrated Project" (VIP), during which interdisciplinary student teams develop a challenging long-term research project under the guidance of experienced researchers. The course is implemented in cooperation with researchers from the Georgia Institute of Technology (the USA). Within the course, cross-disciplinary student teams are assembled, bringing together students from at least three different study programmes, and ranging from first-year Bachelor students to Doctoral students, as well as involving pupils from the Engineering High School (EHS) of RTU (see additional information about the EHS below). During the course, students participate in research work under supervision of RTU researchers, working together with students of other study programmes and gaining experience in research as well as in team and project work. At the end of the course, each team presents its progress and demonstrates the results obtained. For example, during spring semester of 2019, the call for VIP courses was announced for three topics:

- sensor systems and networks (group leader Prof. J. Poriņš);
- wastewater treatment (group leader Prof. T. Juhna);
- energy efficient houses (group leader Leading Researcher J. Zaķis).

The course is registered as a free elective study course and two credit points are assigned to the student in the semester.

The Engineering High School of Riga Technical University is the first general secondary education establishment in Latvia that has been founded within the framework of a university. It is the place where the most talented Latvian pupils can acquire the study courses in exact and natural sciences at an advanced level to get prepared for the engineering studies. At the EHS, special attention is paid to the integration of engineering studies and scientific research activities into the study process.

A success story is the establishment of DF Labs (http://rtudf.rtu.lv) for design and prototyping. Idea of having the Lab at RTU was inspired by a positive example of Aalto University in Finland. Its task is to provide expertise and shared infrastructure for developing prototypes of new products and technologies, based on ideas of students and researchers. RTU DF also works with industry, start-ups and spin-offs and has established a very good reputation. We could observe that it considerably improved the involvement of students at all study levels in research and innovation activities and promoted cooperation of RTU with industry.

To the extent possible, interested students are involved in the scientific work of the structural units implementing the study program and their cooperation partners. For example, in recent years, virtually every defended qualification work in the field of biopolymers and biobased polymer composites has been related to scientific projects implemented by the Institute of Polymer Materials of RTU. In this regard, individual qualification works are defended in closed sessions, if required by the project conditions. At the same time, individual students are involved in conducting research on topics of interest to certain companies, for example, at the request of SIA TENAPORS, a study was conducted on the possibilities of utilizing used thermal insulation foam materials, which allowed J. Lakševičs, a student of the academic bachelor's study program "Materials Science", to develop a bachelor's thesis "Creation of polymer-modified bitumen compositions from for worn-out resources'. At the same time, the results of scientific research are also used in the study process. For example, laboratory work on determining the rheological properties of polymer-modified bitumen has been developed. Undoubtedly, including the results of research works in the study process increases its quality, showing new students the possibilities and results of applying their studies and acquired knowledge.

Overall, more than 15 young researchers received doctoral and postdoctoral grants to support their research in the reporting period:

Doctoral grants were received by doctoral students of Professor M. Šenfelde D. Skoruks in ac.year 2017/2018 and K. Freimanis in ac.year 2021/2022.

Doctoral student of N. Lāce A. Roša obtained a grant in the project “European Social Fund Project “Strengthening of Academic Staff of Riga Technical University in Strategic Specialization Areas”” No. 8.2.2.0/18/A/017” (2019-2020).

Doctoral student of N. Lāce A. Matisone obtained a grant in the project “European Social Fund Project “Strengthening of Academic Staff of Riga Technical University in Strategic Specialization Areas”” No. 8.2.2.0/18/A/017” (2020-2021).

Students enrolled in doctoral study program “Particle physics and accelerators” are full-time early careers researchers. Particle physics students are involved in the research processes at the CMS (Compact Muon Solenoid), AEgIS (Antihydrogen Experiment: Gravity, Interferometry, Spectroscopy)or other future experiments, including both physics analysis and detector development tasks. Students working on accelerator research will are involved in one or more CERN-based or CERN-related accelerator research and development projects, such as I.FAST (Innovation Fostering in Accelerator Science and Technology) or HITRIplus (Heavy Ion Therapy Research Integration plus).

Post-doctoral research project “Creating Riga a Smart City as a Sustainable Tourism Destination in

the Big Data Era" (2021 – 2023) – scientific supervisor N.Lāce. The objective of the project is to develop a public information system for sustainable development of tourism in Riga.

Post-doctoral research project "The methodology for the commercialization of innovative biomedical devices and the evaluation of the productions financing model" (2019 – 2021) – scientific supervisor N.Lāce. Objective of the project: to develop a methodology of commercialisation of innovative biomedical devices and evaluation of the financing model.

Post-doctoral research project ("Elaboration of highly elastic electrodes for hybrid triboelectric nanogenerators from interface layers exhibiting high contact charging" (2020-2023, implementer A.Linarts, supervisor prof. M.Knite). The objective of the post-doctoral research project is to develop highly elastic electrodes for hybrid triboelectric nanogenerators (TENG) based on electroconductive nanostructured polymer composites, as well as to increase the electrical capacity of TENG by incorporating ferro-electric nanoparticles into triboelectric layers made of elastomers.

All information on post-doctoral grants in RTU structural units can be found in the link in section 2.4.3.

In general, students of all levels are involved in research in the programs implemented in the field of study and participate in the fulfillment of the efforts and goals of Latvian Science Council grants, State research programs, and international programs. Students of bachelor's programs mostly fulfill the duties of research assistants, students of master's and doctoral studies are already working as researchers and in many cases continue the researches started during their undergraduate years. Practically all students who finish the programs implemented in the field of study are authors or co-authors of scientific publications.

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.

The study process implemented within the study field has always been linked to technological innovation in products and processes. Students participate in the development of scientific projects, often related to the improvement or development of production processes for the needs of cooperation partners. During study internship, students familiarise themselves with a technological process and develop proposals to improve it.

From the year of studies 2018/2009, bachelor level students have been learning a study module for the development of professional competence in business, technology transfer and product development – "Development of innovative products and entrepreneurship". The study module methodology is based on co-creation, integration of the parties involved in the development and commercialisation of new processes and products into the study process, provision of continuous feedback on the results/achievements of the student groups involved in the study process. It is aimed at learning knowledge by doing and formation of integrated theoretical knowledge.

Students' understanding and knowledge of the importance of innovation in the sector are improved in all fields of study at the appropriate level.

Innovation, valorisation and introduction of innovative methods in the process is one of strategic priorities of RTU. Innovation activities of FMSAC, FCSIT and the Center of High Energy Physics and

Accelerator Technology take place in several fields and at several levels.

Teaching staff of faculties of the Center participates in the implementation of study courses related to the development and commercialisation of innovative products, this ensures artistic creation, innovation development and continuous knowledge transfer. Student start-ups are created as a result of this activity, which continue to develop in an RTU or Latvian business incubator, patents are also registered. Integration of new knowledge and experience in study courses should be mentioned as one of the results.

When scientists and researchers of faculties and the Center implement research projects (for the list see Paragraph 4.3), they obtain new knowledge from project partners and conducted research, and as a result form new innovative ideas and products offered for commercialisation by creating and publishing on the RTU website Commercialisation offers for wider community.

Overall, from 2013 to 2021, academic staff of the structural units implementing study programmes of the study field published 42 commercialisation offers, as well as received 8 patents for inventions (for detailed information on commercialisation offers and patents see Annex).

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.

The choice of cooperation partners is based on the previous experience of the study field and cooperation of experts with Latvian institutions in studies, science, project development, membership in associations, etc. forms.

RTU FMSAC, FCSIT and Center have been cooperating successfully with local companies, sectoral associations and public organisations for a long time. Every year, cooperation is expanding, strengthening and new forms of cooperation are emerging, with a growing mutual interest in delivering a successful outcome of cooperation. The main areas of cooperation and activities within the framework of the study field are:

- Ensuring and improving the study process and quality, including improving of curriculum of the study programmes and forecasts for the needs of specialists;
- Providing internship and professional development of students by offering places of placement and jobs;
- Managing and reviewing study and graduation papers, offering topics of graduation papers (formulating problems to be solved in companies so that students can develop scientifically sound solutions;
- Ordered research and approbation and implementation of the results of scientific studies in companies;

- Involvement of professionals (company specialists) in the study process, state examination boards and the study field committee;
- Organisation and implementation of other, extracurricular, activities outside, including company scholarships and support for students, Career Days;
- Representation of university and industry interests in state and local government institutions, etc.

In order to ensure constant bilateral dialogue, working groups, seminars, events and conferences, where all the stakeholders (employers, graduates, academic staff of the university and students) can meet, are organised on a regular basis. Quality of study programmes, curriculum and form of study courses, organisation and implementation of practical work is organised during such meetings. The study programmes included in the study field are supplemented and updated during their implementation based on labour market research and consultations with employers and practising specialists.

Recommendations of graduates, students and academic staff of the higher education institution play an important role in the implementation of the study field. Surveys of graduates and employers are organised on a regular basis. Respondents are urged to evaluate study programmes, knowledge and skills of graduates of programmes and their compliance with labour market requirements.

In the period of 2013-2021, the structural units implementing the study field study programme in the fields of scientific research cooperated with Latvian and foreign partners and higher education institutions, the list of which is attached to this section of the self-assessment statement.

Cooperation with different professional organisations with the scope of the study field takes place in organising of joint conferences and seminars, and also as scientific cooperation, consultation on development of the industry and necessary changes and improvements to the education system. The following can be mentioned as the most important cooperation partners in this field:

Lecturer, Dr.sc.ing. K. Ruģele – member of the Latvian Biogas Association.

J.Zicāns, member of the editorial board of RTU scientific articles “Material Science and Applied Chemistry”; member of the National Supervisory Board of the 7th biennale of Euronanoforum 2015, Europe’s largest Nanotechnology and Material Science, Innovation and Business Networking Conference; member of the Management committee of COST action MP1206 “Electrospun Nano-fibres for bio inspired composite materials and innovative industrial applications”.

M. Dzenis, Chief Editor of RTU ″Material Science and Applied Chemistry″.

Cooperation with Latvian universities:

Taking into account the wide range of fields of sciences in the study field, academic staff of the study field cooperates with many Latvian higher education institutions: University of Latvia, Rīga Stradiņš University, BA School of Business and Finance and other higher education institutions.

Academic staff of the study field participates in sectoral expert councils of national importance, for example: Professor Maija Šenfelde is an LCS expert in the field of Social Sciences in the sub-sector of Economic and Business until 23.04.2023. and in the field of Social Sciences in the sub-sector of Social and Economic Geography until 25.05.2023.; Professor Natālja Lāce is a member of the LCS expert commission in Social Sciences, an LCS expert, a member of the International Accreditation Committee of the Ministry of Education and Science.

Academic staff of the study field participates in different public activities, for example:

J.Blūms, presentation of the report “How can universities support schools in the implementation of

in-depth courses” within the day of teachers of physics in 2021; presentation of the report at the Conference of the Latvian Association of Teachers of Physics, 21 October 2019.

Andrejs Matvejevs is a member of the board of the Association of Actuaries of Latvia. Currently, the association is engaged in the implementation of the new education standard in accordance with the requirements of the International Actuarial Association.

Several lecturers of the professional bachelor study programme "Financial Engineering" (Natālja Budkina, Oksana Pavļenko, Evija Liepa, Andrejs Matvejevs) are active members of the Latvian Mathematical Society and the Latvian Statisticians’ Association.

Professor Maija Šenfelde is a member of the Latvian Association of Civil Engineers.

Annex includes information on cooperation agreements concluded with other institutions, subject matter and effective period of the agreement.

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.

The choice of cooperation partners is based on the previous experience of the study field and cooperation of experts with foreign institutions in studies, science, project development, membership in associations, etc. forms.

The following can be mentioned as the most important foreign cooperation partners in study field:

- Professor, Dr.sc.ing. L. Bērziņa-Cimdiņa – member of the European Ceramic Society;
- Professor Dr.sc.ing. D. Loča – member of NATO (North Atlantic Treaty Organization); COST Action MP1005 – “NAMABIO - From nano to macro biomaterials (design, processing, characterization, modeling) and applications to stem cells regenerative orthopedic and dental medicine”;
- Professor, Dr.sc.ing. J. Ločs – member of the Committee for Socio-economic Analysis of the European Chemicals Agency; COST MP 1301 “New Generation Biomimetic and Customized Implants for Bone Engineering"; International project: H2020 WIDESPREAD-04-2017- Teaming Phase 1, project “*Baltic Biomaterials Centre of Excellence*”.
  The successful implementation of this project led to the establishment of the Baltic Biomaterials Centre of Excellence, which is a vivid example of the cooperation of of RTU's teaching staff involved in the realization of study field "Physics, Materials Science, Mathematics and Statistics" with both Latvian and foreign institutions.

  The Baltic Center for Biomaterials Excellence (BBCE), which was created to increase scientific capacity and promote excellence in the research and development of new biomaterials for bone regeneration, is an excellent platform for new knowledge for students of all levels of the field of study "Physics, Materials Science, Mathematics and Statistics".

In order to achieve the set scientific goals and ambitions of the BBCE, internationally recognized research institutions and industry representatives have joined together for their implementation. They are as follows:

· Riga Technical University;

· Institute of Organic Synthesis of Latvia;

· Riga Stradins University;

· Institute of Stomatology of Riga Stradins University;

· AO Research Institute in Davos, Switzerland;

· Center for Biomaterials of the Friedrich-Alexander University of Erlangen-Nuremberg in Germany.

The mutual cooperation and exchange of knowledge of all these representatives has a qualitative impact and ensures the achievement of the goals and results of the study direction, as well as promotes the increase of the competence of the teaching staff involved in the study direction, which, in turn, promotes and strengthens the students' knowledge in engineering sciences and technology transfer, promoting innovative industries, as well as development of high added value products and services.

It should be mentioned that based on the newly acquired knowledge and experience that students and graduates of the field of study "Physics, Materials Science, Mathematics and Statistics" can obtain from the experienced staff of BBCE, these young, future specialists are able to work interdisciplinary in their professional work, are able to follow the continuous development of technologies and orients itself in interdisciplinary knowledge. They are able to connect this information, based on interdisciplinary analysis, to create something useful for a wide range of society and improve the daily life of every member of society with new technologies, different products and their knowledge.

- Docent, Dr.sc.ing. A. Stunda-Zujeva – member of the Society of Glass Technology.
- M.Kalniņš, member of the editorial board of the journal “Mechanics of Composite Materials” since 1992.

Prof. G.Mežinskis: Member of the editorial board of the Journal “Cheminė Technologija” of the Kaunas University of Technology.

Member of the editorial board of the “Journal of Sustainable Architecture and Civil Engineering” of the Kaunas University of Technology.

Member of the editorial board of RTU ″Material Science and Applied Chemistry″. Member of American Nano Society.

Prof. S.Gaidukovs: Member of the Management Committee of COST action “Multi-Functional Nano-Carbon Composite Materials Network (MultiComp)”

Prof. R.Merijs Meri: Member of the editorial board of the scientific journal *Environmental Research, Engineering and Management* (Issued by *Kaunas University of Technology*)

Prof. Knite: Expert in Material Science COST (European Cooperation in the field of Scientific and Technical Research) programme sub-programme DC: Materials, Physical and Nanosciences

Foreign cooperation partners are selected in accordance with development interests of study

programmes, for example, ensuring the attraction of visiting lecturers, development of joint projects, etc. The involvement of cooperation partners is related to the topics and scientific research in specific study programmes.

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.

To attract foreign students to RTU, two communication target groups are mainly addressed:

- the internal: management team; general staff, academic staff; existing students;
- the external: prospective foreign students (foreign students studying in Latvia, foreign pupils and students, parents of foreign pupils and students); foreign graduates; mass media; opinion leaders; educational institutions; student recruitment education agencies; diplomatic and consular missions of the Republic of Latvia.

The communication strategy uses several types of information channels, choosing the most appropriate for each target audience – paid advertising channels, earned and owned ones. Marketing communication is an essential part of addressing foreign audience using all the traditional marketing tools – advertising in media and other channels, event marketing, direct marketing, digital marketing etc. The main marketing tool used to reach foreign audience is participation in various educational exhibitions and seminars organized by educational agencies in target markets. Continuity in the provision of information and promotion of studies is ensured by the long-term partner universities and educational agencies. In order to ensure a permanent presence and the provision of quality information about studies at RTU and the selection of students, RTU has opened its own information and study centres in specific countries.

Various virtual seminars are widely used to address potential students, with the participation of RTU ICFSD employees, existing delegated employees of students and study program directors, who acquaint prospective students with RTU infrastructure, study opportunities and requirements for foreigners, study program content, further study opportunities, as well as career opportunities after graduation.

ICFSD foreign student admission staff provides potential students with the opportunity to use online consultations to solve issues related to admission and study program selection. Consultations are arranged by appointment, every week, for a period of two months before the end of the admission period.

Potential students who have provided their contact information to RTU in connection with the commencement of studies, but have not submitted their applications for studies, are regularly addressed at least once a month.

Public relations tools (press releases, media events, face-to-face meetings, interviews, opinion polls, etc.) and RTU social media channels (Facebook, WeChat, WhatsApp, YouTube, etc.) are used in corporate communication. RTU internal channels (ORTUS portal, email, etc.), information seminars and special events are used for internal communication.

RTU foreign student enrolment rates are summarized starting with academic year 2013/2014,

indicating whether the student is pursuing undergraduate or graduate studies. The number implies only students enrolled in the first year.

The number of applications processed is much higher than the number of students actually enrolled. For example, in academic year 2015/2016, 626 applications were received from prospective students, while 349 students commenced their studies; however, in academic year 2016/2017, 670 applications were received, but 445 students were enrolled; in academic year 2017/2018, 1813 applications were received, but 632 students were enrolled; in academic year 2018/2019, 2627 applications were received, but 774 students were enrolled; in academic year 2019/2020, 3340 applications were received, but 870 students were enrolled; in academic year 2020/2021, 2036 applications were received, but 524 students were enrolled; in academic year 2021/2022, 2533 applications were received, but 873 students were enrolled.

Information on the involvement of foreign academic staff is provided in section 3.6.

In the reporting period, 11 teaching staff members went for outgoing mobility 18 times in total. Mobility has intensified in the last years, when 8 teaching staff members participated in mobility per year of studies on average. The most attended country was Estonia, Lithuania, followed by Germany, Austria, Spain. The number of visits depends on individual factors related to cooperation in research or academic work. See the list of teaching staff and the countries visited during mobility in the annex.

Foreign teaching staff members were involved in the implementation of study programmes of the study field. Visiting lecturers mainly participated in ERASMUS+ mobility programme, as well as took advantage of other opportunities related to participation in joint international projects. 28 teaching staff members used incoming mobility in the reporting period. The number of mobilities in the reporting period is similar every year, except in recent years, due to the epidemiological situation in the world, but 6 teaching staff members participated in mobility per year of studies on average. Most teaching staff came from Lithuania, followed by the Czech Republic and Italy, Denmark, Bulgaria, Estonia, Germany, Greece, Finland and Portugal. Teaching staff also came from countries like Poland, United States of America, Japan, etc. See the list of teaching staff and the countries, from which teaching staff came, see the annexes.

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.

The evaluation of the previous study field “Physics, Materials Science, Mathematics and Statistics” took place in 2013. According to the procedure used at that time, study programs were evaluated and recommendations were formulated for each realized study program, not for the study field as a whole. Of all the study programs of the study field, there was a recommendation for only one study program - the professional bachelor's study program "Financial Engineering". The reprimand of the expert commission was for a very wide range of optional study courses, which was carried out by

setting up a labor market demand monitoring system and conducting annual surveys of graduates and identifying their recommendations for improving the quality of the study program. A report on the implementation of the Recommendation is attached.

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).

During the reporting period, four new study programs were licensed:

in the licensing process of the academic bachelor study program **“Materials Engineering”** (decision of the Study Quality Commission of the Ministry of Education and Science of the Republic of Latvia of June 30, 2021, license No. 04051/194), the expert commission recommended fulfilling two short-term and three long-term recommendations;
in the licensing process of the academic master's study program **“Materials Science and Nanotechnology”** (licensed by the decision of the Study Quality Commission of the Ministry of Education and Science of the Republic of Latvia of December 9, 2020, license No. 04051/192), the expert commission recommended one short-term and seven long-term recommendations;
in the licensing process of the academic master's study program **“Financial Engineering Mathematics”** (decision of the Study Quality Commission of the Ministry of Education and Science of the Republic of Latvia of August 22, 2017, license No. 04051-174), the expert commission recommended to implement four recommendations;
In the licensing process of the doctoral study program **“Particle Physics and Accelerator Technologies”** (Decision of the Study Quality Commission of the Ministry of Education and Science of the Republic of Latvia of September 29, 2021, license No. 2021 / 06K), the expert commission recommended fulfilling three short-term and five long-term recommendations.

Major part or recommendations have been implemented, but some recommendations are in the process of implementation. The review of the implementation of recommendations provided by licensing experts is attached in 6.2.1. Annex "Report on the implementation of the recommendations".

Recommendations that are in the process of implementation are most often related to activities at the university level (e.g. recommendation no. 7 for the study program "Material Sciences and Nanotechnology"), or with the short period of time that has passed since the accreditation of the study program (e.g. recommendation no. 1 for the Ph.D. for the study program "Particle Physics and Accelerator Technologies"), or requires a longer execution time in the current global situation (recommendation no. 2 for the doctoral study program "Particle Physics and Accelerator Technologies"). The work on the implementation of the recommendations continues and deadlines have been set for their implementation.

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	List of internal regulations.zip	Ieksejo normativo aktu saraksts.zip
The management structure of the higher education institution/ college	RTU_Management_Structure.pdf	RTU_parvaldibas_struktura.pdf
II - Description of the Study Field - 2.1. Management of the Study Field		
Plan for the development of the study field (if applicable)	Study field development plan.docx	Studiju virziena attistibas plans.docx
The management structure of the study field	RTU_Study_Field_Management_Structure.zip	RTU_studiju_virziena_parvaldibas_struktura.zip
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.	Contracts - Study continuation.zip	Ligumi - Studiju turpināšanas iespējas.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.	Confirmation - on compensation for losses.edoc	Apliecinājums - par zaudējumu kompensāciju.edoc
Standard sample of study agreement	Study_agreements.zip	Studiju_ligumi.zip
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	Summary of surveys.pdf	Aptauju kopsavilkums.pdf
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	Study field teaching staff.xlsx	studiju virziena macibspeki.xlsx
Biographies of the teaching staff members (Curriculum Vitae in Europass format)	Teaching stuff CV.zip	sudiju virziena macibspeku CV.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.	Confirmation - knowledge of the state language.edoc	Apliecinājums - valsts valodas zināšanas.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)	Confirmation - knowledge of the foreign language.edoc	Apliecinājums - svešvalodu prasme.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.	Summary of the results of the research activities of the teaching staff of the study field.docx	Studiju virziena petniecibas kvantitatīvie dati.docx
List of the publications, patents, and artistic creations of the teaching staff over the reporting period.	List of publications of study field staff.docx	Studiju virziena mācībspēku publikāciju saraksts.docx
II - Description of the Study Field - 2.5. Cooperation and Internationalisation		
List of cooperation agreements, including the agreements for providing internship	Annex List of cooperation contracts.zip	Sadarbības partneru saraksts.zip
Statistical data on the teaching staff and the students from abroad	Annex statistical data foreign students and teachers.docx	Pielikums Statistikas dati par ārvalstu studējošajiem un mācībspēkiem (2).docx
Statistical data on the incoming and outgoing mobility of students (by specifying the study programmes)	Annex students mobility.docx	Pielikums studejošo mobilitāte.docx
Statistical data on the incoming and outgoing mobility of the teaching staff	Annex Staff mobility.docx	Pielikums macibspeku mobilitāte.docx
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.	Review of implementation of recommendations.docx	Rekomendāciju izpildes pārskats.docx
An application for the evaluation of the study field signed with a secure electronic signature	01000-2.2.1-e_180.edoc	01000-2.2.1-e_180.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		

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)		

Other annexes

Name of document	Document
Zinātniskie projekti ar studiju virziena mācībspēku dalību.docx	Zinātniskie projekti ar studiju virziena mācībspēku dalību.docx
Scientific projects with the participation of the teaching staff of the study field.docx	Scientific projects with the participation of the teaching staff of the study field.docx
Studiju virziena sadarbibas partneri.docx	Studiju virziena sadarbibas partneri.docx
Cooperation partners of the teaching staff and institutions of the study field.docx	Cooperation partners of the teaching staff and institutions of the study field.docx
RTU_studejoso_priek_un_sudz_iesn_un_izsk_kart.pdf	RTU_studejoso_priek_un_sudz_iesn_un_izsk_kart.pdf
RTU_proposals_complaints.pdf	RTU_proposals_complaints.pdf
RTU IT sistemu saskarnes.zip	RTU IT sistemu saskarnes.zip
Screenshots of RTU IT systems.zip	Screenshots of RTU IT systems.zip
Technological devices FMSAC.docx	Technological devices FMSAC.docx
MLĶF struktūrvienību tehnoloģiskās iekārtas.docx	MLĶF struktūrvienību tehnoloģiskās iekārtas.docx
Anketēšanas rezultāti_RTU_papildinformācija.pdf	Anketēšanas rezultāti_RTU_papildinformācija.pdf

Financial Engineering Mathematics (45460)

Study field	*Physics, Material Science, Mathematics, and Statistics*
ProcedureStudyProgram.Name	*Financial Engineering Mathematics*
Education classification code	*45460*
Type of the study programme	*Academic master study programme*
Name of the study programme director	*Andrejs*
Surname of the study programme director	*Matvejevs*
E-mail of the study programme director	*andrejs.matvejevs@rtu.lv*
Title of the study programme director	*Dr.sc.ing., profesors*
Phone of the study programme director	*26015121*
Goal of the study programme	*The objective of the academic master's study programme "Financial Engineering Mathematics" is to provide deep knowledge in the fields of mathematics, financial and actuarial technologies, with a view to providing higher level technical education for graduates of the study programme who will work in the financial sector, including work in the analytical departments of credit institutions, financial consulting companies, financial management and financial advisory companies, insurance companies and companies engaged in investment in financial markets, as well as to continue education by increasing professional competence, including in doctoral study programmes.*
Tasks of the study programme	*Tasks of the study programme:* *- to ensure the higher education of the second level being competitive and conforming to international standards and to train students for practical work, to develop skills of scientific research work and to promote their use;* *- to provide students with comprehensive knowledge of financial engineering mathematics, to form specialists' skills and to develop competences according to the formulated requirements of labour market;* *- to promote interest in the further education and perfection, improving of the academic and professional knowledge;* *- to initiate students' interest in the ongoing processes in society, to stimulate students' development to be a positive, modern, responsible and capacitated personality who can act independently and independently make decisions;* *- to provide development and changes of the study programme content, the study process, scientific research work according to the changes in the financial sector, the international actuarial practice, science and didactic practice;* *- to promote the academic staff's and students' mutual interaction in carrying out scientific research work and the practical application of the results obtained according to the international standards and trends in the branches of finances and actuarial technologies;* *- to promote and to develop the academic staff's and students' international exchange and participation in projects.* *Measurements of results of task execution are students' study results, graduates' employment indices and references from employers, expansion of international cooperation, the increase in the number of research projects and in the number of students involved in research process as well as approbation of research results in enterprises.*

Results of the study programme	*As a result of the studies a student acquires the basic skills to be able to act independently and to make decisions as well as to use the acquired knowledge in the practical work. A student during the studies is capable:* *A. Knowledge and comprehension* *• to demonstrate comprehensive knowledge and understanding of fundamental mathematical conceptions and principles that are used for solving financial problems;* *• to demonstrate comprehensive knowledge and understanding of such mathematical conceptions, models and methods that are used in the assessment of financial instruments and their derivatives as well as to define and to justify the conditions and limitations for these models, conceptions and methods;* *• to demonstrate comprehensive knowledge and understanding of how theories, conceptions and methods for optimal allocation of capital and risk analysis can be used to build an optimal portfolio of assets;* *• to demonstrate knowledge and understanding of linear and nonlinear optimisation theories and methods;* *• to demonstrate basic knowledge in programming languages and to be able to use software of modern financial industry.* *B. Application and analysis* *Upon completion of the study programme, the graduate is capable:* *• to solve financial problems, to construct mathematical algorithms of their analysis, to use mathematical and computer technological methods to solve these problems;* *• to develop mathematical models of financial problems and to use knowledge of mathematics in the practical applications outside the mathematics context;* *• to use calculation programmes as supplementary aids for information retrieval and processing as well as to use basic knowledge in programming languages and to understand the importance of software in the financial sector;* *• to model mathematically the problems related to financial instruments and their derivatives and to find solutions for this model tasks;* *• to formulate complex problems in which it is necessary to use both optimisation and decision-making and to interpret solutions for the original context of the problems;* *• to effectively communicate the programmes in the study branch according to the adopted academic norms and to be able to write detailed and well-structured reports with a modern content;* *• to demonstrate initiative and personal responsibility in the future professional life.* *C. Synthesis and assessment* *Upon completion of the study programme, the graduate is capable:* *• to assess his/her strengths and weaknesses and to correctly interpret critical issues for the branch;* *• with personal responsibility to develop and to apply conclusions and assessments and to use feedback;* *• to evaluate complex situations in business and financial activity and take into account scientific, social and ethical aspects.*

Final examination upon the completion of the study programme	*The Master's Thesis*

Study programme forms

Full time studies - 2 years - latvian

Study type and form	*Full time studies*
Duration in full years	*2*
Duration in month	*0*
Language	*latvian*
Amount (CP)	*80*
Admission requirements (in English)	*Bachelor degree in financial engineering or comparable education*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Master degree of natural sciences in mathematics*
Qualification to be obtained (in english)	*-*

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

Full time studies - 2 years - english

Study type and form	*Full time studies*
Duration in full years	*2*
Duration in month	*0*
Language	*english*
Amount (CP)	*80*
Admission requirements (in English)	*Bachelor degree in financial engineering or comparable education. The assessment of the level of English language proficiency under the requirements specified in regulatory enactments.*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Master degree of natural sciences in mathematics*
Qualification to be obtained (in english)	*-*

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

Part time studies - 2 years, 6 months - latvian

Study type and form	*Part time studies*
Duration in full years	*2*
Duration in month	*6*
Language	*latvian*
Amount (CP)	*80*
Admission requirements (in English)	*Bachelor degree in financial engineering or comparable education*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Master degree of natural sciences in mathematics*

Qualification to be obtained (in english)	-

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

Part time studies - 2 years, 6 months - english

Study type and form	*Part time studies*
Duration in full years	*2*
Duration in month	*6*
Language	*english*
Amount (CP)	*80*
Admission requirements (in English)	*Bachelor degree in financial engineering or comparable education. The assessment of the level of English language proficiency under the requirements specified in regulatory enactments.*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Master degree of natural sciences in mathematics*
Qualification to be obtained (in english)	-

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

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.

The Licencing Committee of the study program took a decision on licencing the program “Financial Engineering Mathematics” on 22 August 2017. **No changes have been introduced** in the study program parameters during the reporting period.

The study program is included in the study field “Physics, Material Science, Mathematics and Statistics”, which was accredited until 30 May 2019 by decision No 75 of the Study Accreditation Committee of the Ministry of Education and Science of the Republic of Latvia on 31 May 2013. The accreditation period of the study field has been extended until 31 December 2023 by amendments to the Law on Higher Education Institutions of 3 June 2021.

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.

An important task of the study field is to educate and train internationally recognized, highly qualified specialists in various fields of physics, material science and statistics, thus the general tasks of the study field and the learning outcomes are formulated as follows:

- to develop students' analytical critical thinking and to promote their interest in the current social processes by analyzing the development trends of specific sectors, analyzing and evaluating the situation in the enterprises, the national economy and regions in general and in various fields of science;
- to acquire knowledge and improve professional skills and abilities in their chosen study program, presenting appropriate achievements and learning outcomes in each course and integrating them into research;
- to promote the acquisition of research skills by developing study papers within the framework of various courses and graduation papers;
- to develop skills in identifying problems, formulating goals and solving them, offering practical solutions to individual problems within the framework of study courses and graduation papers;
- as a result of the study process, to develop students' intellect, to promote their growth, to promote the use of intellectual abilities in the study process and further in their practical

activities.

The Master study program "Financial Engineering Mathematics" is the academic study program that provides profound knowledge in mathematics, in the area of finances and actuarial technologies in order to provide advanced engineering technical education for the program graduates who will work in the growing financial sector, including the work in the analytical departments of credit institutions, financial companies, financial management companies and financial consulting agencies, insurance companies and enterprises engaged in investments in the financial markets.

Measurements of results of task execution are students' study results, graduates' employment indices and references from employers, expansion of international cooperation, the increase in the number of research projects and in the number of students involved in research process as well as approbation of research results in enterprises, etc.

As a result of mastering the study program, graduates will be awarded a **Master of Science degree in mathematics**. The study volume of the program is 80 credit points (120 ECTS), its implementation duration is two years for full-time studies and 2.5 years for part-time studies.

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

The rapid development of technologies has caused the necessity for higher-level educational programs, whose graduates have mastered and are capable of working with the latest mathematical and financial instruments and methods to assess the financial market and to set investment strategies, as well as are capable of creating, developing and managing new financial products. There are wide innovation opportunities in this field for working with the latest securities and financial instruments, for instance, options, futures, swaps, interest rate derivative instruments, credit derivative instruments, and private pension plans.

Graduates of the Master study program "Financial Engineering Mathematics" can work not only at the enterprises trading financial products but also at financial departments of state authorities, as well as manufacturing enterprises as specialists, consultants, and experts.

Surveys of the graduates take place regularly, clarifying, among other things, the workplace and position of the graduates. Participation in surveys is voluntary, therefore there is no 100% information.

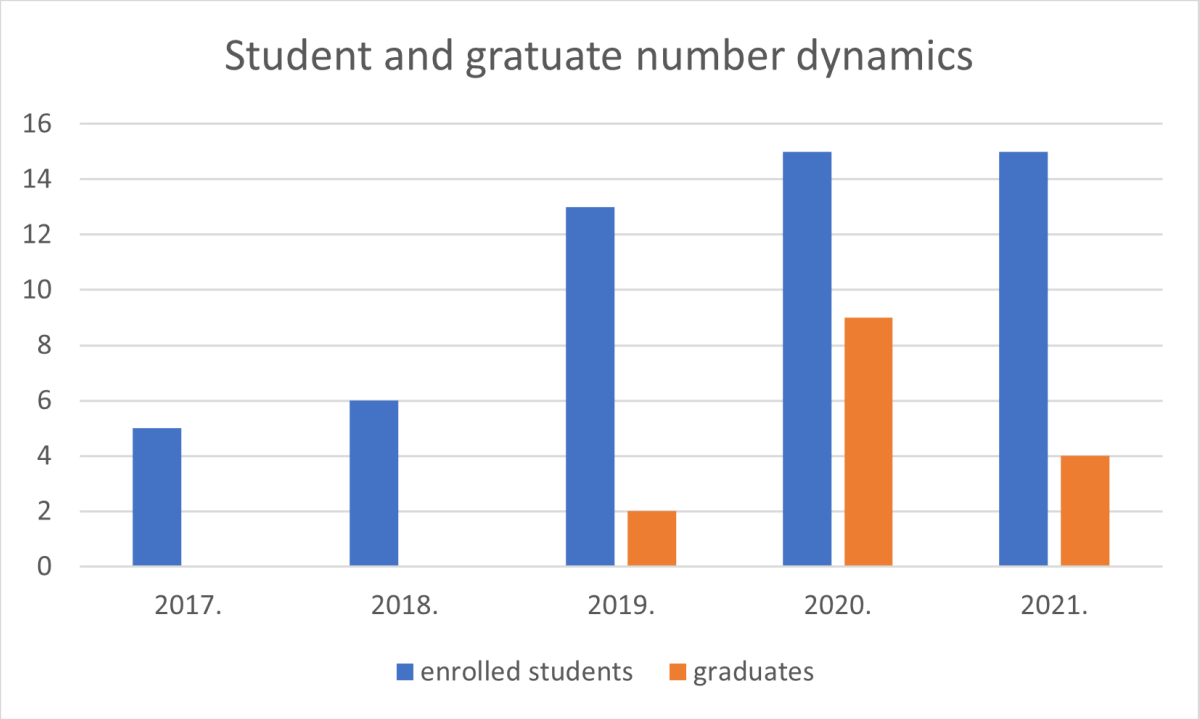
Name, surname	Graduate employment	Position	Graduation year
I. Daņilovs	JSC Swedbank	Head of the Investment Department	2019
S. Batenko	JSC Sun Finance Group	Senior Data Researcher	2019

K. Ļohina	JSC Swedbank, Department of Operational Risk Management Flow Governance	Business Analyst	2020
J. Petrova	JSC Swedbank	Senior Investment Analyst	2020
A. Zaharāns	Squaliio Latvija	Head of Software Resource Management Group	2020
R. Akmeņkalēja	Puratos Latvia	Business Controller Nordics&Baltics	2020
T. Donerblīcs	Banka Citadele	Financial Analyst	2020
S. Janovska	Balcia insurance SE	Chief Actuary	2020
S. Klodža	Pipelife international	Data Researcher	2020
A. Komkova (Ārmane)	JSC "BTA Baltic Insurance Company"	Actuary	2021
A. Mališevs	SEB Global Services	Junior Liquidity Risk Controller	2021
M. Ņikolajeva	JSC BALTA	Junior Analyst	2021
K. Rudāks	Picanova Baltics	Data Researcher	2021

As seen from the Table, all graduates are employed.

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.

The study program is implemented only in Latvian and only for full-time studies. Implementation of the study program was started in 2017, when 5 students were admitted for the state budget funds. With time popularity of the study program grew – both in 2020 and 2021, 15 entrants were admitted. The study program has so far been implemented only in Latvian and only in full-time studies. However, to be possible to organize the study process by attracting foreign students, we would like to provide such an opportunity by organizing studies also in the English.



Still, it has to be concluded that not all entrants evaluated their capabilities adequately. Both in 2019 and 2021, six first-year students were expelled for academic failure. However, those who graduated from the study program highly evaluate the study program quality.

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 curricula of the study courses of the academic Master study program “Financial Engineering Mathematics” are designed to ensure the aggregate of knowledge, skills and competences in compliance with the ones of the 7th level framework structure set by the Latvian Education Classification. In the course of implementing the study program, students obtain profound

knowledge in mathematics, finance and actuarial technologies, as well as skills to work in the analytical departments of credit institutions, financial enterprises, financial management and financial consultation enterprises, insurance companies and undertakings engaged in investments on the financial markets. Moreover, the academic staff involved in conducting the study courses are professionals in their field with extensive practical experience, guest lecturers are also attracted. Therefore, during their studies, students are acquainted with the latest experience, discoveries, and methods of the sector.

The study program has been developed and updated on the basis of regulatory enactments, expert recommendations, student and graduate survey results, results of graduation papers, current scientific research, including research carried out by RTU academic staff, as well as recommendations of employers expressed in the surveys, ideas expressed at the meetings at conferences and seminars, working groups, supervising the development of the Master Theses, reviewing Master Theses and participating in the state examination committees (viva voce of the Master Theses). Such a complex and diverse approach to the improvement of the study curriculum and study process ensures the conformity of the curriculum of the study program with the requirements of the labor market and the development trends of the industry.

So, for example, in the study course DMS100 - *Time series* - a new topic - Non-linear time series models has been introduced, because not all financial series models can be explained only by linear models.

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).

Logical sequence is observed in the development and implementation of the study program – in accordance with the market requirements, the aim of the program is formulated and the resulting tasks; the curriculum of the study program (distribution of the study courses) is based on achieving the aim and learning outcomes and the criteria set by the education standards; correspondingly, the curricula of the study courses are designed to implement the acquisition of the knowledge, skills, and competences set by the occupational standards and ensure implementation of the aim of the study program. When creating the study program, the requirements prescribed by the Cabinet Regulation No. 240 adopted on 13 May 2014 "Regulations on the State Academic Education Standards" (only in Latvian: https://likumi.lv/doc.php?id=266187) were observed.

Acquiring the Master study program, the student not only consolidates and supplements the knowledge and qualification of the previous education cycle (academic or professional Bachelor higher education) but also gets ready for the next education cycle – PhD studies. Therefore, the Master students in their graduation paper (the Master Thesis), which forms an integral part of the study program and is one of the main control forms of the learning outcomes, have to demonstrate not only their capabilities and competency to solve financial analysis tasks but also ability to perform theoretical research and apply latest achievements and concepts in the field of actuarial technologies.

Scientific Advisers of the Master Theses are RTU professors, reviewers come not from the Institute of Applied Mathematics, and viva voce examination takes place in the presence of the commission.

In 2021, **Aleksejs Mališevs, under the supervision of Professor Viktors Ajevskis,** developed the Master Thesis “What the Term Structure Models Tell us about Future Prospects: in the Context of Different Countries of the European Union”. This work was awarded the **third place in the competition of student graduation papers organized by the Bank of Latvia.** The results are officially published on the makroekonomika.lv webpage:

https://www.macroeconomics.lv/prizes-were-awarded-winners-competition-student-scientific-research-papers-organised-latvijas-banka

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.

Different and diverse study methods and forms are used in the process of implementation of the study program– lectures, seminars, case studies, discussions, presentations, independent tasks completed individually and in groups, etc. Alongside with contact hours, students perform independent tasks as scheduled by the study course, regardless of whether the studies take place in full-time or part-time.

The academic staff share experience regularly in using new, modern training methods, mastering the e-environment opportunities, development of creative thinking, etc. The academic staff select the study methods and forms in accordance with the specifics of their study course and its significance in the study program, practical activities in the study process and student-cantered education principles, which if observed at the university grant additional capacity to the students and impose additional duties and responsibility. By supporting opportunities for the students to influence their study process, RTU academic staff accept the challenge of creating a modern, open and innovative idea-based study process.

Starting to work with a specific group of students, the member of the academic staff introduces the students to the expected learning outcomes and discusses the topicality of the study course. Then, taking into account the interests and needs of the students, as well as the specifics of the study course, the instructor agrees with the students on the possible adjustment of the study process and assessment system. Before mastering the study course, students are informed about the requirements that must be met during the acquisition of the study course, knowledge assessment principles, and the principles of calculating the final grade. This set of requirements is also included in the description of each study course.

To ensure the topicality of the study curriculum, professionals from the respective field are also involved in the implementation of the study process as guest lecturers, acquainting students with the topicalities in the industry, debating and providing specific examples of practical activities, as well as consulting students during practical research.

Students are motivated and receive support from the academic staff in diversifying the planning and organization of their independent work, for example, by using study materials developed by the

academic staff of the respective study courses in the MOODLE e-training system. However, it has to be noted that more active usage of MOODLE would be desirable in the communication process between the academic staff and students, not only by using the placed study materials but also by passing interactive tests and other test activities available in the study process and communicating in the e-environment.

Students pass some tests within the study courses in writing. At the discretion of the instructor, it is also possible to take the examinations orally or by developing a practical work. The assessment also takes into account the work of students during the acquisition of the study course (performance in tests, activity in seminars, development of independent work, drawing of reports, etc.), applying the summative assessment method, which provides for the gradual formation of the final grade from several types of student work. Throughout the study process, the basic principles of evaluation are taken into account – the principle of openness of evaluation, the principle of mandatory evaluation, the principle of the possibility of reviewing the evaluation, the principle of the diversity of the types of assessment used in the evaluation.

The final stage in the study program is passing the state examination, including the development and viva voce examination of the Master Thesis. The student may defend the Master Thesis only having acquired the content of the entire study program and, respectively, having received positive assessment for each study course and fulfillment of practical tasks.

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).

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.

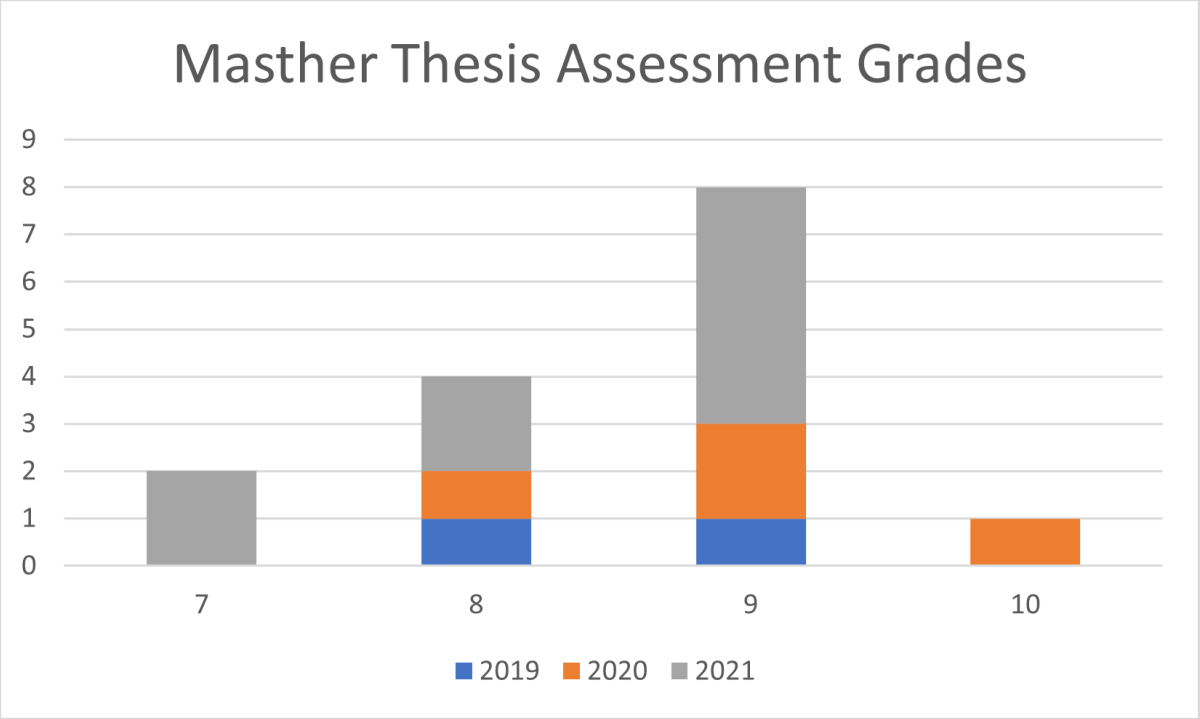
A large part of the research carried out within the framework of the Master Theses and the recommendations developed as a result thereof are economically justified and are appreciated and actually used in the activities of specific companies, as evidenced by the feedback provided by employers. Thus, it is possible to argue that students in the study program when choosing the

themes and research objects of their graduation papers considered not only theoretical knowledge acquired during studies but also practical skills, and are competent to solve professional tasks of the industry and the labor market.

Student	Theme	Year, grade
A. Komkova	Non-life insurance IBNR loss reserve estimation using various alternative methods and calculation environments	2021, 9
A. Mališevs	What the term structure models tell us about future prospects: in the context of different countries of the European Union	2021, 10
M. Nikolajeva	Time series splitting using Markov switching models and their effect on the quality of seasonal adjustment	2021, 9
K. Rudāks	Changes in share price dynamics due to their inclusion in tradable funds	2021, 8
S. Janovska	General linear model for calculation of IBNR for non-life insurance	2020, 9
A. Zaharāns	Company stock selection and price movement forecasting using machine learning algorithms	2020, 9
T. Donerblics	Dynamic asset and liability analysis in IRRBB valuation	2020, 9
S. Klodža	Stock price forecasting using Hidden Markov models and machine learning algorithms	2020, 9
A. Škļarova	Demand forecasting in Baltic airports using dynamic Tobit models with GARCH errors	2020, 8
K. Ļohina	Stochastic modeling for age structured population growth under assumption of small random perturbations	2020, 8
M. Pečens	Comparative analysis of R libraries for determining structural change points in time series data	2020, 9
R. Akmenkaleja	The effective lower bound for interest rate: financial asset pricing	2020, 7
J. Petrova	Stochastic modeling for age structured population growth under assumption of small random perturbations)	2020, 7
S. Batenko	Research and application of the gradient busting algorithm for classification tasks in finance	2019, 8

I. Daņilovs	Euro yield curve forecasting and portfolio implementation in the case of effective lower bound	2019, 9

Analyzing the grades received by the students for their Master Theses in the period 2019-2021, it should be noted that all graduation papers during this period have been defended successfully and evaluated with the grades above 7 (out of 10 maximum possible points), which is considered a good indicator:



Since industry representatives are involved both as reviewers and the members of the Final Examination Committee, high assessment grades are considered a good performance indicator of the joint work of students and academic staff. Employers highly value the professionalism of 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.

Thanks to the high level of digitization, the infrastructure and material and technical resource base available for the implementation of the study field and the corresponding study programs provide an opportunity to increase competitiveness, quality, and efficiency of the university, as well as increase availability of information by integrating IT solutions into the administrative, academic and research processes of the university, providing students, administrative and academic staff with modern, reliable, safe and unified IT infrastructure and high-quality IT services.

The library plays an important role in providing methodological and informative support to the students. The Scientific Library of RTU (https://www.rtu.lv/lv/studijas/biblioteka) is an academic library of state significance, which has obtained its status as a result of library accreditation. The Scientific Library of RTU provides the necessary information for RTU study process and research activities, performs library, bibliographic and information services for RTU students, teaching staff, and employees. The Library's collection includes 1.29 million printed documents and e-resources in the databases relevant to RTU fields. The collection is stored in the Central Library, the Study Literature Subscription Office, the Chemistry Collection, the Transport Collection and the Study and Research Centers in Daugavpils, Liepāja, Cēsis and Ventspils.

The aims and tasks of RTU Scientific Library are subordinated to the aims and tasks of RTU. The mission of RTU Scientific Library as the main engineering library is to implement the provision of higher academic and professional education study programs with excellent quality information resources in technical, natural, social sciences and humanities, as well as architecture.

The Library comprises the following units:

- Collection Formation Department
- Department of Information and Technology
- User Service Department
- Department of Study and Sectoral Literature
- as well as branches in Daugavpils, Liepaja, Ventspils and Cesis.

The library is equipped with modern equipment and technologies, and provides various services:

- books, magazines, databases, and other electronic resources;
- remote access to electronic resources 24/7;
- the electronic joint catalogue of the largest university libraries;
- the unified search tool PRIMO (information is searched simultaneously in the catalog and subscribed databases);
- SBA – interlibrary subscription;
- lectures, classes, consultations, and trainings on information literacy;
- printing, scanning, copying documents;
- access to the Internet;
- premises for studies and leisure time;
- library tours;
- binding of graduation papers;

The library collection consists of educational literature, scientific literature, and fiction. It includes books, serial publications (periodical publications, magazines, newspapers), electronic resources (databases, e-books, e-journals), production codes, product catalogs, unpublished publications (scientific paper reports, PhD theses and summaries thereof), audiovisual documents, cartographic documents. Currently, there are 1.5 million printed copies and 14 electronic databases in stock. Trials of new databases are regularly provided.

E-books and e-journals corresponding to the study program in the subscribed databases:

- Proquest Ebook Central – full-text e-books published by the leading scientific publishers – Elsevier, Wiley, Springer, Oxford Press, Emerald;
- EBSCOhost eBook Academic Collection – a full-text e-book database, which contains books in English by leading scientific publishers;
- Academic Search Complete – the most comprehensive multidisciplinary scientific journal full-text database;
- ScienceDirect – a database of multidisciplinary scientific journals maintained by Elsevier;

- Wiley Online Library – full-text scientific journals published since 1997 in various fields of science;
- SCOPUS/Web of Science – bibliographic research literature citation databases;
- ACM Digital Library – publications in computer science;
- SpringerLink - full-text journals and e-books in computer science, engineering, chemistry and materials science.

The collection (both printed and electronic) is renewed and supplemented by the Collection Formation Department in cooperation with the academic staff and User Service Departments in accordance with the Library's Collection Formation Policy. The Collection Formation Policy is adopted and overseen by the Library Council.

The task of the Collection Formation Policy is to centrally form and supplement the library collection in accordance with the needs of RTU study programs, scientific research fields, library tasks and functions specified in RTU Scientific Library regulations, collection policy and according to the position of RTU Scientific Library in the unified information system of the Latvian libraries.

The task of the Collection Formation Policy is to centrally form and supplement the library collection in accordance with the needs of RTU study programs, scientific research fields, library tasks and functions specified in RTU Scientific Library regulations, collection policy and according to the position of RTU Scientific Library in the unified information system of the Latvian libraries.

The basic criteria for selecting collections by RTU Scientific Library are:

- compliance with RTU study programs and scientific research areas;
- the level of formation intensity (completeness), defining it for each RTU study program and field of science (minimum level of information, basic information level, education level, scientific research level and level of relative completeness);
- recommendations of RTU program directors, academic staff, industry specialists;
- user requests;
- language;
- the price of the edition.

Detailed information can be found in Sections 2.3.1 - 2.3.3 of Chapter 3 of Part II

Graduates of the study program have pointed at the worn premises at 1/3 Meža Street, but in the summer of 2021 the construction of the new building at 10 Zunda Embankment was completed, and the Department of Probability Theory and Mathematical Statistics (DPTMS) has relocated to this new building. Premises available for DPTMS at 10 Zunda Embankment are described in the Section 2.3.2. of Part II.

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).

In accordance with Cabinet Regulations of 12 December 2006 No 994, the amount of the study funding granted to the institution of higher education from the state budget is calculated using the following formula:

$F_s = T_b \times [S(k_i \times n_i) + 1{,}5 \times S(k_i \times m_i)] + S_b \times S(n_i + m_i)$, where

F_s – amount of study financing

T_b – basic costs of the study seat;

k_i – coefficient of the study costs in the relevant field of education (Annex 1 to the Regulations;

n_i – the number of study seats for a higher education institution or college at undergraduate and professional study programs in the relevant thematic area of education;

m_i the number of study seats at the Master study programs in the relevant thematic area of education;

S_b – study seat social security expenses at Bachelor, professional and Master study programs (Annex 2 to the Regulations).

State budget subsidies and potentially also student tuition fees are used for the implementation of the study program. Information on the financial resources of the program is presented in the table below:

Year	State-budget funded students	Tuition fee-paying students	State subsidy	Tuition fee	Total financing for study program	Desired costs per 1 student, taking into account the current regulations, EUR
2017/2018	5	0	16 790	3 500	16 790	3 358,00
2018/2019	6	0	27 334	3 500	27 334	4 555,67
2019/2020	13	0	66 046	3 500	66 046	5 080,46
2020/2021	15	0	76 311	3 700	76 311	5 087,40
2021/2022	15	0		3 700		

State budget grants and student funds are used for the implementation of the study program. Tuition fee for the academic year of 2022/2023 is 2800 EUR per full-time student. The tuition fee is determined in accordance with the instructions of the State Audit Office defining that the tuition fee

for students who study together with budget students cannot be less than the state funding for this service.

Over the years, a continuous increase in RTU costs has been observed (utilities, maintenance of buildings, construction of a new building, etc.).

For the development of all study programs, centralized funding is used for the renewal of the collection of the Scientific Library, improvement and maintenance of joint use premises, public relations, program marketing activities, development and maintenance of information systems related to the study process, development of Ķīpsala Campus and other activities. Therefore, the minimum number of students for the creation of a group is 19.

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.

Selection criteria for of the academic staff include their specific knowledge, scope of scientific and on-the-job experience taking into account the specifics of the study program and study courses therein. The study program invites professionals in the field.
The study program also involve the academic staff of other organizational units of RTU.
A more detailed list of all members of the academic staff involved in the study program is given in Annex 5, their biographies (Curriculum Vitae) are enclosed in Annex 6, and the list of scientific publications related to the study program published by the members of the academic staff during the last six years in peer-reviewed journals or research innovation list is summarized in Annex 5.

Only the members of academic staff holding a PhD degree are involved in the implementation of the study program. They are 7 Doctors of Mathematics, 5 Doctors of Economics, 6 Doctors of Engineering, 1 Doctor of Philology, 2 Doctors of Psychology and 2 Doctors of Pedagogy.

The list of scientific publications related to the study program is wide and comprehensive, publications are related to the curricula of the delivered study courses:

Carkovs, J**., Pavļenko,** O., Petrova, J. Stochastic Modeling for Age Structured Population Growth Under Assumption of Small Fast Oscillating Perturbations. In: APLIMAT 2019: 18th Conference on Applied Mathematics: Proceedings, Slovakia, Bratislava, 5-7 February, 2019. Bratislava: Slovak University of Technology, 2019, 172-181 pp. ISBN 978-80-227-4884-1.

Matvejevs, A., Pavļenko, O. Training of Financial Technology Specialists with RTU Bachelor Program in "Financial Engineering". In: Joint International Conference on Engineering Education & International Conference on Information technology, ICEE/ICIT-2014 : Proceedings, Latvia, Riga, 2-6

June, 2014. Riga: Riga Technical University, 2014, 492 -499 pp. ISBN 978-9934-10-560-9. e-ISBN 978-9934-10-561-6.

Čerņajeva, S., Volodko, I., Iltiņa, M., **Iltiņš, I.** Good Knowledge of Basic Mathematics - a Successful Prerequisite to Study in Riga Technical University. In: APLIMAT 2018:17th Conference on Applied Mathematics: Proceedings, Slovakia, Bratislava, 6-8 February, 2018. Bratislava: Slovak University of Technology, 2018, 217-223 pp. ISBN 978-80-227-4765-3.

Rubenis, O., **Matvejevs, A.** Increments of Normal Inverse Gaussian Process as 09.03.2022 © Eiropas Savienība, 2002-2022 | http://europass.cedefop.europa.eu Lapa 6/12 Curriculum vitae Andrejs Matvejevs Logarithmic Returns of Stock Price. Information Technology and Management Science, 2018, Vol. 21, No. 1, 93-97 pp. ISSN 2255-9094. e-ISSN 2255-9094. Available at: doi:10.7250/itms-2018-0015

Rubenis, O., **Matvejevs, A.** Valuation of European Call Option via Inverse Fourier Transform. Information Technology and Management Science, 2017, Vol. 20, No. 1, 91-96 pp. ISSN 2255-9086. e-ISSN 2255-9094.

Pučkovs, A., **Matvejevs, A.** Volatility Forecasting with Wavelet Neural Networks. APLIMAT - Journal of Applied Mathematics, 2015, No.7, 143-150 pp. ISSN 1337-6365.

Pučkovs, A**., Matvejevs, A.** 'Northeast Volatility Wind' Effect. Aplimat Journal, 2014, Vol.6, 324-339 pp. ISSN 1337-6365.

Pučkovs, A., **Matvejevs, A.** 'North-East Volatility Wind' Effect. No: 13th Conference on Applied Mathematics (APLIMAT 2014): Book of Abstracts, Slovakia, Bratislava, 4-6 February, 2014. Bratislava: 2014, 67-67 pp. ISBN 978-80-227-4139-2.

Pučkovs, A., **Matvejevs, A**. Stock Market Structural Changes Discovering Helical Structure of Volatility Wave Fourier Image. Information Technology and Management Science. Nr.17, 2014, 98-105 pp. ISSN 2255-9086. e-ISSN

Fjodorovs, Jegors. PhD Thesis "Riska prognozēšana nepārtraukto laika modeļu ietvaros tehnoloģiju un tirgus novērtēšanai". Riga: [RTU], 2019. 134 p.

Matvejevs, A., Fjodorovs, J. Revaluation of Estimated Option Prices Using GARCH Processes with Most Preferable Properties. Datorvadības tehnoloģijas. No 14, 2013, 100-104 pp. ISSN 2255-9108. e-ISSN 2255-9116.

Šitova, I., **Pečerska, J.** Process Mining Techniques in Simulation Model Adequacy Assessment. In: 2019 60th International Scientific Conference on Information Technology and Management Science of Riga Technical University (ITMS 2019): Proceedings, Latvia, Riga, 10-11 October, 2019. Piscataway: IEEE, 2019, 1-4 pp. ISBN 978-1-7281-5710-8. e-ISBN 978-1-7281-5709-2. Available at: doi:10.1109/ITMS47855.2019.8940672

Šitova, I., **Pečerska, J.** Data Mining Techniques in Simulation Results Analysis. No: 2018 59th International Scientific Conference on Information Technology and Management Science of Riga Technical University (ITMS 2018), Latvia, Riga, 10-12 October 2018. Piscataway: IEEE, 2018, 1-5 pp. ISBN 09.03.2022 © European Union, 2002-2022 | 7281-0099-9. e-ISBN 978-1-7281-0098-2. Available at: doi:10.1109/ITMS.2018.8552972

Šitova, I., **Pečerska, J.** A Concept of Simulation-based SC Performance Analysis Using SCOR Metrics. Information Technology and Management Science, 2017, Vol. 20, No. 1, 85-90 pp. ISSN 2255-9086. e-ISSN 2255-9094.

1. **Pečerska** project: 01.10.2021 - 31.12.2021 senior expert at the project "Development of

effective governance of Riga Technical University", digitization of the study course "Fundamentals of Computer Simulation and Modelling" DMI201. Type of project: ESF

Urbans, M., **Pundure, J.,** Jemeļjanovs, V. Evaluation of State of Technogenic Environment in Latvia and the World in the 21st Century. In: 20th International Scientific Conference "Engineering for Rural Development": Proceedings. Vol.20, Latvia, Jelgava, 26-28 May, 2021. Jelgava: Latvia University of Life Sciences and Technologies, 2021, 1021-1031 pp. ISSN 1691-3043. Available at: doi:10.22616/ERDev.2021.20.TF226

Urbans, M., **Pundure, J.,** Jemeļjanovs, V. Differences in the Application of Methods for Assessing the Effects of Accidents and the Impact on the Risk Level at the Increased Hazard Object. In: Scientific Conference on Economics and Entrepreneurship SCEE'2021 Organized within the 62nd International Scientific Conference of Riga Technical University: Book of Abstracts, Latvia, Riga, 14-15 October, 2021. Riga: RTU Press, 2021, 36-36 pp. ISBN 978-9934-22-678-6. ISSN 2256-0866.

Politika, V., Ļabis, J**., Pundure, J**. Trends in the Development of Fire Fighting and Rescue Equipment and Special Equipment. Analysis and Improvement if the Norms Set by the Regulatory Framework. No: Scientific Conference on Economics and Entrepreneurship SCEE'2021 Organized within the 62nd International Scientific Conference of Riga Technical University: Book of Abstracts, Latvia, Riga, 14-15 October, 2021. Riga: RTU Press, 2021, 35-35 pp. ISBN 978-9934-22-678-6. ISSN 2256-0866.

Bistrova, J., **Lāce,** N., Kasperoviča, L. Uzņēmumu krīzes noturība un konkurētspēja. No: Latvijas tautsaimniecība pandēmijas ēnā un pēckrīzes izrāviena iespējas. I.Šteinbuka red. Rīga: LU Akadēmiskais apgāds, 2021. 104.-128.lpp. ISBN 978-9934-18-687-5. Available at: doi:10.22364/ltpepii

Bistrova, J., **Lāce, N.** Uzņēmumu produktivitāte, finanšu veselība un inovatīvais potenciāls. No: Latvijas tautsaimniecība pandēmijas ēnā un pēckrīzes izrāviena iespējas. I.Šteinbuka red. Rīga: LU Akadēmiskais apgāds, 2021. 271.-285.lpp. ISBN 978-9934-18-687-5. Available at: doi:10.22364/ltpepii

Mehmood, K., **Lāce, N.,** Danileviciene, I. Comparative Efficiency Analysis of Conventional Banks and Islamic Banks: in Evidence of Pakistan. No: Business and Management 2020: 11th International Scientific Conference: Selected Papers, Lithuania, Vilnius, 7-8 May, 2020. Vilnius: Technika, 2020, 397-406 pp. ISBN 978-609-476-231-4. e-ISBN 978-609-476-230-7. ISSN 2029-4441. e-ISSN 2029-929X. Available at: doi:10.3846/bm.2020.583

Krilova, K., **Ciemleja, G., Lāce, N.** Challenges in Digital Product Development at Latvian Commercial Banks. No: Perspectives of Business and Entrepreneurship Development: Digital Transformation of Corporate Business: Economic, Management, Finance and System Engineering from the Academic and Practitioners Views: Proceedings of Selected Papers, Czechia, Brno, 30 April, 2019. Brno: Brno University of Technology, 2019, 65-74 pp. ISBN 978-80-214-5756-0.

Shkurko, I., **Lāce, N.,** Tamosiuniene, R. Impact of Capital Structure Decisions on Company's Profitability: Evidence from Ukraines Companies. In: XIV International Scientific Conference "Management and Engineering'16": Conference Proceedings, Bulgaria, Sozopol, 19 -23 June, 2016. Sofia: Technical University Sofia, 2016, 782-796 pp.

The academic staff participated in the methodological conferences, for example:

Matvejevs, O. Pavļenko

- Joint International Conference on Engineering Education & International Conference on

Information technology, ICEE/ICIT-2014 : Latvia, Riga, 2-6 June, 2014. Training of Financial Technology Specialists with RTU Bachelor Program in "Financial Engineering"

A.Koliškins

- New Trends and Issues Proceedings on Humanities and Social Sciences: 9th World Conference on Educational Sciences (WCES-2017), France, Nice, 1-4 February 2017. Paris: 2017. The Role of Real-Life Examples in Teaching Business Statistics Course.

N.Budkina

- 25 May 2018. The 19th conference Teaching mathematics: retrospective and perspectives. “Adaptation of the course of operations research for students of different specialities.” Kaunas University of Technology, Kaunas, Lithuania
- 12.05.2017 - 13.05.2017 The 18th conference Teaching mathematics: retrospective and perspectives. «Simulation and Visualisation Tools in Teaching Mathematics». University of Latvia, Riga, Latvia

J. Pundure

- 13 May 2021. Acadmeic conference of RTU FEEM "Think Differently". Report: “Challenges in teaching study courses in civil defense to foreign students” RTU, FEEM, Riga.

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.

The composition of the academic staff involved in the study program is stable; no significant changes have taken place in it since licensing the study program. 100% of the academic staff hold a PhD degree.

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).

There is a mechanism promoting mutual cooperation between academic staff working in the study program, which ensures improvement and integration of the study courses. Both the results of the annual student surveys and the graduate surveys allow receiving feedback, which indicates individual shortcomings. Consequently, the improvement of the study courses takes place on a regular basis, based both on the suggestions expressed by the students and on the industry development trends. In the process of implementation of the study program, close cooperation of the academic staff takes place, which is also manifested in the following activities:

1. Discussion of the results of student and graduate surveys at the meeting of the Department, discussing student comments, suggestions, and possibilities for prevention of negative feedback;
2. Discussion of the results of the graduation papers and the quality of reviews at the meeting of the Department, discussing the possibilities for improving the quality of the graduation papers;
3. Mutual integration of classes, discussions on laboratory and practical work carried out within the framework of classes, in order to promote the provision of complementary practical skills;
4. Cooperation within projects where academic staff use the experience gained in the study process;
5. Joint study tours, where educators together with the students get acquainted with the current events in the field, are used in practical case studies during the practical classes in the auditorium.

At the time of submitting the self-assessment report, student-faculty ratio at the study program is 15 members of academic staff per 15 students (1:1 ratio).

Within the framework of the study program, the cooperation of academic staff may be assessed as promoting the achievement of the learning outcomes. When reviewing and updating the study program, the academic staff mutually agree on the most appropriate and effective solutions for the evaluation of student achievements and attainment of performance indicators. By periodically discussing and reviewing the curricula of the study courses, thematically coordinated and complementary acquisition of the study program is achieved, and duplication of the considered within different courses in one study program is avoided.

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	Diploms_ar_ pielik_ maģistriem_DMN0_eng.pdf	Diploms ar pielik_ maģistriem_DMN0_LAtv.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)	02000-2.1.1-15_ATZINUMS.pdf	02000-2.1.1-15_ATZINUMS.pdf
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	Statistikas dati_RDMN0-magistri EN.docx	Statistikas dati_RDMN0-Lv.docx
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	Piel.Salidz ar standartu - mag-EN.docx	Piel.Salidz.ar standartu-mag.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	Pielikums8-mag.xlsx	Pielikums8-mag.xlsx
The curriculum of the study programme (for each type and form of the implementation of the study programme)	Studiju_Plāns (FI_mag)-EN.docx	Studiju_Plāns (FI_mag)-LV.docx
Descriptions of the study courses/ modules	Fin mat study courses_ENG.zip	Fin mat_studiju_kursi_mag_LATV.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)		
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)	Confirmation - on compliance of the academic staff.edoc	Apliecinājums - AL 55. pants par prof. skaitu akadēmiskās programmās.edoc

Financial Engineering (42460)

Study field	*Physics, Material Science, Mathematics, and Statistics*
ProcedureStudyProgram.Name	*Financial Engineering*
Education classification code	*42460*
Type of the study programme	*Professional bachelor study programme*
Name of the study programme director	*Andrejs*
Surname of the study programme director	*Matvejevs*
E-mail of the study programme director	*andrejs.matvejevs@rtu.lv*
Title of the study programme director	*Dr.sc.ing., profesors*
Phone of the study programme director	*26015121*
Goal of the study programme	*The aim of the professional Bachelor study program "Financial Engineering" is to educate and train internationally competitive and dynamic specialists that meet the requirements of the national economy, who, using the latest information technology (IT) achievements, can perform work related to the management of financial activities, perform analysis of business processes; analyze, model and forecast financial flows; optimizing portfolios and investments in securities portfolios and investments through IT; identify problems, formulate objectives, anticipate pathways to achieve them and implement them.*
Tasks of the study programme	*The tasks of the professional Bachelor study program are:* *- To provide students with comprehensive knowledge in the area of specialization and to develop their skills of financial management and financial analysis in accordance with the requirements of the labor market.* *- To develop competencies relevant to the labor market, to promote student interest in further education and professional advancement, and development of professional and academic knowledge.* *- To provide competitive education in accordance with international standards and to prepare students for practical work in the industry, to develop students' scientific research skills, and to promote their application.* *- To ensure the development of the curriculum of the study program, the study process, and scientific research activities in accordance with the changes in the market.* *- To promote cooperation between the academic staff and students in the performance of scientific research and practical use of the obtained research results in accordance with international standards and trends.* *- To provide the necessary level of knowledge for further studies at the Master study programs.*

Results of the study programme	*The compliance of the knowledge and skills of the graduates with the occupational standard.* *To understand the economic and financial situation in Latvia and in the world;* *Ability to identify financial and actuarial problems that can be solved by applying information technologies;* *Ability to analyze business-related processes using IT solutions;* *Ability to manage optimization of security portfolios and investments;* *Ability to analyze, model and forecast financial flows, as well as to design management systems for financial analysis using IT solutions;* *Ability to explain the basic principles of the use of financial instruments;* *Skills to assess profitability and risk of financial investments, to develop recommendations for reduction of financial risks;* *Skills to solve economic and social tasks by conducting the statistical analysis of the financial flows;* *Ability to conduct statistical analysis of such indicators as mortality, functional disorders, and others using IT solutions;* *Skills to analyze insurance market trends and calculate insurance losses and premiums using IT solutions;* *Ability to apply modern quantitative methods in financial analysis and financial engineering;* *Skills to use mathematics and statistics software.* *Skills in order to be able to act independently and make decisions, as well as to use the acquired knowledge in practice.* *Reach a certain level of culture, which allows starting public activities and communicating with Latvian and foreign intellectual circles.*
Final examination upon the completion of the study programme	*The state examination, Bachelor's thesis*

Study programme forms

Full time studies - 4 years - latvian

Study type and form	*Full time studies*
Duration in full years	*4*
Duration in month	*0*
Language	*latvian*
Amount (CP)	*160*
Admission requirements (in English)	*General or vocational secondary education*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Professional bachelor degree in financial engineering*
Qualification to be obtained (in english)	*Financial statistician*

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

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.

The study programme is included in the study field "Physics, Material Science, Mathematics and Statistics", which was accredited until 30 May 2019 by decision No 75 of the Study Accreditation Committee of the Ministry of Education and Science of the Republic of Latvia on 31 May 2013. The accreditation period of the study field has been extended until 31 December 2023 by amendments to the Law on Higher Education Institutions of 3 June 2021.

Until now, graduates of the study programme were awarded the qualification of a financial analyst, but while updating the occupational standard, the Council of Experts in the Field of Business, Finance, Accounting, and Administration decided that this qualification should be granted only to the graduates of the master level study programme. Therefore, the head of the study programme "Financial Engineering" Professor Andrejs Matvejevs and Assistant Professor Evija Liepa joined the working group that developed the occupational standard . The Ministry of Education and Science supported this idea by offering to develop the professional standard of a financial statistician as a specialization for the qualification "Senior Specialist in Data Analysis", the draft version of which will be reviewed at the meeting of the Tripartite Cooperation Sub-council of Vocational Education and Employment in June 2022. When developing the "Senior Data Analysis Specialist" professional standard, it was decided that such a qualification cannot be awarded, one of two qualifications will have to be chosen - "Financial Statistician", which will be obtained by RTU or "Statistical Mathematician", which will be obtained by graduates of LU. The drafts of these qualifications are still in progress.

No other changes have been made to the parameters of the study programme during the reporting period.

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.

RTU Strategy for 2020-2025 defines four main aims, three of which are related to the implementation of the basic university functions: excellent science, high-quality studies and sustainable valorization. The fourth, institutional excellence, is related to the university support function and the development of internal governance in the six areas: digitalization, sustainable

development, effective financial and administrative action, internationalization, communication and cooperation, human resources development. Specific tasks to be performed and performance indicators have been defined for all the aims set in the Strategy to make it possible to follow the implementation of the Strategy and ensure that RTU can realize its vision by 2025 – to become an internationally competitive, dynamic and modern university of science and technology.

Measurements of the results of the task performance include the academic results of the students, employment rates of the graduates and feedback from employers, expansion of international cooperation, increase in the number of research projects and increase in the number of students involved in the research process, as well as the approbation of research results in enterprises, etc.

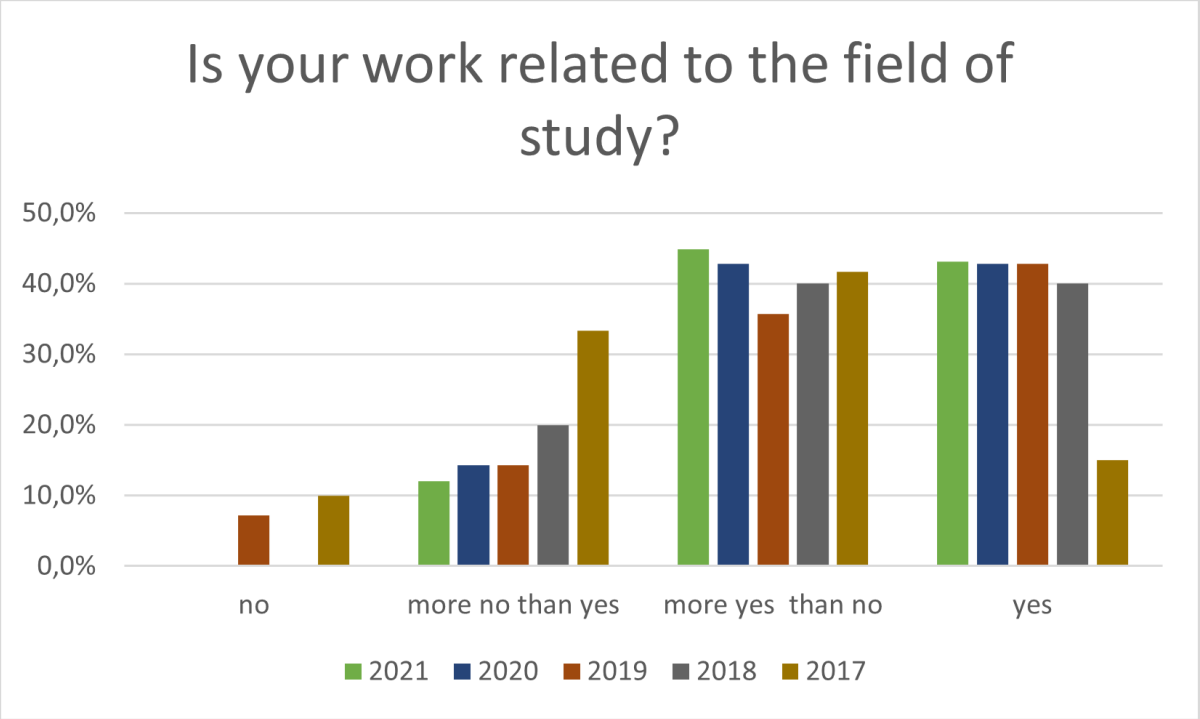
On completion of the study program, graduates will be awarded a professional Bachelor degree in financial engineering, as before, but the qualification will change - from financial analyst to financial statistician. This qualification change has small effect on the achievable results, they will be adjusted after the development and approval of the professional qualification requirements project.

The volume of the study program is 160 credit points (240 ECTS), its duration in full-time studies is 4 years.

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

The study program is an interfaculty study program, which has been implemented at Riga Technical University since academic year 2009/2010. The study program is implemented in cooperation between the Faculty of Computer Science and Information Technology and the Faculty of Engineering Economics and Management. The study program was developed based on the occupational standard of the financial analyst. The study program, focusing on information technologies, includes the study courses in economics, computer science, mathematics and actuarial science. The total volume of study program in credit points amounts to 160 CP. The volume of the compulsory part is 94 CP, compulsory elective study courses amount to 28 CP, 4 CP are allocated for free elective study courses, Internship amounts to 20 CP and the Bachelor Paper amounts to 12 CP.

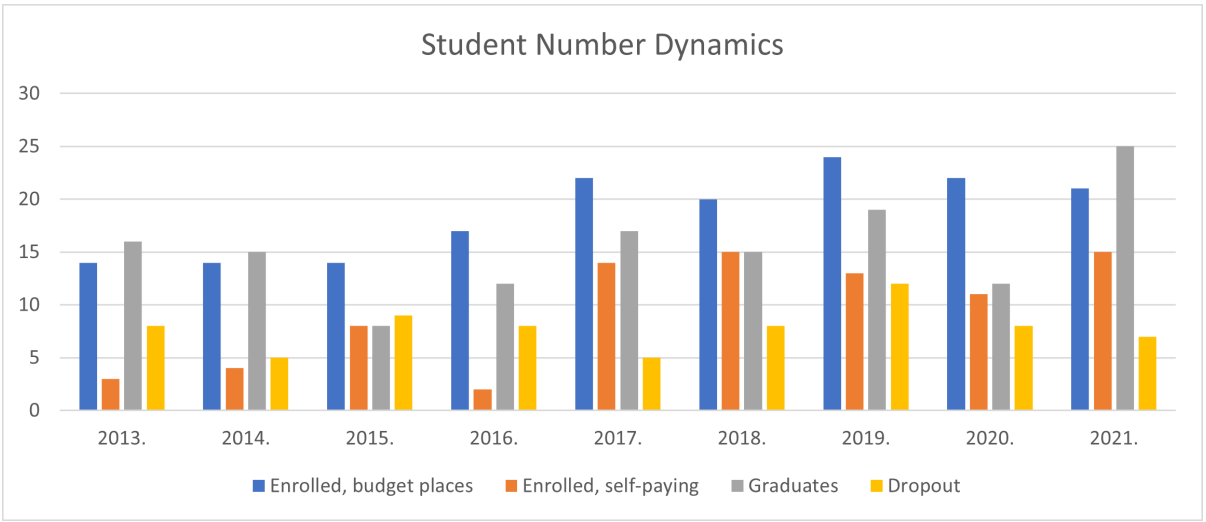
The study program has been improved in accordance with the demand of the labor market and complies with the draft version of the occupation standard of the “Senior Specialist in Data Analysis”, the planned specialization is “financial statistician”. Graduates of the program are in great demand in the labor market, they work as financial analysts and in related professions, for example, as data analysts. Graduates of the program do not face any problems in finding a job in their major in the banks, insurance companies, Central Statistical Bureau, etc.:



The total volume of study program in credit points amounts to 160 CP. The volume of the compulsory part is 94 CP, compulsory elective study courses amount to 28 CP, 4 CP are allocated for free elective study courses, Internship amounts to 20 CP and the Bachelor Paper amounts to 12 CP.

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.

The study program is implemented only in Latvian and only in the full-time intramural mode.



2020 was the year of restrictions caused by the pandemic when it was necessary to adapt to working remotely. This explains the relatively low number of graduates of this year – several took academic leave and graduated in 2021 and 12 students were expelled.

The highest number of state budget-funded seats was in 2019 (24 seats), after which fewer and

fewer budget seats were allocated each year. However, there is interest in the study program, students are willing to pay for their studies.
Currently, 110 students study in the study program.

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 curricula of the study courses of the professional Bachelor study programme "Financial Engineering" are designed so as to ensure a body of knowledge, skills and competence in accordance with the knowledge, skills and competence of the 6th level of the Framework laid down in the Classification of Education of Latvia, as well as to ensure compliance with the qualification "Financial Statistician ", which is specialization of the senior specialist in data analysis standard. During the implementation of the study programme, students acquire in-depth knowledge in mathematics, finance and actuarial technologies, as well as skills to work in the analytical departments of credit institutions, financial companies, financial management and financial consulting companies, insurance companies and companies engaged in investments in financial markets. In addition, the academic staff involved in delivery of the study courses are professionals of their field with considerable practical experience, visiting lecturers are also attracted, thus during their studies, students are introduced to the latest industry experience, discoveries and methods.

Academic staff of the Faculty of Computer Science and Information Technology implement study courses in the amount of 122 CP (including compulsory elective study courses), academic staff of the Faculty of Engineering Economics and Management implement study courses in the amount of 43 CP, 2 CP are implemented by an educator of the Faculty of Material Science and Applied Chemistry and 12 CP are ensured by the academic staff of the Faculty of E-learning Technologies and Humanities:

The study program has been developed and updated on the basis of regulatory enactments, expert recommendations, student and graduate survey results, results of graduation papers, current scientific research, including research carried out by RTU academic staff, as well as

recommendations of employers expressed in the surveys, ideas expressed at the meetings at conferences and seminars, working groups, supervising the development of the Master's Theses, reviewing Master's Theses and participating in the state examination committees (viva voce of the Master's Theses). Such a complex and diverse approach to the improvement of the study curriculum and study process ensures the conformity of the curriculum of the study program with the requirements of the labor market and the development trends of the industry.

Current events in the financial industry affect the content of study courses. For example, the new requirements of the actuarial assessment according to the AAE (Educational Committee of the European Actuarial Association) - every new introduced insurance product must have a justification based on a Profitability Testing analysis. Therefore, the subject of profit testing procedure based on IT technologies was introduced in the study course DMS313 *Software Packages of Actuarial Technology* of the Bachelor program.

In the study courses DMS701 *Statistical Data Analysis* and DMS703 *Introduction to Time Series Analysis (study project)* the Eviews program package has been replaced by R, because the R package is more widely used and well-suited for financial applications.

According to the request of employers and standard requirements, a graduate students of RTU should have in-depth knowledge of statistical methods, which is why the topic "Statistical hypothesis testing" has been introduced.

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).

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.

During the implementation of the study courses and at examinations, oral, written and hybrid learning and evaluation methods are used.

In the course of studies, a variety of methods for acquiring and strengthening the knowledge are used, such as introductory lectures, interactive lectures, summary lectures, and problem-oriented lectures. Practitioners, professionals from different institutions are invited to deliver individual lectures within the study courses in order to promote the unity of theory and practice. Practical tasks, seminars, individual, pair and group work, discussions and project development, study trips

to industry organizations are widely used. Employers are involved in the implementation and improvement of the study courses (they are invited to conduct individual seminars, often classes are organized as experience exchange visits to workplaces, etc.).

Seminars organized within the study courses promote students' speaking, presentation and discussion skills.

To ensure the students achieve learning outcomes – acquire and strengthen knowledge, skills and develop competence – the study process is mainly organized using the methods facilitating individual student activity. In the study process, methods are used that promote student communication in the performance of study tasks, solving real problems in the field, and modeling situations.

The physical academic environment is also gradually changing: audiences are easily convertible for group work, individual work, students can use digital technologies. Academic staff mostly use methods that encourage active participation of the students, their critical thinking and self-reflection. The e-learning environment is used to promote the study process and independent learning. Each study course has an e-learning environment (Moodle), where students have access to course materials, task descriptions, additional study materials related to the course themes, as well as study tasks (tests, forums, seminars, conferences, etc.). All evaluations of interim examinations and final examinations of study courses with the justification of the grade are recorded and available to students in the e-learning environment.

The student-centered approach is exercised by updating study programs and their study courses, paying special attention to the meaningful formulation of learning outcomes, thus promoting the dialogue between educators and students on the content of studies, forms and methods of their organization. In turn, correctly formulated learning outcomes promote students' understanding and co-responsibility for their learning, self-assessment, and understanding of the received assessment. In the study process, academic staff use methods, test forms and evaluation criteria corresponding to the study aims and expected learning outcomes.

Students receive support and feedback from lecturers during the study process. The evaluation criteria for the display of tags have been made public in advance. Assessment gives students the opportunity to demonstrate the extent to which they have achieved their expected learning outcomes.

Taking into account the principles of student-centered education, student mobility is promoted (recognition of learning outcomes), students engage in research and social activities initiated by academic staff in society, thus gaining significant experience using what they have learned during studies in practice. By implementing the internal quality assurance policy, the study programs are implemented in such a way that students are encouraged to actively participate in the improvement of the study process. There are procedures and guidelines for submitting student suggestions and resolving complaints, reviewing student appeals. In the improvement of the study process, the results of student surveys are evaluated and taken into account. Students eagerly express their recommendations for improvement of the study programs and process in conversations with the academic staff and program directors.

The assessment also takes into account the work of students during the acquisition of the study course (performance in tests, activity in seminars, development of independent work, drawing of reports, etc.), applying the summative assessment method, which provides for the gradual formation of the final grade from several types of student work. Throughout the study process, the basic principles of evaluation are taken into account – the principle of openness of evaluation, the principle of mandatory evaluation, the principle of the possibility of reviewing the evaluation, the

principle of the diversity of the types of assessment used in the evaluation.

The final stage in the acquisition of the study program is the taking of the State Examination, including the development and viva voce examination of the Bachelor Paper. A student can take a part in viva voce examination of the Bachelor Paper only when the entire content of the program has been acquired, i.e., a positive assessment has been obtained for each study course and performance of internship tasks.

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).

The internship within the study program "Financial Engineering" is planned in the 4th year in the amount of 10 CP in the 7th semester and 10 CP in the 8th semester in full-time studies. The internship tasks have been developed according to the place of internship:

One of the internship places is Commercial Bank:

The most important internship tasks	The result to be achieved
To get acquainted with and describe the procedure and for opening demand deposit accounts of natural and legal persons and drafting of the related documents;	Skills to solve economic and social tasks by conducting the statistical analysis of the financial flows;
To get acquainted with the procedure for issuing debt securities in the bank; To show the structure of the issue prospectuses;	Ability to manage optimization of security portfolios and investments;
To describe the procedure for settlement of interbank and bank loans with the Bank of Latvia; To analyze the bank’s capital adequacy against the industry average and in their group; To perform structural analysis of the bank’s loan portfolio and according to the system of coefficients; To carry out the bank’s ROA and ROE analysis	Ability to identify financial and actuarial problems that can be solved by applying information technologies;

To describe the bank’s credit policy; To characterize the activity of the commercial bank in transactions in the interbank market and transactions with the Bank of Latvia.	To understand the economic and financial situation in Latvia and in the world;
To describe the principles of the bank’s own securities portfolio formation; To describe bank brokerage services; to fill in the relevant contracts; Securities placement operations of other issuers (underrating), their characteristics To describe the bank trust services at the bank.	Ability to explain the basic principles of the use of financial instruments;

The second place of internship is an insurance company:

The most important internship tasks	**The result to be achieved**
To get acquainted with the principles for calculating insurance premiums for real estate, road transport and general civil liability; To get acquainted with the factors that increase or decrease insurance premiums; To describe the basics of the formation of insurance premiums in different types of insurance.	Ability to conduct statistical analysis of such indicators as mortality, functional disorders, and others using IT solutions
To get acquainted with different types of insurance in the insurance company; To fill in real estate, road transport and general civil liability insurance applications To characterize the types of insurance of the property, road transport, Motor Third Party Liability Insurance (MTPL), general civil liability;	Skills to analyze insurance market trends and calculate insurance losses and premiums using IT solutions;
To get acquainted with the accident, life, endowment insurance premium calculation principles; To describe the basics of the formation of insurance premiums in different types of insurance. To get acquainted with the factors that increase or decrease insurance premiums; To calculate the premiums for various insurable objects;	Skills in order to be able to act independently and make decisions, as well as to use the acquired knowledge in practice.

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.

A large part of the research carried out within the framework of Bachelor Papers and the recommendations developed as a result thereof are economically justified and are appreciated and actually used in the activities of specific companies, as evidenced by the feedback provided by employers. Thus, it is possible to argue that students in the study program when choosing the themes and research objects of their graduation papers considered only theoretical knowledge acquired during studies but also practical skills, and are competent to solve professional tasks of the industry and the labor market.

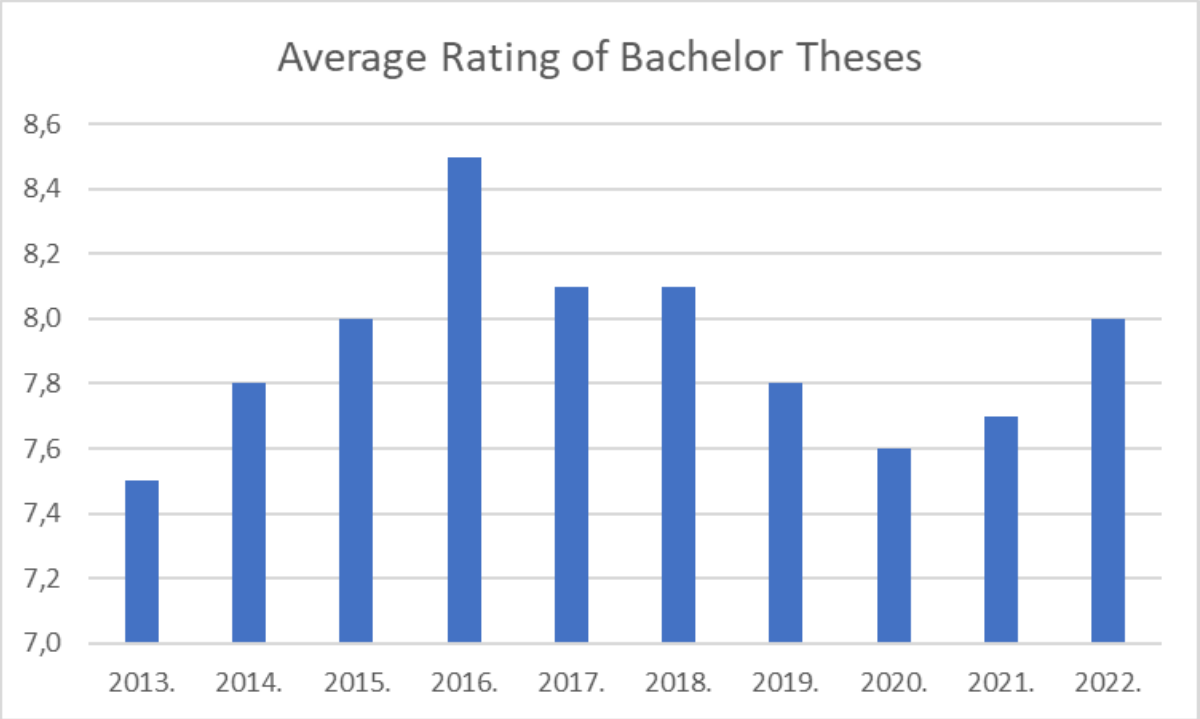
Themes of the defended Bachelor Papers in the last two years:

Student	Theme	Year, grade
I. Adata	Technical reserves and claims handling process in non-life insurance in Latvia	2021, 7
O. Brenča	Application of queueing theory in supply chain management	2021, 10
A. Buravcova	Full-service fuel stations customer service chain modelling by using the methods of queuing theory	2021, 9
L. Dalbiņa	Impact of company’s digital maturity on operational financial indicators	2021, 8
S. Dzene	Adaptation of the “Bonus-Malus” models used in Europe to the Latvian motor third party liability insurance premium management system	2021, 7
B. Kazarina	Application of collective risk model and Chain-Ladder method in performance analysis	2021, 8
K. Kočāns	Application of machine learning library Catboost for trading in financial markets	2021, 10
L. Oskars	Efficiency of machine learning in trading in financial markets	2021, 9
K. K. Miķelsone -	Analysis and forecast of the number of new passenger cars registered for the first time	2021, 8

J. Nikiferovič	The determination of market value of JSC “Air Baltic Corporation” after initial public offering	2021, 8
S. Padamane	Technical provisions role and calculation in non-life insurance in Latvia	2021, 8
M. Serģe	Comparison of the effects of financial crises (in 2000 and 2008) in European countries and the USA with time series models	2021, 7
R. Simanovičs	Activity based budgeting and activity based costing model for Rail Baltica project	2021, 6
T. Svistuna	Life insurance in Latvian banks	2021. 6
A. Šaraņina	Settings an option premium using low probability event analysis	2021, 7
I. Valpētere	Applications of Collective Risk Model	2021, 7
E. R. Vēriņš	Determination of the derivatives premium by allowing negative rate scenarios	2021, 9
J. V. Vēriņš	Option pricing based on machine learning	2021, 9
V. Verjovkina	American type option pricing by Monte Carlo method	2021, 7
M. Zinovjeva	Modeling and Actuarial Analysis of the Pension System	2021, 9
D. Zlibina	Option pricing using the binomial tree method and its convergence	2021, 7
L. Freimane	Analysis of dynamics and forecasting of future values of the interest income of the bank	2021, 6
A. Mihailovs	Insurance deposits and it features in EU countries and Latvia	2020, 6
A. Lukašenoka	Modelling and forecasting household electricity market prices	2020, 7
D. Šiškina	Modeling and actuarial analysis of the pension system	2020, 9
E. Čeirāns	Forecasting the likelihood of bankruptcy for small and medium-sized enterprises by using stochastic modeling	2020, 7

K. Vasiļevska	Application of queueing theory in simulating an enterprise workflow model	2020, 9
B. K. Andžāne	Development of insurance premium calculator in MATLAB environment	2020, 8
A. Razma	Good deal indices in financial market	2020, 10
D. Kliešmits	Project for Effective Management of Functional Requirements and Costs in a Digital Marketing Service Company	2020, 8
P. Meinerte	Internal rate of return calculator development in a browser	2020, 7

Analyzing the grades received by the students for their Bachelor Papers in the period 2016-2021, it should be noted that all graduation papers during this period have been defended successfully and evaluated with the grades above 7 (out of 10 maximum possible points), which is considered a good indicator because at least half of the members of the Final Examination Committee are representatives of employers:



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.

Thanks to the high level of digitization, the infrastructure and material and technical resource base available for the implementation of the study field and the corresponding study programs provide an opportunity to increase competitiveness, quality, and efficiency of the university, as well as increase availability of information by integrating IT solutions into the administrative, academic and research processes of the university, providing students, administrative and academic staff with modern, reliable, safe and unified IT infrastructure and high-quality IT services.

The library plays an important role in providing methodological and informative support to the students. The Scientific Library of RTU (https://www.rtu.lv/lv/studijas/biblioteka) is an academic library of state significance, which has obtained its status as a result of library accreditation. The Scientific Library of RTU provides the necessary information for RTU study process and research activities, performs library, bibliographic and information services for RTU students, teaching staff, and employees. The Library's collection includes 1.29 million printed documents and e-resources in the databases relevant to RTU fields. The collection is stored in the Central Library, the Study Literature Subscription Office, the Chemistry Collection, the Transport Collection and the Study and Research Centers in Daugavpils, Liepāja, Cēsis and Ventspils.

The aims and tasks of RTU Scientific Library are subordinated to the aims and tasks of RTU. The mission of RTU Scientific Library as the main engineering library is to implement the provision of higher academic and professional education study programs with excellent quality information resources in technical, natural, social sciences and humanities, as well as architecture.

The Library comprises the following units:

- Collection Formation Department
- Department of Information and Technology
- User Service Department
- Department of Study and Sectoral Literature
- as well as branches in Daugavpils, Liepaja, Ventspils and Cesis.

The library is equipped with modern equipment and technologies, and provides various services:

- books, magazines, databases, and other electronic resources;
- remote access to electronic resources 24/7;
- the electronic joint catalogue of the largest university libraries;
- the unified search tool PRIMO (information is searched simultaneously in the catalog and subscribed databases);
- SBA – interlibrary subscription;
- lectures, classes, consultations, and trainings on information literacy;
- printing, scanning, copying documents;
- access to the Internet;
- premises for studies and leisure time;
- library tours;
- binding of graduation papers;

The library collection consists of educational literature, scientific literature, and fiction. It includes books, serial publications (periodical publications, magazines, newspapers), electronic resources (databases, e-books, e-journals), production codes, product catalogs, unpublished publications (scientific paper reports, PhD theses and summaries thereof), audiovisual documents, cartographic documents. Currently, there are 1.5 million printed copies and 14 electronic databases in stock. Trials of new databases are regularly provided.

E-books and e-journals corresponding to the study program in the subscribed databases:

- Proquest Ebook Central – full-text e-books published by the leading scientific publishers – Elsevier, Wiley, Springer, Oxford Press, Emerald;
- EBSCOhost eBook Academic Collection – a full-text e-book database, which contains books in English by leading scientific publishers;
- Academic Search Complete – the most comprehensive multidisciplinary scientific journal full-text database;
- ScienceDirect – a database of multidisciplinary scientific journals maintained by Elsevier;
- Wiley Online Library – full-text scientific journals published since 1997 in various fields of science;
- SCOPUS/Web of Science – bibliographic research literature citation databases;
- ACM Digital Library – publications in computer science;
- SpringerLink - full-text journals and e-books in computer science, engineering, chemistry and materials science.

The collection (both printed and electronic) is renewed and supplemented by the Collection Formation Department in cooperation with the academic staff and User Service Departments in accordance with the Library's Collection Formation Policy. The Collection Formation Policy is adopted and overseen by the Library Council.

The task of the Collection Formation Policy is to centrally form and supplement the library collection in accordance with the needs of RTU study programs, scientific research fields, library tasks and functions specified in RTU Scientific Library regulations, collection policy and according to the position of RTU Scientific Library in the unified information system of the Latvian libraries.

The basic criteria for selecting collections by RTU Scientific Library are:

- compliance with RTU study programs and scientific research areas;
- the level of formation intensity (completeness), defining it for each RTU study program and field of science (minimum level of information, basic information level, education level, scientific research level and level of relative completeness);
- recommendations of RTU program directors, academic staff, industry specialists;
- user requests;
- language;
- the price of the edition.

Detailed information can be found in Sections 2.3.1 - 2.3.3 of Chapter 3 of Part II

Graduates of the study program have pointed at the worn premises at 1/3 Meža Street, but in the summer of 2021 the construction of the new building at 10 Zunda Embankment was completed, and the Department of Probability Theory and Mathematical Statistics (DPTMS) has relocated to this new building. Premises available for DPTMS at 10 Zunda Embankment are described in Section 2.3.2. of Part II.

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).

In accordance with Cabinet Regulations of 12 December 2006 No 994, the amount of the study funding granted to the institution of higher education from the state budget is calculated using the following formula:

$F_s = T_b \times [S(k_i \times n_i) + 1{,}5 \times S(k_i \times m_i)] + S_b \times S(n_i + m_i)$, where

F_s – amount of study financing

T_b – basic costs of the study seat;

k_i – coefficient of the study costs in the relevant field of education (Annex 1 to the Regulations;

n_i – the number of study seats for a higher education institution or college at undergraduate and professional study programs in the relevant thematic area of education;

m_i the number of study seats at the Master study programs in the relevant thematic area of education;

S_b – study seat social security expenses at Bachelor, professional and Master study programs (Annex 2 to the Regulations, only in Latvian).

State budget subsidies and potentially also student tuition fees are used for the implementation of the study program. Information on the financial resources of the program is presented in the table below:

Year	State-budget funded students	Tuition fee-paying students	State subsidy	Tuition fee	Total financing	Desired costs per 1 student, taking into account the current regulations, EUR
2016/2017	80	8	169 556	1 800	183 956	2 090,41
2017/2018	76	22	190 982	1 800	230 582	2 352,88
2018/2019	78	30	221 908	2 400	293 908	2 721,37

2019/2020	73	35	217 230	2 400	301 230	2 789,17
2020/2021	73	45	245 023	2 400	353 023	2 991,72

Over the years, a continuous increase in RTU costs has been observed (utilities, maintenance of buildings, construction of a new building, etc.).

For the development of all study programs, centralized funding is used for the renewal of the collection of the Scientific Library, improvement and maintenance of joint use premises, public relations, program marketing activities, development and maintenance of information systems related to the study process, development of Ķīpsala Campus and other activities.

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.

Selection criteria for of the academic staff include their specific knowledge, scope of scientific and on-the-job experience taking into account the specifics of the study program and study courses therein. The study program invites professionals in the field.
The study program also involve the academic staff of other organizational units of RTU. In total, 37 Doctors of Science are involved to the implementation of the study program. There are 8 Doctors of Mathematics, 13 Doctors of Engineering and Doctor of Computer Science, 12 Doctors of Economics, 1 Doctor of Physics and 3 Doctors of Psychology and Doctors of Sociology. There are also 8 lecturers are involved to the implementation of the study program, which have a master's degree.

A more detailed list of all members of the academic staff involved in the study program is given in Annex 5, their biographies (Curriculum Vitae) are enclosed in Annex 6, and the list of scientific publications related to the study program published by the members of the academic staff during the last six years in peer-reviewed journals or research innovation list is summarized in Annex 5.

The list of scientific publications related to the study programme is wide and comprehensive, publications are related to the curricula of the delivered study courses:

Šenfelde, M. Makroekonomika. Riga: RTU, 2014. 245 pp. ISBN 978-9934-10-523-4.

Judrupa, I., Šenfelde, M., Juščius, V. Evaluation of the Competitiveness of Statistical Regions in Latvia Using Official Statistical Information. Engineering Economics, 2021, Vol. 32, No. 2, 154.-164.lpp. ISSN 1392-2785. e-ISSN 2029-5839. Available at: doi:10.5755/j01.ee.32.2.27979

Freimanis, K., **Šenfelde, M**. Assessment of Compliance Costs in the Banking Market. Economics

and Organization of Management, 2021, No. 3, 14.-27.lpp. ISSN 2307-2318. e-ISSN 2707-9899. Available at: doi:10.31558/2307-2318.2021.3.2

Freimanis, K., **Šenfelde, M.** Methodology for the Assessment of Regulation Costs in the Banking Market. In: International Scientific Conference "Contemporary Issues in Business, Management and Economics Engineering 2021", Lithuania, Vilnius, 13.-14. maijs, 2021. Vilnius: Vilnius Gediminas Technical University, 2021, 1.-8.lpp. e-ISBN 978-609-476-260-4. e-ISSN 2538-8711. Available at: doi:10.3846/cibmee.2021.600

Vītola, A., **Šenfelde, M.** Institucionālā vide un ekonomiskā attīstība mūsdienu apstākļos. Rīga: RTU Izdevniecība, 2019. 132 lpp. ISBN 978-9934-22-307-5. Available at: doi:10.7250/9789934223082 MONOGRāfija

Freimanis, K., **Šenfelde, M**. Effect of the Government Intervention on Market Efficiency. In: Scientific Conference on Economics and Entrepreneurship SCEE'2018 [CD-ROM], Latvia, Riga, 18 October, 2018. Riga: 2018, 1-1 p. ISBN 978-9934-22-141-5. ISSN 2256-0866.

Mihņenoka, A., **Šenfelde, M.** The Impact of National Economy Structural Transformation on Regional Employment and Income: The Case of Latvia. South East European Journal of Economics and Business, 2017, Vol.12, No.2, 47-60 pp. e-ISSN 2233-1999. Available at: doi:10.1515/jeb-2017-0015

Vītola, A., **Šenfelde, M.** The Role of Institutions in Economic Performance. Business: Theory and Practice, 2015, Vol.16, No.3, 271-279 pp. ISSN 1648-0627. e-ISSN 1822-4202. Available at: doi:10.3846/btp.2015.498

Mihņenoka, A., **Šenfelde, M.** Wage Share as a Factor of Income Inequality in the Context of the Structure of National Economy. Procedia Economics and Finance, 2015, Vol.26, 1035-1043 pp. ISSN 2212-5671. Available at: doi:10.1016/S2212-5671(15)00927-2

Ciemleja, G., Kozlovskis, K. Building Financial Literacy during the Covid-19 Pandemic. Entrepreneurship and Sustainability Issues, 2021, Vol. 9, No. 2, 289-302 pp. e-ISSN 2345-0282. Available at: doi:10.9770/jesi.2021.9.2(19)

Počs, R., Ozoliņa, V., Auziņa-Emsiņa, A., Skribans, V., **Lāce, N., Oganisjana, K., Kozlovskis, K.** Ekonomiskā attīstība. No: Simtam pāri. Viedā Latvija. B.Rivža, E.Jermolajeva, A.Mukāne red. Rīga: Latvijas Zinātņu akadēmija, 2018. 152.-221.lpp. ISBN 978-9984-9542-9-5.

Oganisjana, K., Monge-Iriarte, N., **Kozlovskis**, **K**., **Laizāns, T**., Surikova, S. Sabiedrības finansiālā, informatīvā, organizatoriskā un kopējā iesaiste sociālās inovācijas procesos Latvijā. No: Sociālā inovācija: izaicinājumi un risinājumi Latvijā. K.Oganisjana red. Rīga: RTU Izdevniecība, 2019. 55.-70.lpp. ISBN 978-9934-22-228-3. e-ISBN 978-9934-22-229-0. Available at: doi:10.7250/9789934222290.05

Kasperoviča, L., **Lāce, N.** Factors Influencing Companies' Positive Financial Performance in Digital Age: A Meta-Analysis. Entrepreneurship and Sustainability Issues, 2021, Vol. 8, No. 4, 291-311 pp. e-ISSN 2345-0282. Available at: doi:10.9770/jesi.2021.8.4(17)

Bistrova, J., **Lāce,** N., Kasperoviča, L. Uzņēmumu krīzes noturība un konkurētspēja. No: Latvijas tautsaimniecība pandēmijas ēnā un pēckrīzes izrāviena iespējas. I.Šteinbuka red. Rīga: LU Akadēmiskais apgāds, 2021. 104.-128.lpp. ISBN 978-9934-18-687-5. Available at: doi:10.22364/ltpepii

Bistrova, J., **Lāce, N.** Uzņēmumu produktivitāte, finanšu veselība un inovatīvais potenciāls. No: Latvijas tautsaimniecība pandēmijas ēnā un pēckrīzes izrāviena iespējas. I.Šteinbuka red. Rīga: LU Akadēmiskais apgāds, 2021. 271.-285.lpp. ISBN 978-9934-18-687-5. Available at:

doi:10.22364/ltpepii

Mehmood, K., **Lāce, N.,** Danileviciene, I. Comparative Efficiency Analysis of Conventional Banks and Islamic Banks: in Evidence of Pakistan. In: Business and Management 2020: 11th International Scientific Conference: Selected Papers, Lithuania, Vilnius, 7-8 May, 2020. Vilnius: Technika, 2020, 397-406 pp. ISBN 978-609-476-231-4. e-ISBN 978-609-476-230-7. ISSN 2029-4441. e-ISSN 2029-929X. Available at: doi:10.3846/bm.2020.583

Krilova, K., **Ciemleja, G., Lāce, N.** Challenges in Digital Product Development at Latvian Commercial Banks. No: Perspectives of Business and Entrepreneurship Development: Digital Transformation of Corporate Business: Economic, Management, Finance and System Engineering from the Academic and Practitioners Views: Proceedings of Selected Papers, Čehija, Brno, 30 April, 2019. Brno: Brno University of Technology, 2019, 65-74 pp. ISBN 978-80-214-5756-0.

Shkurko, I., **Lāce, N.,** Tamosiuniene, R. Impact of Capital Structure Decisions on Company's Profitability: Evidence from Ukraines Companies. In: XIV International Scientific Conference "Management and Engineering'16": Conference Proceedings, Bulgaria, Sozopol, 19 -23 June, 2016. Sofia: Technical University Sofia, 2016, 782-796 pp.

Špakova, A., **Uhanova, M.** Scenario-Based Testing Method Adaptation for Information Systems Testing. No: Proceedings of the International Conferences "Big Data Analytics, Data Mining and Computational Intelligence 2018", "Theory and Practice in Modern Computing 2018" and "Connected Smart Cities 2018": Part of the Multi Conference on Computer Science and Information Systems 2018, Spain, Madrid, 17-20 July, 2018. [S.l.]: IADIS Press, 2018, 81-88 pp.

Carkovs, J**., Pavļenko,** O., Petrova, J. Stochastic Modeling for Age Structured Population Growth Under Assumption of Small Fast Oscillating Perturbations. In: APLIMAT 2019: 18th Conference on Applied Mathematics: Proceedings, Slovakia, Bratislava, 5-7 February, 2019. Bratislava: Slovak University of Technology, 2019, 172-181 pp. ISBN 978-80-227-4884-1.

Matvejevs, A., Pavļenko, O. Training of Financial Technology Specialists with RTU Bachelor Program in "Financial Engineering". In: Joint International Conference on Engineering Education & International Conference on Information technology, ICEE/ICIT-2014 : Proceedings, Latvia, Riga, 2-6 June, 2014. Riga: Riga Technical University, 2014, 492 -499 pp. ISBN 978-9934-10-560-9. e-ISBN 978-9934-10-561-6.

Čerņajeva, S., Volodko, I., Iltiņa, M., **Iltiņš, I.** Good Knowledge of Basic Mathematics - a Successful Prerequisite to Study in Riga Technical University. In: APLIMAT 2018:17th Conference on Applied Mathematics: Proceedings, Slovakia, Bratislava, 6-8 February, 2018. Bratislava: Slovak University of Technology, 2018, 217-223 pp. ISBN 978-80-227-4765-3.

Rubenis, O., **Matvejevs, A.** Increments of Normal Inverse Gaussian Process as 09.03.2022 © Eiropas Savienība, 2002-2022 | http://europass.cedefop.europa.eu Lapa 6/12 Curriculum vitae Andrejs Matvejevs Logarithmic Returns of Stock Price. Information Technology and Management Science, 2018, Vol. 21, No. 1, 93-97 pp. ISSN 2255-9094. e-ISSN 2255-9094. Available at: doi:10.7250/itms-2018-0015

Rubenis, O., **Matvejevs, A.** Valuation of European Call Option via Inverse Fourier Transform. Information Technology and Management Science, 2017, Vol. 20, No. 1, 91-96 pp. ISSN 2255-9086. e-ISSN 2255-9094.

Pučkovs, A., **Matvejevs, A.** Volatility Forecasting with Wavelet Neural Networks. APLIMAT - Journal of Applied Mathematics, 2015, No.7, 143-150 pp. ISSN 1337-6365.

Pučkovs, A**., Matvejevs, A.** 'Northeast Volatility Wind' Effect. Aplimat Journal, 2014, Vol.6, 324-339

pp. ISSN 1337-6365.

Pučkovs, A., **Matvejevs, A.** 'North-East Volatility Wind' Effect. No: 13th Conference on Applied Mathematics (APLIMAT 2014): Book of Abstracts, Slovakia, Bratislava, 4-6 February, 2014. Bratislava: 2014, 67-67 pp. ISBN 978-80-227-4139-2.

Pučkovs, A., **Matvejevs, A**. Stock Market Structural Changes Discovering Helical Structure of Volatility Wave Fourier Image. Information Technology and Management Science. Nr.17, 2014, 98-105 pp. ISSN 2255-9086. e-ISSN

Fjodorovs, Jegors. PhD Thesis "Riska prognozēšana nepārtraukto laika modeļu ietvaros tehnoloģiju un tirgus novērtēšanai". Riga: [RTU], 2019. 134 p.

Matvejevs, A., Fjodorovs, J. Revaluation of Estimated Option Prices Using GARCH Processes with Most Preferable Properties. Datorvadības tehnoloģijas. No 14, 2013, 100-104 pp. ISSN 2255-9108. e-ISSN 2255-9116.

Šitova, I., **Pečerska, J.** Process Mining Techniques in Simulation Model Adequacy Assessment. In: 2019 60th International Scientific Conference on Information Technology and Management Science of Riga Technical University (ITMS 2019): Proceedings, Latvia, Riga, 10-11 October, 2019. Piscataway: IEEE, 2019, 1-4 pp. ISBN 978-1-7281-5710-8. e-ISBN 978-1-7281-5709-2. Available at: doi:10.1109/ITMS47855.2019.8940672

Šitova, I., **Pečerska, J.** Data Mining Techniques in Simulation Results Analysis. No: 2018 59th International Scientific Conference on Information Technology and Management Science of Riga Technical University (ITMS 2018), Latvia, Riga, 10-12 October 2018. Piscataway: IEEE, 2018, 1-5 pp. ISBN 09.03.2022 © European Union, 2002-2022 | 7281-0099-9. e-ISBN 978-1-7281-0098-2. Available at: doi:10.1109/ITMS.2018.8552972

Šitova, I., **Pečerska, J.** A Concept of Simulation-based SC Performance Analysis Using SCOR Metrics. Information Technology and Management Science, 2017, Vol. 20, No. 1, 85-90 pp. ISSN 2255-9086. e-ISSN 2255-9094.

J.Pečerska project: 01.10.2021 - 31.12.2021 senior expert at the project "Development of effective governance of Riga Technical University", digitization of the study course "Fundamentals of Computer Simulation and Modelling" DMI201. Type of project: ESF

Urbans, M., **Pundure, J.,** Jemeļjanovs, V. Evaluation of State of Technogenic Environment in Latvia and the World in the 21st Century. In: 20th International Scientific Conference "Engineering for Rural Development": Proceedings. Vol.20, Latvia, Jelgava, 26-28 May, 2021. Jelgava: Latvia University of Life Sciences and Technologies, 2021, 1021-1031 pp. ISSN 1691-3043. Available at: doi:10.22616/ERDev.2021.20.TF226

Urbans, M., **Pundure, J.,** Jemeļjanovs, V. Differences in the Application of Methods for Assessing the Effects of Accidents and the Impact on the Risk Level at the Increased Hazard Object. In: Scientific Conference on Economics and Entrepreneurship SCEE'2021 Organized within the 62nd International Scientific Conference of Riga Technical University: Book of Abstracts, Latvia, Riga, 14-15 October, 2021. Riga: RTU Press, 2021, 36-36 pp. ISBN 978-9934-22-678-6. ISSN 2256-0866.

Politika, V., Ļabis, J**., Pundure, J**. Trends in the Development of Fire Fighting and Rescue Equipment and Special Equipment. Analysis and Improvement if the Norms Set by the Regulatory Framework. No: Scientific Conference on Economics and Entrepreneurship SCEE'2021 Organized within the 62nd International Scientific Conference of Riga Technical University: Book of Abstracts, Latvia, Riga, 14-15 October, 2021. Riga: RTU Press, 2021, 35-35 pp. ISBN 978-9934-22-678-6. ISSN 2256-0866.

Bistrova, J., **Lāce,** N., Kasperoviča, L. Uzņēmumu krīzes noturība un konkurētspēja. No: Latvijas tautsaimniecība pandēmijas ēnā un pēckrīzes izrāviena iespējas. I.Šteinbuka red. Rīga: LU Akadēmiskais apgāds, 2021. 104.-128.lpp. ISBN 978-9934-18-687-5. Available at: doi:10.22364/ltpepii

Bistrova, J., **Lāce, N.** Uzņēmumu produktivitāte, finanšu veselība un inovatīvais potenciāls. No: Latvijas tautsaimniecība pandēmijas ēnā un pēckrīzes izrāviena iespējas. I.Šteinbuka red. Rīga: LU Akadēmiskais apgāds, 2021. 271.-285.lpp. ISBN 978-9934-18-687-5. Available at: doi:10.22364/ltpepii

Mehmood, K., **Lāce, N.,** Danileviciene, I. Comparative Efficiency Analysis of Conventional Banks and Islamic Banks: in Evidence of Pakistan. No: Business and Management 2020: 11th International Scientific Conference: Selected Papers, Lithuania, Vilnius, 7-8 May, 2020. Vilnius: Technika, 2020, 397-406 pp. ISBN 978-609-476-231-4. e-ISBN 978-609-476-230-7. ISSN 2029-4441. e-ISSN 2029-929X. Available at: doi:10.3846/bm.2020.583

Krilova, K., **Ciemleja, G., Lāce, N.** Challenges in Digital Product Development at Latvian Commercial Banks. No: Perspectives of Business and Entrepreneurship Development: Digital Transformation of Corporate Business: Economic, Management, Finance and System Engineering from the Academic and Practitioners Views: Proceedings of Selected Papers, Czechia, Brno, 30 April, 2019. Brno: Brno University of Technology, 2019, 65-74 pp. ISBN 978-80-214-5756-0.

Shkurko, I., **Lāce, N.,** Tamosiuniene, R. Impact of Capital Structure Decisions on Company's Profitability: Evidence from Ukraines Companies. In: XIV International Scientific Conference "Management and Engineering'16": Conference Proceedings, Bulgaria, Sozopol, 19 -23 June, 2016. Sofia: Technical University Sofia, 2016, 782-796 pp.

and other.

The academic staff participated in the methodological conferences, for example:

A.Matvejevs, O. Pavļenko

- Joint International Conference on Engineering Education & International Conference on Information technology, ICEE/ICIT-2014 : Latvia, Riga, 2-6 June, 2014. Training of Financial Technology Specialists with RTU Bachelor Program in "Financial Engineering"

A.Koliškins

- New Trends and Issues Proceedings on Humanities and Social Sciences: 9th World Conference on Educational Sciences (WCES-2017), France, Nice, 1-4 February 2017. Paris: 2017. The Role of Real-Life Examples in Teaching Business Statistics Course.

N.Budkina

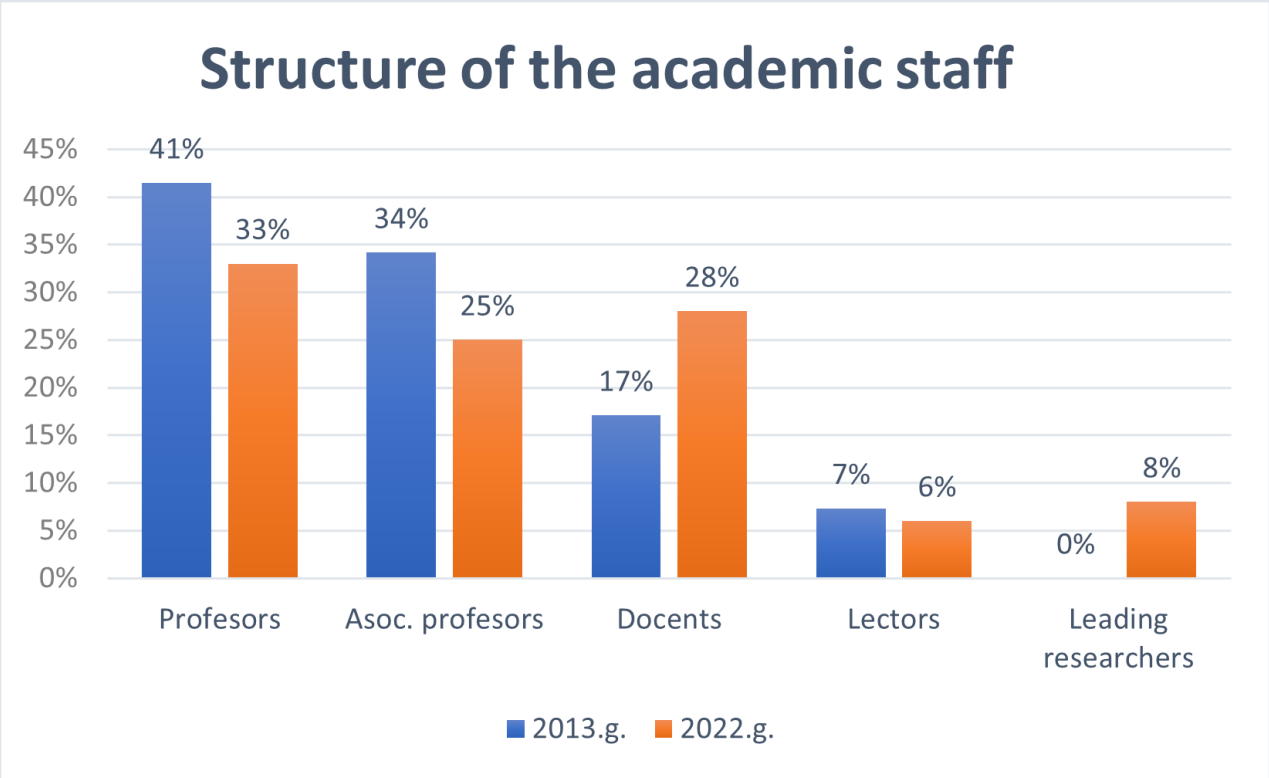
- 25 May 2018. The 19th conference Teaching mathematics: retrospective and perspectives. "Adaptation of the course of operations research for students of different specialities." Kaunas University of Technology, Kaunas, Lithuania
- 05.2017 - 13.05.2017 The 18th conference Teaching mathematics: retrospective and perspectives. «Simulation and Visualisation Tools in Teaching Mathematics». University of Latvia, Riga, Latvia

J.Pundure

- 13 May 2021. Acadmeic conference of RTU FEEM "Think Differently". Report: "Challenges in teaching study courses in civil defense to foreign students" RTU, FEEM, Riga.

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.

The composition of the academic staff involved in the implementation of the study program is stable, since the licensing of the study program, there have been no significant changes in the composition of the academic staff. 32 lecturers had a PhD in the previous accreditation period, at the moment 35 lecturers hold a PhD degree.



Comparing the structure of academic staff in 2022 and 2013, one can notice a decrease in the proportion of professors and associate professors, but a significant increase in the proportion of leading researchers and assistant professors (docents). This can be explained by the retirement of some experienced professors and the recruitment of new lecturers - assistant professors who have not yet met the criteria necessary for the position of professor, due to the significantly increased requirements for election to academic positions. In order to ensure the connection of the study programm with practice, leading researchers, working in industry companies and professionals in the field are also involved in the study process.

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).

There is a mechanism promoting mutual cooperation between academic staff working in the study program, which ensures improvement and integration of the study courses. Both the results of the annual student surveys and the graduate surveys allow receiving feedback, which indicates individual shortcomings. Consequently, the improvement of the study courses takes place on a regular basis, based both on the suggestions expressed by the students and on the industry development trends. In the process of implementation of the study program, close cooperation of the academic staff takes place, which is also manifested in the following activities:

1. Discussion of the results of student and graduate surveys at the meeting of the Department, discussing student comments, suggestions, and possibilities for prevention of negative feedback;

2. Discussion of the results of the graduation papers and the quality of reviews at the meeting of the Department, discussing the possibilities for improving the quality of the graduation papers;
3. Mutual integration of classes, discussions on laboratory and practical work carried out within the framework of classes, in order to promote the provision of complementary practical skills;
4. Cooperation within projects where academic staff use the experience gained in the study process;
5. Joint study tours, where educators together with the students get acquainted with the current events in the field, are used in practical case studies during the practical classes in the auditorium.

Student-faculty ratio at the study program is 36 members of academic staff per 110 students, i.e., about 3 students per educators at the time of submitting the self-assessment report.

Within the framework of the study program, the cooperation of academic staff may be assessed as promoting the achievement of the learning outcomes. When reviewing and updating the study program, the academic staff mutually agree on the most appropriate and effective solutions for the evaluation of student achievements and attainment of performance indicators. By periodically discussing and reviewing the curricula of the study courses, thematically coordinated and complementary acquisition of the study program is achieved, and duplication of the considered within different courses in one study program is avoided.

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	Prof_bak_diploms_diploma (ENG).pdf	Prof_bak_diploms_DCM0_2022_Latv.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)		
Statistics on the students in the reporting period	Statistikas dati_RDCM0_bakalauri ENG.docx	Statistikas dati_RDCM0_bakalauri.docx
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	P6-bak_ENG.docx	P6-bak.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)	P7-Finanšu inženierija-mapping.xlsx	P7-Finanšu inženierija-kartējums.xlsx
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	Pielikums8-bak.xlsx	Pielikums8-bak.xlsx
The curriculum of the study programme (for each type and form of the implementation of the study programme)	Studiju_Plāns (FE_bak)-LV+EN.docx	Studiju_Plāns (FE_bak)-LV+EN.docx
Descriptions of the study courses/ modules	Fin inz study courses_ENG.zip	Fin inz _stud_kursi_bak_LAT (1).zip
Description of the organisation of the internship of the students (if applicable)	FI_prakses_programma_en.docx	FI_prakses_programma.doc
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)		

Material Science and Nanotechnologies (45526)

Study field	*Physics, Material Science, Mathematics, and Statistics*
ProcedureStudyProgram.Name	*Material Science and Nanotechnologies*
Education classification code	*45526*
Type of the study programme	*Academic master study programme*
Name of the study programme director	*Remo*
Surname of the study programme director	*Merijs-Meri*
E-mail of the study programme director	*Remo.Merijs-Meri@rtu.lv*
Title of the study programme director	*Dr.sc.ing.*
Phone of the study programme director	*26093097*
Goal of the study programme	*The aim of the study programme is to prepare progressively thinking, new technology and knowledge-oriented, highly qualified specialists in materials science and high value-added technologies, including nanotechnologies, with specialization in the following fields "Material Physics", "Biomaterials", "Traditional Inorganic Materials and Nanomaterials" and "Polymer Materials and Composites (including Nanocomposites)", as well as for further doctoral studies.*
Tasks of the study programme	*The tasks of the study programme are:* *- to ensure competitive academic master's level education in the European Higher Education Area in accordance with the Bologna recommendations, preparing students for work in leading positions, to develop skills of scientific research work and to promote their use;* *- to provide students with in-depth knowledge in the chosen field of specialization, to develop expert skills and develop competencies not only to solve conventional everyday problems, but also tackle technically and scientifically challenging innovative problems both in accordance with labour market requirements and future industry development trends;* *- to develop the student's skills in identifying problems, formulating goals and solving them, finding an opportunity to use both laboratory-wide infrastructure and industrial equipment in cooperation with the manufacturer;* *- to promote knowledge transfer and develop the student's skills in presenting scientific results not protected by patent rights in international conferences and / or publishing in highly-ranked scientific journals;* *- to stimulate the interest of students and graduates in doctoral studies, lifelong learning, as well as academic and scientific excellence.*

Results of the study programme	*Graduates of the study programme:* *1) will show expanded and specialized knowledge and understanding of the fundamental issues, as well as the most current discoveries and development trends of the chosen field of specialization of materials science and nanotechnology, as well as basic knowledge in the field of management of social, communication, education and business processes,* *2) able to demonstrate an understanding of the methods of industrial production processes and scientific research planning, implementation, processing of results, analysis and interpretation, as well as modelling of physical processes of materials, understanding their essence and areas of application;* *3) Able to practically and theoretically apply knowledge about the fundamental issues, most current discoveries and development trends of the chosen specialization in the field of materials science and nanotechnology, and able to share knowledge with others,* *4) will be able to reasonably choose, plan and independently use methods and equipment for material development, characterization, as well as processing, analysis and modelling of results;* *5) will be able to summarize, compare and reasonably discuss the obtained results of research and/or production process in scientific works or technical instructions, reports and present these results to both industry specialists and the general public;* *6) will be able to propose and develop innovative scientific and market-oriented projects in accordance with the project call, market requirements and available resources, as well as will be able to perform technical expertise of the manufacturer's products,* *7) will be able to critically evaluate and substantiate the importance of the introduction of modern materials and innovative technological solutions in research and production processes;* *8) will be able to competently explain and substantiate the use of technical means, modelling approaches and results processing and analysis methods to solve technical problems of manufacturers' products, as well as to develop modern materials and technologies to meet market demands in competitive conditions.*
Final examination upon the completion of the study programme	*Master thesis and Final examination*

Study programme forms

Full time studies - 2 years - latvian

Study type and form	*Full time studies*
Duration in full years	*2*
Duration in month	*0*
Language	*latvian*
Amount (CP)	*80*

Admission requirements (in English)	*Bachelor degree of engineering sciences in materials science or chemical technology or bachelor degree of natural sciences in chemistry or physics, or biology, or comparable education*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Master degree of engineering sciences in material science and nanotechnologies*
Qualification to be obtained (in english)	-

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

Full time studies - 2 years - english

Study type and form	*Full time studies*
Duration in full years	*2*
Duration in month	*0*
Language	*english*
Amount (CP)	*80*
Admission requirements (in English)	*Bachelor degree of engineering sciences in materials science or chemical technology or bachelor degree of natural sciences in chemistry or physics, or biology, or comparable education. The assessment of the level of English language proficiency under the requirements specified in regulatory enactments.*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Master degree of engineering sciences in material science and nanotechnologies*
Qualification to be obtained (in english)	-

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

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.

Since the time of the previous accreditation of the study field, significant changes to the implementation model of the Master study program “Materials Sciences” and “Nanotechnologies” have been made and a new Master study program “Materials Science and Nanotechnologies” has been developed. The preceding study programs were consolidated and replaced with a new study program “Materials Science and Nanotechnologies”' in compliance with the defined aims and tasks of the Specific Support Objective project “8.2.1. Reducing Fragmentation of Study Programs and Strengthening Sharing of Resources” of the operational program “Growth and Employment”, as well as based on the requirements towards academic Master study programs stipulated in the Law on Higher Education Institutions and RTU regulations “The Procedure for Application, Development and Amendments to Study Programs”. The main changes in the new study program include:

- integration of compulsory internship, based on the recommendations of the Advisory Board of the Faculty of Materials Science and Applied Chemistry (FMSAC) and results of student surveys, which prove the necessity to increase the specific weight of practical training and the level of practical competencies of students who start working in the manufacturing industry or research and development sector;
- decrease in the proportion of compulsory study courses (reduced from 37 CP to 24 CP by 35 %) and greater opportunities for the selection of study courses of professional specialization, including the courses developing communication and business skills.

The academic study program “Materials Science and Nanotechnologies”, education classification code 45526, is licensed by Decision of 9 December 2020 No. 2020/70-L - license No. 04051/192 of the Higher Education Quality Commission of the Ministry of Education and Science of the Republic of Latvia. Currently the academic Master study program is being approbated.

Based on the recommendations stipulated in the Commission report, the following amendments have been taken into account and implemented:

- ***Short-term recommendation:*** *Prior to the launch of the study program, it is necessary to define in more detail study course election opportunities in the compulsory elective part in the fields of specialization “Biomaterials” and “Traditional non-organic materials and nanomaterials” for the students, who do not have such opportunities at the moment, because students are offered the study courses in the volume of 16 CP, which coincides with the total volume of compulsory elective study courses within the study program.*

Implementation: Providing rationale for election opportunities in the compulsory elective part of the specializations “Biomaterials” and “Traditional non-organic materials and nanomaterials”, it should be noted that in this part students can choose both study courses within the scope of the chosen specialization and study courses within another specialization, generally increasing the election opportunities from 16 CP to 32 CP. Furthermore, in the scope of the specializations “Biomaterials” and “Traditional non-organic materials and nanomaterials” students are offered to

acquire a study course related to a research project development (“Research Project - Biomaterials Research and Characterisation” and “Research Project - Traditional Inorganic Materials and Nanomaterials”, respectively), which provide students with additional opportunities to acquire individual practical and theoretical aspects of the topic of interest in the chosen specialization. In parallel, students are offered ample of opportunities of enhanced specialization in the chosen field through one of the study courses offered in the scope of elective study courses (12 CP). In order to increase students’ long-term opportunities of choosing study courses according to their interests, the continuous labor market demand follow up is planned and new B1 study courses can be offered through development of the study program;

- ***Long-term recommendation:*** *Until academic year of 2022/2023 RTU FMSAC Advisory Board should revise the curricula of study courses in humanities and social sciences together with the members of the academic staff responsible for appropriate courses. The training module should include an opportunity to acquire the skills of project management, communication, process management and competencies in business finance and investments that are in demand on the labor market.*

Implementation: Reviewing the compulsory elective study courses in humanities and social sciences included in Part B2 of the new study program “Materials Science and Nanotechnologies” and the results of student surveys, the offer of these study course is constantly analyzed. RTU already offers the study courses that are aimed at development of project management, communication, process management skills and competencies in the field of business finance and investment (for example, PBM467 Corporate Governance, PBM429 Leadership, IUF748 Investments, IUV207 Fundamentals of Finances, IRO468 Organization of Investments Production (3CP), Vertically Integrated Projects (VIP) VIP001 (2CP), Innovation and Technology Transfer IVZ836 (4CP), Technology transfer and product design IVZ745 (2CP), Product Design and Development IUE550 (4CP), Organization of Investments Production IRO468 (3CP), DEMOLA Latvia (2CP), Marketing Fundamentals IUE731 (2CP), Business Forecasting IUE589 (4CP), Economic Forecasting IUE471 (3CP), Innovation Economics IUE461 (3CP), Economics of Engineering Solutions IUE417 (2CP), EU Co-financed Project Management IRE407 (4CP), Financial and Economics Information Analysis Methods IEU504 (2CP), which students can already choose as part of their free elective study courses. It should be noted that a new study course “Chemical Industry and Sustainability” has also been developed, which is implemented with the participation of the representatives of the management of the leading Latvian companies working in the field of materials science. At the same time, certain lectures within the framework of separate study courses of the study program “Materials Science and Nanotechnologies” are provided by representatives of the manufacturing companies (e.g., Ltd TENACHEM/Soudal, Ltd Kinetics Nail Systems, JSC Valmieras stikla šķiedra). The curriculum of these courses is discussed both with the responsible instructors and representatives of RTU FMSAC Advisory Board. In turn, RTU Career Center regularly organizes free courses that are envisaged to develop student communication, leadership and business competencies.

- ***Long-term recommendation:*** *Until the academic year 2022/2023 it is recommended to increase the number of internship places and to sign cooperation agreements with places of internship in the Baltic states and in the rest of Europe in order to strengthen students’ competitiveness in the European labor market.*

Implementation: In order to increase the number of potential places of internship, possibilities of new cooperation agreements with manufacturers are regularly considered (i.e., the agreements on places of internship and cooperation have been signed with “Lauma Fabrics” Ltd., “Mežroze” Ltd.). More cooperation agreements are expected to be signed until the end of academic year 2022/2023. At the same time, it should be noted that RTU students can do internships at foreign companies

within the scope of ERASMUS+ program, thus strengthening their competitiveness in the labor market not only at the Latvian but also at the European level.

- ***Long-term recommendation:*** *Until the current accreditation, the long-term development of the study program needs the involvement of new members of the academic staff from foreign institutions with post-doc experience.*

Implementation: When developing the competencies of the academic staff and renewing the academic staff, along with experienced members of the academic staff the study program involves many young specialists both to increase the proportion of younger members of the academic staff and to ensure effective knowledge transfer. For the moment, the assistant Ritvars Bērziņš works are the study program, who is simultaneously a PhD student and an industry professional who has accumulated a rich on-the-job experience, which includes the work in product development laboratories at a range of companies (TENACHEM Ltd., SKONTO Group). In parallel, the study program has involved the lecturer Oskars Platnieks, whose PhD Thesis supervisors are Sergejs Gaidukovs, Professor at RTU Department of Polymer Technology, and Vijay Kumar Thakur (SRUC, Scotland's Rural College). O. Platnieks has also accumulated considerable experience both during his internship at the Latvian manufacturers and at foreign universities. Involvement in the studies of young members of the academic staff is a continuous process. As far as possible the study program involves young specialists with post-doc expertise from foreign institutions, for instance, by planning guest lectures for them in the scope of certain study courses (i.e., Dr. rer. nat. J. Lejnieks with PhD experience at RWTH Aachen University, as well as with post-doc experience at the University of Pennsylvania).

- ***Long-term recommendation:*** *In order to ensure the long-term quality of the study program, general improvement of the English language skills among the academic staff is desirable.*

Implementation: In order to ensure the quality of implementation of the new study program "Materials Science and Nanotechnologies" in English, many members of the academic staff working in the program have undertaken English language courses and acquired B2 or C1 certificates. In parallel, the majority of responsible instructors have gained experience in working with foreign students. To ensure the long-term quality of the study program, the possibilities to improve the English language competencies of both responsible instructors (achieving C1 certificate) and other members of the academic staff (providing in the long term the achievement of B2 certificate for all the academic staff involved in the study program) are being constantly sought.

- ***Long-term recommendation:*** *Until academic year 2022/2023, it is recommended to evaluate the efficiency of student engagement and the deployed awareness and outreach campaign based on student number dynamics in the following academic years.*

Implementation: In order to popularize the study program, every year after admission of students the efficiency of student engagement and the deployed awareness and outreach campaign is evaluated based on the student number dynamics in the following academic years. Various student involvement events are organized on a regular basis (i.e., exhibition "Skola", Open Doors Days, Connect to RTU, Scientists' Nights, and others). In parallel, students in the study program inform a broad audience about their research both in the printed and digital social media. However, taking into account that the first admission to the study program took place at the beginning of 2021 in the winter academic term of the academic year 2020/2021, it is still impossible to measure the effectiveness of the outreach campaign. In addition, the possibilities to acquire certain study courses of the study program in cooperation with foreign universities are being sought. In this context, the program has been invited to participate in the joint Master program with the Grenoble Institute of Technology (France), Aalto University (Finland), The Technical University of Darmstadt

(Germany), University of Bordeaux (France), and University of Liège (Belgium).

- ***Long-term recommendation:*** *Until the current accreditation, it is recommended to raise the general prestige of research activities through publications in international scientific journals indexed in international citation databases (Q1, Q2).*

Implementation: In order to further improve the research skills of the academic staff involved in the studies, the opportunities of getting financing within the national and international research projects will be sought, which will allow achieving new research results and publishing them in highly ranked Q1-Q2 journals. It should be noted that already now the leading members of the academic staff in each specialization have high h-indexes and a large number of publications of high quality and with high citation index. For example, already today Hirsch indexes of A.K. Gross, A. Šutka, J. Ločs, D. Loča, G. Mežinska, M. Knite, A. Medvids, P. Onufrijevs, A. Ozols, G. Rēvalde, R. Merijs-Meri and S. Gaidukovs are higher than 10. The leading members of the academic staff in 2021 alone had more than 30 SCOPUS indexed publications. In addition, the citation index of the leading authors exceeds 10,000.

- ***Long-term recommendation:*** *Until the current accreditation, the possibility to join the international program for the improvement of pedagogical skills of academic staff should be considered in order to let the academic staff obtain an ING.PAED.IGIP certificate.*

Implementation: Until the current accreditation, the possibility to join the international program for the improvement of pedagogical skills of academic staff for at least some responsible members of the academic staff will be considered to let them obtain an ING.PAED.IGIP certificate.

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 Master students who have completed a study program "Materials Science and Nanotechnologies" in the study field “Physics, Materials Science, Mathematics and Statistics” are competent to qualify for decision-making and leadership positions, getting involved in the work tasks relevant to the public starting from solving business challenges to fundamental research in Physics, Materials Science, Mathematics and Statistics. The academic multidisciplinary program “Materials Science and Nanotechnologies” offers to acquire enhanced theoretical knowledge and on-the-job experience to perform the duties within the high responsibility scope in cooperation with the leading Latvian companies that process and manufacture products (construction products, packaging, clothing, heat insulation products, varnishes, paints, etc.) of different materials (including wood, glass, ceramics, metal, polymers and their composites). This allows graduates of the study program to build a professional career in various fields related to materials science and modern technologies, including development of new materials, monitoring and improvement of product quality, innovation development, improvement of study content in higher education and lifelong learning, as well as elsewhere. At the same time, the graduates of the study program have the opportunity to continue their studies in a doctoral degree in Materials Science or another relevant field of technical sciences in Latvia or abroad. Taking account of the multidisciplinary

nature of the study program, the Licensing Commission ascribed code 45526 to the study program “Materials Science and Nanotechnologies” on 21 December 2020 based on decision No. 2020/70-L taken at the meeting of the Educational Quality Committee on 9 December 2020. In accordance with the national regulatory framework, this code is the most appropriate for the multidisciplinary content of the study program and the awarded degree – Master of Engineering in Materials Science and Nanotechnology.

Such study program model has been shown to be attractive also in international level. In this course as one of the possibilities of the program implementation in international level is involvement in the European Institute of Innovation & Technology (EIT) system within the framework of the AMIS (Master’s Programme in Advanced Materials for Innovation and Sustainability) project (https://amis-master.eitrawmaterials.eu/). It is planned that agreement on the involvement of RTU within AMIS, will be concluded in the beginning of the academic year of 2022/2023 (September). Thus the first students could be enrolled in the program “Materials Science and Nanotechnogies” at the academic year of 2023/2024. The students will acquire specific courses of the study program “Materials Science and Nanotechnogies” in the chosen field of specialization ensuring that the content of the study program “Materials Science and Nanotechnologies” is acquirted. This is made possible by considering broad spectrum of compulsory elective and free elective study courses if the study program “Materials Science and Nanotechnologies”. The AMIS program students, studying at RTU in the 2nd course, after graduation will be eligible to receive two diplomas, the first one - from the university, studied in the 1st study year, and the second one - from RTU.

The study program corresponds to Level 7 of EQF and LQF, and thus it is intended for the applicants with the Bachelor degree or any other compatible degree according to effective Latvian regulations. The aim of the study program is to satisfy the urgent labor market demand for the competent, independent and responsible specialists fit for the leading technical management positions with appropriate theoretical and practical training in the field of product manufacturing and quality assessment for the performance of highly complex technical tasks, as well as for technology transfer from laboratory to production. The main tasks of the study program “Materials Science and Nanotechnologies” are to ensure that program graduates are competent to engage in the production of various materials and products, their quality control, expertise, and technology transfer processes. In this regard, the curriculum of the study program is designed so that the aims of the study courses included in the study program and their learning outcomes would be consistent and complementary to promote the achievement of the program aims and learning outcomes.

In this way the interrelationship between the title, the awarded degree, the specialization fields, the aims and tasks, the learning outcomes, as well as admission requirements is established.

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

The economic and social rationale behind the study program “Materials Science and Nanotechnologies” is defined by high labor market demand for the independent and responsible specialists fit for leadership positions, who could be involved in the control of technological production of different materials and/or products, development of innovative materials and approaches, as well as in technology transfer from lab to mass-production.

Graduates of the study program can be employed almost in any field related to the development of new materials and property modeling for the design of various innovative customized products, selection of corresponding materials for production of technologically, ecologically and economically sustainable composite materials, processing of natural and synthetic materials (including, wood, polymers, rubber, textiles, silicates, metals, biomaterials, semiconductors) and treatment of their various kinds (monolith, fibre, coating, aerogel/hydrogel) for manufacturing of a certain product to be applied in civil engineering, transport, power engineering, electronics, medicine, agriculture, and other industries. At the same time, the study program is designed so as to let its graduates perform independent, high responsibility duties and management of a corresponding work team. Graduates of the study program in the academic or commercial work environment will:

- show expanded and specialized knowledge and understanding of the fundamental issues, as well as the most current discoveries and development trends of the chosen field of specialization in materials science and nanotechnology;
- be familiar with the methods of industrial production processes and scientific research planning, implementation, processing of results, analysis and interpretation, as well as modelling of physical processes of materials, understanding their essence and areas of application;
- be able to practically and theoretically apply knowledge about the fundamental issues, the most current discoveries and development trends of the chosen field of specialization in materials science and nanotechnology, as well as will be able to transfer this knowledge to others;
- will be able to reasonably choose, plan and independently use methods and equipment for material development, characterization, as well as processing, analysis and modelling of results;
- will be able to summarize, compare and reasonably discuss the obtained results of research and/or production process in scientific works or technical instructions, reports and present these results to both industry specialists and the general public;
- will be able to propose and develop innovative scientific and market-oriented projects in accordance with the project call, market requirements and available resources, as well as will be able to perform technical expertise of the manufacturer’s products,
- will be able to critically evaluate and substantiate the importance of the introduction of modern materials and innovative technological solutions in research and production processes;
- will be able to competently explain and substantiate the use of technical means, modelling approaches and results processing and analysis methods to solve technical problems of manufacturers' products, as well as to develop modern materials and technologies to meet market demands in competitive conditions.

Thus, the scope of activities of the graduates of the study program “Materials Science and Nanotechnologies” includes startup companies developing innovative products, new product development laboratories, biomaterial, non-organic material, polymer material and composite treatment and recycling companies, product conformity assessment and quality control laboratories, and centers for technical expertise of materials and products and certification.

The knowledge, skills and critical thinking-based competence acquired during the study program will let young specialists not only join the team of a company successfully operating in the local or international market (also the management team) but also with a high likelihood start their own innovative business. In parallel, graduates of the study program have a wide range of opportunities to continue studies for a PhD degree at some of the leading universities or research centers in

Latvia or abroad, for example, at the RTU PhD study program “Chemistry, Materials Science and Technology”.

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.

Statistical data on the students have been analyzed for the entire review period of the study direction and therefore include data on both the previous academic master's study programs "Materials Science" and "Materials Nanotechnology", as well as on the new study program "Materials Science and Nanotechnology", which was created within the framework of the project "Reducing the fragmentation of study programs of Riga Technical University and strengthening the sharing of resources" of the specific support objective (SAM) 8.2.1. "Reduce the fragmentation of study programs and strengthen the sharing of resources" 2nd project call. The first students were admitted to the newly created study program "Material Science and Nanotechnology" in 2021 in the spring semester. Students of the previous study programs "Materials Science" and "Materials Nanotechnology" were matriculated in the newly created study program "Materials Science and Nanotechnology" ensuring that its content is fully mastered.

Analyzing the statistical data on the number of students, it can be concluded that the total number of students was variable during the reporting period, with a general tendency to decrease: 33 students (of which 20 students in the study program “Materials Science” and 13 – in the study program “Materials Science and Nanotechnologies”) in academic year 2012/13, 9 students in academic year 2017/2018 (of which 6 students in the study program “Materials Science” and 3 – in the study program “Materials Science and Nanotechnologies”) and 16 students in academic year 2018/2019 (of which 12 students of the study program “Materials Science” and 4 – in the study program “Materials Science and Nanotechnologies”). The number of students in the new study program in academic year 2021/2022 was 10 students. There are several reasons for these trends, including:

- decrease in the number of students due to the demographic situation in the country,
- graduates of the Bachelor program starting the family or starting full time job,
- emigration, mainly to Great Britain and Ireland,
- increased offer of studies abroad and student solvency growth, which, in combination with the mentioned above emigration, not rarely is the reason for brain drain of many of the Bachelor program graduates to other European universities,
- negative impact of Covid-19 pandemic that limited full-time studies, worsened the population health in general, and the mental health state in particular.

Still, taking into account that since 2019 the bachelor study program "Materials Science" has been offered not only in Latvian but also in English, foreign students are gradually beginning to take interest in the program. Unfortunately, such a positive trend could fade down due to the current unstable geopolitical situation in the region.

The graduate number dynamics is directly related to the number of students in the final year of studies. In this regard, the situation during the reporting period has been fluctuating, which is to a large extent due to the reasons mentioned above.

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).

Not 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 curriculum of the study program has been developed in compliance with the defined aims and tasks of the Specific Support Objective project “8.2.1. Reducing Fragmentation of Study Programs and Strengthening Sharing of Resources” of the operational program “Growth and Employment”, as well as based on the requirements towards academic Master study programs stipulated in the Law on Higher Education Institutions and RTU regulations “The Procedure for Application, Development and Amendments to Study Programs”.

The study program is implemented in the full-time on-site mode, its duration is 2 years divided into 4 study semesters. In this period, students have to acquire compulsory study courses, compulsory elective study courses in the field of specialisation and free elective study courses, as well as to undergo internship and develop a Master Thesis. Students select the field of specialization at the beginning of the study program depending on the student’s interest area or the specialization study courses acquired previously within the Bachelor study program. Students can change their specialization in the course of studies, provided that all the compulsory study courses of the specialization have been acquired. Such a change may be implemented in a certain stage of the study program implementation due to a relatively large number of free elective study courses. The volume of the study program is 80 CP (120 ECTS), of which 12 CP (18 ECTS) are compulsory study courses for the entire study program (A1), 12 CP (18 ECTS) - compulsory study courses for the chosen specialization (A2), 16 CP (24 ECTS) – compulsory elective study courses of the specialization/field-specific study courses (B1), 4 CP (6 ECTS) - humanities and social sciences study courses, promoting communication and management skills, as part of the compulsory elective study courses group (B2), 4 CP (ECTS) – internship (D), 20 CP (30 ECTS) – final examination (E) and 12 CP (18 ECTS) – free elective study courses (C).

Applicants with a Bachelor degree in materials science or chemical technology or a Bachelor degree in chemistry or physics or biology, or compatible education, may enrol in the study program.

The compulsory study courses comprise for the whole study program common study courses “Advanced Technologies of Materials” (4 CP/ 6 ECTS), “Modern Materials” (4 CP/ 6 ECTS), “Modeling and Simulation of Physical Processes” (4 CP/ 6 ECTS) and compulsory specialization study courses (12 CP / 18 ECTS). The study course “Modern Materials” will provide students with the in-depth knowledge in innovative materials, using which the student will understand the existing regularities between the structure, performance and application of different materials, which in turn will allow the future specialist to choose materials for creating a certain innovative product. In turn, the study course “Advanced Technologies of Materials” provides in-depth knowledge in innovative materials technologies, using which the students will be able to rationally select the processing technologies for polymer, ceramics, metal and composite materials and assess their applicability in the manufacturing of a definite product. Finally, the study course “Modeling and Simulation of Physical Processes” which provide the knowledge on the opportunities offered by computer simulation in the modeling and calculation of psychical processes of the material, which will allow using numerical models in decision-making, as well as will provide an opportunity for the graduates to independently conduct optimization of the physical properties of materials and technological processes.

At the moment, there are four areas of specialization within the study program:

1) Biomaterials;

2) Material physics;

3) Polymer materials and composites (including nanocomposites);

4) Traditional non-organic materials and nanomaterials.

Compulsory study courses of the specialization fields (12CP/ 18 ECTS) will offer advanced knowledge and skills in the most significant and relevant theoretical and practical aspects of the chosen specialization, focusing on student’s individual work and cooperation with manufacturers in order to promote career growth of a future specialist. The field-specific study courses (16 CP/ 24 ECTS) of the study program are designed so that future masters can acquire in-depth knowledge and skills in the chosen specialization area, while the humanities and social sciences study courses (4 CP/ 6 ECTS) are designed to strengthen students' communication, organization and management skills. Free elective study courses in the amount of 12 CP (18 ECTS) are intended for in-depth specialization or further development of communication and management skills. The study program also includes internship (4CP/ ECTS), the purpose of which is to introduce students to the job specifics, especially by performing duties of increased responsibility at potential employers (including both manufacturers and scientific institutes). Final examination of the study program is based on the development and public defense of the master's thesis with examination commission, for which 20 CP (30 ECTS) are allocated.

Foreign students have to acquire the study course VSL711 “Latvian for Foreign Students” within the compulsory part of the study program amounting to 1 CP (1.5 ECTS) to help them integrate in the RTU community.

Scientific novelty of study courses is ensured by research activities of the teaching staff, which is evidenced by the involvement of the teaching staff in the implementation of research projects and writing of scientific publications (see CVs and list of publications of the teaching staff). At the same time, scientific novelty is ensured by involvement of foreign guest lecturers in the provision of certain study courses. Similarly, the compliance of the study program with the requirements of the labor market is ensured by involvement of representatives of companies/employers in the provision of lectures, in the development of laboratory works, as well as in the co-supervision of students qualification works.

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).

The compulsory part of the study program includes study courses (A1 category study courses) which are directly dedicated to the review and analysis of the latest achievements in materials science and modern material technologies. Concomitant, the compulsory part of the study program includes study courses (A2 category study courses) corresponding to specific areas of specialization (Biomaterials, Materials Physics, Polymer materials and composites (including nanocomposites), Traditional inorganic materials and nanomaterials), which provide in-depth knowledge and skills on the most important and relevant theoretical and practical aspects of the chosen specialization, emphasizing the student's independent work and cooperation with the manufacturer. At the same time, within the framework of the field specific study courses (B1 category study courses), students have the opportunity to choose study courses on the research project development, which are related to scientific investigations carried out by the structural units implementing the study program. The study program also includes internship, which can be done either in industry (commonly at R&D part of the company) or research institute. In the first case, the student works on a topic, relevant for a company. In the second case the student works for research institute, implementing the study program, or for it cooperation partner (e.g., Latvian State Institute of Wood Chemistry, Institute of Solid State Physics, University of Latvia) by conducting research on a certain topical problem and writing a draft scientific paper at the end of the internship. Thus, obtainment of master's degree is based on the latest achievements and findings in the field of materials science.

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 academic Master program "Materials Science and Nanotechnologies" is designed to satisfy the labor market demand for competent, independent, critically-thinking, and skilled specialists fit for the managerial positions who would demonstrate not only theoretical knowledge but also the skills to apply them on-the-job (including work team management). As a result, the study program is designed so that students have opportunities to strengthen their

- theoretical knowledge in the chosen field of specialization (biomaterials, polymer materials and composites, traditional silicate materials and nanocomposites, material physics),
- on-the-job skills in cooperation with a research institute and/or manufacturer in
    - different material processing technologies, according to the chosen field of

specialization,
- methods for the analysis of materials and product structures and performance characteristics and their interdependency on the manufacturing technologies used in the production of these materials and products,
- selection of materials for the design of sustainable innovative products,
- social, psychological, and management aspects in communication with a work team, potential investors and cooperation partners, customers, and the public in general.

To ensure acquisition of both necessary theoretical and practical knowledge, various learning forms are used in the study process, making a particular emphasis on independent and group work. Education modes include lectures used for knowledge transfer, assessment tests for control of knowledge acquisition, case studies and discussions to check knowledge and understanding, as well as laboratory works and practical classes to strengthen theoretical knowledge. Observing the restrictions imposed by the pandemic, the approaches to implementing these learning forms not only as intramural studies, but also as remote studies (to the extent possible) were developed. For example, students are offered opportunities to conduct individual group discussions of some relevant topics, as well as prepare and present a brief presentation of a solution for a certain challenging situation (also using Zoom or MS Teams platforms). At the same time, after the assessment of student tests, an instructor analyzes the main mistakes together with the students and discuss their assessment modes. Both local and international industry experts (Paulius Danolovas from Kaunas University of Technology, Emiliano Bilotti from Queen Mary School of Engineering and Materials Science, etc.) and representatives of companies (for example, TENACHEM Ltd, State Agency “Latvian National Accreditation Bureau” (LATAK), “Nordic Plast” Ltd, ALBA Synchrotron light facility (CELLS)) are invited to increase the added value of studies by delivering guest lectures and providing consulting services.

The study program actively practices independent research work both in groups and individually (e.g., study courses “Research Project - Biomaterials Research and Characterisation” and “Research Project - Traditional Inorganic Materials and Nanomaterials”). In the scope of certain courses (e.g., Selection of Polymer Materials and Product Design), groups of students or individuals have to choose an economically and environmentally feasible material for manufacturing of a certain product or to solve an issue to rise durability technical, economical, and environmental sustainability of some product or technology. Thus, based on the preliminary theoretical knowledge acquired at the lectures and practical skills developed during laboratory works, as well as independent analysis of information for solving specific issues, students are encouraged to apply the acquired knowledge and skills to “real life” situations. While carrying out and defending their laboratory works via presentations (usually in Microsoft PowerPoint format), students also enhance their communication skills and learn to defend their opinion with scientifically justified argumentation. When practicing different kinds of teamwork students are oriented towards independence, responsibility growth and promotion of mutual respect. In their feedback, students positively appreciated such teamwork and the opportunity to participate personally in technological processes, in selection of materials for production and expertise of a certain product. In the acquisition of technological processes, students are also offered on-site tours to potential employers – local manufacturing companies. Local producers, for instance, SAKRET Ltd, TENACHEM/Soudal Ltd, Kinetic Nail Systems Ltd, offer students scholarships for development of the themes of their interest, which can be covered within the scope of a Master Thesis. The most successful students also have the opportunity to start a career at the place of their internship.

In parallel, Master students are invited to take part in research work of scientific institutes involved in the implementation of the program. Some of the most diligent students rather often appear to be already involved in research work of the scientific institutes and already during their Master studies

are involved in consulting, practical training and qualification paper co-supervising for the Bachelor students. In addition, the scientific institutes rather often entrust Master students to handle high responsibility duties in the scope of some national or international project or market-oriented research involving a manufacturer.

Taking into the account that by launching the new study program "Material Science and Nanotechnology", a small number of students is possible, especially in the English language stream, an action plan has been developed to ensure that students completely acquire the study program. One of the most important elements of the action plan is careful elaboration of the students' individual plans, which helps to assemble larger groups of students (as far as possible, by combining students from different study years), as well as by offering study courses with a certain regularity (e.g. only in one specific semester or once every two years). Concomitant, in the case of a small number of students, the study process is organized in the form of seminars, consisting of lectures given by lecturer, student presentations on the most relevan issues of the study program and discussions between the lecturer and the student, ensuring that the minimum number of contact hours is maintained. In case of a small number of students, laboratory work assignments are combined with similar laboratory work assignments from the study courses with a larger number of students. At the same time, the assignment of individual work tasks is practiced.

Summative assessment system is used in calculating the final grade within the study courses – the final grade is formed from numerous components, as a results, students contribute to their final grade throughout the semester. The assessment criteria for study courses and individual tasks / home tasks are published in advance in the ORTUS system. The grades for the home tasks, tests, reports, presentations, and other tasks performed during the semester are given a certain weight in the final assessment. The academic staff determine the assessment structure for the study course they deliver, considering the decision of the RTU Senate that the examination grade may not contribute more than 50% to the final grade.

Taking into consideration that the deadlines for the submission of individual / group / home tasks are known to the students, for justified reasons (e.g., illness), students have the opportunity to submit the work separately on the prior agreement of the instructor.

Students can discuss the issues of concern with the academic staff during the allocated consultation time (at least 2 academic hours per week), or at an individual tutorial agreed with the tutor. Also, joint discussions of ambiguous issues together with all participants of a study course are practiced (both in the classroom and online, using Zoom or MS Teams platforms).

Learning outcomes of students in the academic Master program “Materials Science and Nanotechnologies” are discussed at least twice a year at meetings of the organizational units that implement the program. The outcomes are also summarized and assessed by the program administration. Together with student survey results, they serve as a basis for further improvement of the study process.

When analyzing the methods used in the implementation of the study program and assessment of learning outcomes, it should be concluded that student-centered learning principles are followed consistently:

- the student community and the diversity of their interests are taken into account and respected by establishing appropriate learning paths;
- different methods of study program implementation are used;
- according to students’ abilities and needs, the academic staff apply diversified pedagogical methods and promote students’ propensity to be autonomous, whilst ensuring their supervision and support;

- organization of studies in the study program promotes mutual respect in educator-student relationships because the principle of democracy is respected and the program's administration takes into account students' opinions;
- assessment is consistent, fair, applies to all students, and is carried out according to approved procedures (assessment methods and grading criteria are published in the descriptions of study courses, and the academic staff also familiarize students with them at the start of a study course);
- the assessment reflects achieved learning outcomes and students are given an opportunity of receiving feedback;
- the academic staff continuously improve their teaching competencies for enhancement of teaching methods and learning outcome assessment methods at academic conferences and seminars.

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).

The second semester of the first year of the study program "Materials Science and Nanotechnologies" includes an internship in the volume of 4 CP (6ECTS). The internship procedure is stipulated by RTU FMSAC "Regulation on Internship", approved by RTU FMSAC Faculty Council (https://www.rtu.lv/lv/mlkf/par-mums-mlkf/dokumentacija/mlkf_nolikumi). Students can undergo internship at some materials treatment, recycling or high-tech company, or at a scientific research institution in the field. The main objective of the internship is to get the student on-the-job experience at some manufacturing company, public service institution or research institute in the field of specificialistion. According to the Regulation on Internship, starting their internship students are clearly explained the aims and tasks of the internship. On completion of internship, students report about the achievement of the aims and tasks in an internship report and its public presentation. According to the RTU FMSAC "Regulation on Internship" (https://www.rtu.lv/lv/mlkf/par-mums-mlkf/dokumentacija/mlkf_nolikumi), at the Master level the internship task must imply a higher degree of responsibility than during the Bachelor level internship (for example, it should contain certain elements of a higher level of independence, organization or management of the technological process). At the end of the Master internship, which is completed in a scientific institution and has been dedicated to the scientific research theme, the internship report must be written in the form of a scientific publication, which is drawn up according to the guidelines and using the language of the chosen scientific journal. The internship coordinator at the organizational unit helps students to find places for internship. In parallel with the selection of places for internship, student suggestions are also analyzed if any. In case some additional help is needed, the Career Centre provides assistance, whereas a career consultant and a project manager help students with finding a place for internship and writing a cover letter, and with help of various events promote the development of career management skills, which can ensure successful results of the internship.

Once a year, RTU Career Centre organizes RTU Career Day, during which students also have the opportunity to meet company representatives and communicate about future career opportunities. More information about the event and the participants in the previous years can be found at: https://www.rtu.lv/lv/studentuserviss/karjeras-centrs-ssc/karjeras-diena. Following the constraints imposed by the Covid-19 pandemic, in 2021 and 2022, the event was organized in a virtual environment. In 2022, more than 60 companies took part in the Virtual Career Days. An additional resource that has been developed since 2015 is a website where companies are invited to post vacancies that are topical for RTU students (https://ekarjera.rtu.lv/). Students can connect with the university username and follow the internships and later job opportunities that are topical in their field. Additional support for the advancement of practical skills is RTU Development Fund (https://www.rtu.lv/lv/attistibasfonds). During the year, several hundred competitions for the advancement of practical skills are offered, which are organized in cooperation with companies and where students could acquire practical skills. Every year, the university signs cooperation agreements with companies and organizations agreeing to provide places of internships for the students. Information about cooperation partners is available at: https://www.rtu.lv/lv/valorizacija/.

Possibilities of providing internships for potential foreign students have been identified and it is expected that this will cause no problems either at the institutes implementing the study program or at certain companies (e.g. TENACHEM Ltd., Kinetics Nail Systems Ltd.). It has been agreed with representatives of these companies to ensure greater involvement in the study process by providing guest lectures, as well as by offering students opportunities to develop their qualification thesis in the companies.

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.

Taking into the account that the first admission to the academic master's study program "Materials Science and Nanotechnology" took place in the spring semester of the 2020/2021 study year, the self-evaluation report provides information about the students in the previous academic master's study program "Materials Science" and "Materials Nanotechnologies". Within the considered study program "Materials Science and Nanotechnologies" the thesis are subject to the same quality criteria for choosing the topic as in the case of the "Materials Science" study program, namely scientific novelty and practical applicability.

Graduation Master Theses are developed considering the research topicalities in the fields of professional specialization of the study program, and normally they are aligned with challenges of research and market-oriented projects implemented by research institutions involved in the implementation of the study program, as well as with current concerns of interested manufacturers.

Correspondence of the topics of Master thesis to scientific novelty in the study field is ensured by competence of scientific supervisors, confirmed by their scientific publications, as well as

participation in the execution of scientific projects. On the other hand, relevance of the topics of Master thesis to the labor market is determined by the fact that they are developed in cooperation with employers (e.g. SIA Kinetics Nails on obtaining composite systems using UV-activated polymerization or SIA Nordic Plast on recycling solutions for used polymers).

In the professional specialization field “Biomaterials”, the themes of graduation papers were related to

- technology of calcium phosphate granules production;
- use of calcium phosphate in remineralization of tooth enamel;
- development of calcium phosphate composite materials;
- modification of calcium phosphate bases with biocompatible polymer coatings;
- development of calcium phosphate coatings for titanium implants;
- research in pharmaceutical supply chains;
- hydrogels for biomedical research.

In the professional specialization field “Traditional silicate materials and nanomaterials”, graduation paper topics were related to

- synthesis, structure, and properties of nanostructured metal oxides (including, iron oxide, zinc oxide) and their composite coatings;
- industrial waste recycling opportunities for ceramics;
- study of modified concrete composite properties;
- study of fluorescent properties of glass and glass ceramics;
- synthesis of thin nonorganic layers and study of their properties;
- synthesis of high-temperature ceramics materials and study of their properties;
- modification of porous ceramics for the production of innovative catalysts;
- study of hydrogen storage opportunities;
- synthesis and properties of segnetoceramics.

In the professional specialization field “Polymers and composite materials (including, nanocomposites)”, graduation paper topics were related to

- recycling of polymer waste products (tyres, waste foams) and production of composite materials on their basis;
- development of different thermoplastic polymer matrix-based (polyethylene, polypropylene) microcomposites (using lignocellulosic biomass derived microfibers) and study of their properties;
- development of different thermoplastic polymer matrices (polyurethane, polyethylene, polypropylene, polyoxymethylene) based nano- and hybrid composites with carbon nanoparticle fillers (graphene, carbon nanotubes), nanostructured clays, metal oxide fillers (ZnO, TiO_2), nanofibers derived from renewable resources and study of their properties;
- development of nanocomposites based on biodegradable polymer matrices (thermoplastic starch, polyhydroxyalkanoates, polybutylene succinate, polylactide) and nano-clays and study of their properties;
- production of graphene aerogels and study of their properties;
- production, structure and properties of nanocomposite barrier coatings based on matrices of different polymers (styrene-acrylate copolymer);
- development of anticorrosion polymer coatings;
- study of thermoresponsive polymer (e.g., polyurethane) synthesis depending on raw materials, catalysts and technological parameters of synthesis;
- production of composite systems using UV activated polymerization;
- photopolymerization and 3D printing research;

- characterization of raw lignocellulosic biomass in the production of promising eco composites;
- production of innovative adhesives for timber laminating;
- pretreatment of natural fibers;
- multifunctional processing of textile fibers in hydrophobization, acquisition of antimicrobial properties and reduction of combustibility;
- textile material printing.

In the specialization field “Material Physics”, the topics of graduation papers were related to

- polymer triboelectric nanogenerators;
- study of properties of electro-optical ceramics;
- growing of semiconductor monocrystals and their electro-physical properties;
- investigation of piezoresistive response in polymer nanocomposites;
- integration of piezoresistive sensors in the fabrics;
- development of chemical vapour sensors and performance characteristics;
- development of pressure sensors and characterization of their performance;
- synthesis, study of structural formation and characterization of properties

of segnetoelectric materials. Certain Master Theses were developed in cooperation with scientific partners from the University of Latvia, Institute of Solid State Physics, Latvian State Institute of Wood Chemistry, Riga Stradiņš University, RTU Faculty of Civil Engineering, University of Latvia, Faculty of Chemistry, as well as state and commercial partners from the Latvian National Museum of History, MassPortal Ltd., Tenachem Ltd., Kinetics Nail Systems Ltd. etc.

The graduation papers were traditionally assessed by the qualification paper assessment committee of the responsible department. However, in order to get a comprehensive view of the quality of qualification papers, since academic year 2020/2021, the viva voce examination is made centralized in front of the joint Qualification Paper Assessment Committee. In view of Covid-19 limitations, the experience of remote qualification paper examination was acquired in academic years 2019/2020 and 2020/2021.

The grades for the graduation papers demonstrate academic performance and the acquired knowledge and skills of the graduates. 90% of students complete the study program with a graduation grade “8, very good” or higher grades. 5% of graduation grades are “10, excellent”.

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 studies are mainly provided by RTU FMSAC, its academic staff, lab technicians, and other technical personnel. The study program is implemented by the following RTU FMSAC units:

- Institute and Department of General Chemical Engineering, as well as Rudolfs Cimdins Riga

Biomaterials Innovations and Development Centre;

-Institute of Polymer Materials, Polymer Testing Laboratory accredited according to LVS EN ISO/IEC 17025 and the Department of Polymer Materials Technology;

-Institute of Materials and Surface Engineering;

-Institute of Technical Physics and its organizational units.

FMSAC is continuously monitoring the compliance of premise and equipment quality to the requirements following the latest trends in technologies. To ensure qualitative studies, renovation and refurbishment works are constantly going on in all involved organizational units in order to promote development of FMSAC and ensure the compliance of classrooms, lecture halls and laboratories to international standards.

The staff of FMSAC institutes, departments and laboratories are involved in educational and methodological activities according to their competencies by writing and updating descriptions of the study courses, providing delivery of appropriate parts of study courses (including, seminars, practical classes, and laboratory assignments), supervision of graduation papers and viva voce examination, as well as carry out other activities related to academic, methodological and research work.

The laboratory technicians prepare standard laboratory equipment, as well as technological and research equipment for the planned laboratory works and practical classes, ensure compliance with the safety rules when working with laboratory equipment and necessary chemical agents. The professional administrative staff help in the implementation of the study program – the Vice Dean for Academic Affairs, secretaries and technicians.

To ensure the joint RTU requirements, as well as the specific study program requirements, in the implementation of the study program also other organizational units of RTU are involved, such as the Faculty of Civil Engineering, Faculty of E-learning Technologies and Humanities, Faculty of Engineering Economics and Management and the Study Department.

Description of the available IT infrastructure for implementation of the study program is given in part 2.3.4. of the study field.

The organizational units implementing the study program “Materials Science and Nanotechnologies” are concentrated in RTU Ķīpsala Campus (Campus). More detailed description of the environment and the available infrastructure is given in part 2.3.2. of the study field.

The organizational units involved in the implementation of the study program maintain a wide range of modern technological and scientific research equipment, including rapid prototyping and pilot equipment, which allow implementing the study process in compliance with global trends, and scaling up from lab to industrial production of certain new materials. The currently available summary of technological, teaching and research equipment of the most important structural units of MLĶF is given in the appendix of part 2.3.2. of the study field.

In addition to the equipment mentioned above, to broaden the range of the acquired skills and according to the aims of the study courses, the institutions involved in the study program have vast opportunities for employment of facilities of research partners, including the research infrastructure of the National Research Centre (https://www.cfi.lu.lv/petnieciba/projekti/vnpc/), such as the clean rooms and transmission electron microscope, for the acquisition of high added-value technologies. Certain technological equipment is also available from cooperation partners in the commercial sector - TENACHEM Ltd, MassPortal ltd, “Latvijas Finieris”, etc.

An important source of information required for implementation of study program “Materials

Science and Nanotechnologies” is RTU Scientific Library, which is described more in detail in part 2.3.3. of the study field.

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).

The amount of the state funding for study programs is determined by Regulations of the Cabinet of Ministers No 944 of December 12, 2006 (please refer to part 2.3. Resources and Provision of Study Field). For implementation of the "Materials Science and Nanotechnology" study program state budget grants and student funds are used. Tuition fees for the academic year 2022/2023 is 4200 EUR per student. The tuition fee is determined in accordance with the instructions of the State Audit Office that the tuition fee for students who study together with budget students cannot be less than the state funding for this service.

The determined tution fee is the utmost minimum required, and it is aligned with the existing annual fees for mastering RTU engineering study programs.

By considering the previously mentioned, the budget for acquisition of the 2-year study program “Materials Science and Nanotechnologies” is estimated for EUR per student and makes 84000 EUR per presently existing 10 students. During the reporting period, the state budget subsidy for the study program, both in terms of total funding and per student, has fluctuated year by year, however, by showing increasing trend. Concomitant progressive increase in RTU costs has been experienced (costs for municipal services, premises, etc) year after year.

By performing approximate cost estimation of only invested contribution for implementation of study process, total expenses already exceed the amount of subsidy of Latvian state. The cost estimation is indicative and it is based on the average costs of the study program “Materials Science and Nanotechnologies” in 2021:

Cost position	*Sum EUR*	*% from the total*
The reader costs	66 300	63.58
Support staff costs	20 500	19.66

Other costs	2 000	1.92
Consumer goods and services (for ensuring laboratory assignments)	6 000	5.75
Infrastrucure costs (from the regulations of RTU Senate, in the amount of 10 % from direct costs)	9 480	9.09
Total costs	104 280	100.00

These base costs for ensuring the study process largely are due to the multidisciplinarity of the study program, for which it is necessary to involve specialists from various fields of material science and engineering. In order to increase the revenues of the study program, it is important to attract the largest possible number of students to the study program, including from foreign countries. Consequently, measures have been taken to promote the study program in order to attract not only local but also foreign students. There are currently 10 students studying in the study program. However, until now, unfortunately, it has not been possible to attract foreign students. Therefore, the procedure to participate in the European Institute of Innovation and Technology (EIT) system by engaging in the implementation of the AMIS (Master's Program in Advanced Materials for Innovation and Sustainability) project has been initiated. It should be noted that despite the small number of students, the study program "Materials Science and Nanotechnology" is unique, because it is the only materials science master's study program in Latvia and its graduates are important for the development of the Latvian economy, especially in the fields of innovative materials and modern technology development. This has been also mentioned by potential employers at the meetings of the Council of Councilors of the Faculty of Materials Sciences and Applied Chemistry.

The information about the minimal number of students in RTU study programs is provided in Annex 21 of the self-assessment report “On the minimal number of students in the study programs”.

The head of the study program and the faculty in charge are responsible for the specific development of each study program. For the benefit of all study programs, the centralized financing is used to renew the funds of the scientific library, refurbishment, and maintenance of the joint use lecture halls, public relations, marketing of the study programs, development and maintenance of the academic information systems, development of Ķīpsala Campus and other activities.

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.

37 members of the academic staff, including 21 responsible instructors, are involved in the implementation of the study program. All the responsible instructors hold a PhD degree, and majority are also experts of the Latvian Council of Science in the corresponding subsector. All the responsible instructors are elected in RTU.

Selection criteria for of the academic staff include their specific knowledge, scope of scientific and on-the-job experience taking into account the specifics of the study program and study courses therein. The study program invites professionals in the field of new materials synthesis, treatment of materials, and advanced technologies.

The study program will also involve the academic staff of other organizational units of RTU. A. Kovaļovs and S. Ručevskis, the members of the academic staff from the Department of Composite Materials and Structures of RTU Faculty of Civil Engineering, will ensure delivery of the study course "Modelling and calculations of physical processes of materials" within the compulsory part of the study program. In the scope of the study course, students will obtain knowledge on the applications of computer simulation in modeling and calculations of physical processes of materials, which in turn will allow using numerical models in decision-making, as well as will allow graduates independently enhance physical properties of materials and technological processes. Apart from experienced members of the academic staff, the study program will involve younger lecturers and researchers of the faculty, whose fields of activities and research are related to a wide range of sub-fields in materials science and nanotechnologies.

In the appendices of the description of the study field a more detailed list of all members of the academic staff, involved in the study program, is given along with their biographies (Curriculum Vitae) and the list of scientific publications related to the study program. The total number of scientific publications written by the academic staff involved in the study program during the last 6 years is 472, including highly-ranked Q1 and Q2 publications with Hirsch index of 100 and higher.

The compliance of the qualifications of academic staff to the requirements stipulated in Paragraph 55 of the Law on Higher Education Institutions is evidenced by the following qualitative and quantitative indicators – the study program involves 13 elected professors – doctors of science, whose scientific and pedagogical qualifications meet the regulations on criteria for assessment of a candidate's scientific and pedagogical qualifications; 5 elected associate professors – doctors of science, whose scientific and pedagogical qualifications meet the regulations on criteria for assessment of a candidate's scientific and pedagogical qualifications. Assistant professors (5), lecturers (1), leading researchers (7), researchers (2), and visiting lecturers also participate in the implementation of the study program. All members of the academic staff involved in the study program have appropriate qualification and experience to ensure an efficient study process.

The majority of the members of the academic staff in the study program are certified experts of the Latvian Council of Science in their fields. At the same time, several young academic staff members have been elected as Latvian Academy of Sciences academicians (e.g., D. Loča) and corresponding members of Latvian Academy of Sciences (e.g., K. Šalma-Ancāne and R. Merijs-Meri). Academic staff regularly strengthen their professional and academic knowledge at methodological seminars, conferences (national and international), and in scientific and research work, as well as participating in different projects.

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.

The change in personnel of the study program during the reporting period is mainly related to the engagement of new members of the academic staff in the study courses, thus ensuring the renewal of the academic staff. New specialists have been recruited or academic loads have been increased for the existing younger specialists, promoting the establishment of new study courses (e.g., study courses on modern materials and technologies, textiles, choice and design of materials, modeling and calculations of physical processes of materials) and introducing new pedagogical approaches, especially in the context of remote studies. Thus, the study program was joined by professors (e.g., Kristīne Šalma-Ancāne), assistant professors (e.g., Andrejs Kovaļovs, Arita Dubņika, Līga Grase, Santa Stepiņa), lecturers (e.g., Māris Rundāns), assistants (e.g., Artis Linarts), researchers (e.g., Anda Barkāne), lecturers (e.g., Oskars Platnieks), scientific assistants (Sergejs Beļuns). Some of the members of the academic staff retired (e.g., Skaidrīte Reihmane, Jānis Grabis) or have significantly decreased their workload (e.g., Mārtiņš Kalniņš, Laimonis Mālers). Once the employment relations were terminated due to the fact that a person started a career in the industry, which offers much higher remuneration (assist. prof. A. Borisova).

In general, changes to the academic staff promoted the decrease in the average age of the members of the academic staff. The trend to recruit PhD students and PhD graduates as new members of the academic staff tends to continue, thus making it possible updating of the educational materials with the latest scientific discoveries that younger members of the academic staff studied in their Doctoral Theses. Younger members of the academic staff are actively improving their competencies and participate in mobility programs, which promotes experience exchange and allows optimizing the curriculum of the study program.

To further promote the renewal of the academic staff, PhD and master students are engaged in teaching activities. As evidenced by experience, a part of them continue their work in research projects and over some time start building their academic career.

At the moment, RTU is implementing the project of the European Social Found SSO 8.2.2. “Strengthening of Riga Technical University academic staff in the fields of strategic specialization”, where one of the tasks is to renew the academic staff. The aim of the project is to strengthen RTU academic staff in the fields of strategic specialization covering 10 study fields, including Materials Science. The project activities are oriented toward four aspects:

- involvement of PhD students in the academic work at RTU;
- engagement of foreign academic staff at RTU;
- improvement of the academic staff competencies, including undergoing internship at a commercial company;
- specialized English language courses for the academic staff.

During the project, certain members of the academic staff involved in the program took an active part in these activities to the extent possible.

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).

There is a mechanism promoting mutual cooperation between academic staff working in the study program, which ensures improvement and integration of the study courses. Both the results of the annual student surveys and the graduate surveys allow receiving feedback, which indicates individual shortcomings. Consequently, the improvement of the study courses takes place on a regular basis, based both on the suggestions expressed by the students and on the industry development trends. In the process of implementation of the study program, close cooperation of the academic staff takes place, which is also manifested in the following activities:

1. Discussion of the results of student and graduate surveys at the meeting of the Department, discussing student comments, suggestions, and possibilities for prevention of negative feedback;
2. Discussion of the results of the graduation papers and the quality of reviews at the meeting of the Department, discussing the possibilities for improving the quality of the graduation papers;
3. Mutual integration of classes, discussions on laboratory and practical work carried out within the framework of classes, in order to promote the provision of complementary practical skills;
4. Cooperation within projects where academic staff use the experience gained in the study process;
5. Joint study tours, where educators together with the students get acquainted with the current events in the field, are used in practical case studies during the practical classes in the auditorium.

For the moment of submitting the self-assessment report, the student-educator ratio in the study

program is 28 responsible instructors per 10 students or almost three instructors per one student. A large number of instructors is connected with a large selection of the study courses offered to the students in accordance with their interests, as well as the gradual involvement of young teaching staff alongside the experienced academic personnel. A large number of involved instructors is also connected with the necessity to provide students with opportunities to use the rich FMSAC research infrastructure under the guidance of competent specialists.

Within the framework of the study program, the cooperation of academic staff may be assessed as promoting the achievement of the learning outcomes. When reviewing and updating the study program, the academic staff mutually agree on the most appropriate and effective solutions for the evaluation of student achievements and the attainment of performance indicators. By periodically discussing and reviewing the curricula of the study courses, thematically coordinated and complementary acquisition of the study program is achieved, and duplication of the content considered within different courses in one study program is avoided.

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	Diploma paraugs diploma sample.zip	Diploma paraugs diploma sample.zip
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)	Studiju virziena akreditacija MZNT Provisional translation.docx	Nr21 MZNT - AIP atzinums - Nr_52_RTU_par+250+stud (2).edoc
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	Student Statistics, MATERIALSCIENCE.xlsx	Studentu Statistika, MATERIĀLZINĀTNE.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	MZNT ENG P6 (2).docx	MZNT P6 (2).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	MZNT Studiju kursu kartējums_ed 130822.xlsx	MZNT Studiju kursu kartējums 110822.xlsx
The curriculum of the study programme (for each type and form of the implementation of the study programme)	MSc Studiju programmas MZNT plānojums F ENG (130822).docx	MSc Studiju programmas MZNT plānojums F LV 100822.docx
Descriptions of the study courses/ modules	MZNT studdy courses EN.rar	MZNT studiju kursi LV.rar
Description of the organisation of the internship of the students (if applicable)	Internship.rar	Prakse.rar
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)	Confirmation - on compliance of the academic staff.edoc	Apliecinājums - AL 55. pants par prof. skaitu akadēmiskās programmās.edoc

Materials Engineering (43526)

Study field	*Physics, Material Science, Mathematics, and Statistics*
ProcedureStudyProgram.Name	*Materials Engineering*
Education classification code	*43526*
Type of the study programme	*Academic bachelor study programme*
Name of the study programme director	*Remo*
Surname of the study programme director	*Merijs-Meri*
E-mail of the study programme director	*Remo.Merijs-Meri@rtu.lv*
Title of the study programme director	*Dr.sc.ing.*
Phone of the study programme director	*26093097*
Goal of the study programme	*The aim of the study program is to prepare progressively thinking, oriented to the introduction of new technologies and knowledge, highly qualified, responsible professionals in the field of materials science and engineering with comprehensive theoretical knowledge, practical work skills and competencies suitable for both master's studies and career development in the fields significant for national economy, including development of exportable innovative solutions in the fields of biomaterials, inorganic materials, polymer materials and composites, as well as in the fields focused on conservation and restoration of national cultural heritage.*
Tasks of the study programme	*General tasks of the study program are:* *- to ensure competitive academic bachelor's level education in the European Higher Education Area in accordance with the Bologna recommendations, preparing students for responsible positions in production, consulting, product quality control, development of new products,* *- to provide students with scientifically based broad profile knowledge in certain fields of materials science and engineering, to develop critical thinking, to develop expert skills and improve competencies in solving real everyday problems both in accordance with labor market requirements in tight conditions of competitiveness and in accordance with future industry development trends,* *- to develop the student's skills in identifying problems, formulating goals and solving them, finding an opportunity to use both laboratory-wide infrastructure and industrial equipment in cooperation with the manufacturer,* *- to promote knowledge transfer and develop the student's skills in the reasoned presentation of real material development problems and their solutions both to professionals in the field and to society in general,* *- to stimulate the interest of students and graduates in the expansion of the knowledge horizon, professional development and studies in master's study programs.*

Results of the study programme	*Graduating the study program, the student:* *1) will be able to demonstrate comprehensive theoretical knowledge of materials science and engineering basics, as well as specialized knowledge and understanding of fundamental issues, current discoveries and development trends in certain fields of materials science and engineering, understanding their nature and significance in an interdisciplinary context,* *2) will be able to demonstrate an understanding of the methods of industrial production processes and scientific research planning, implementation, processing of results, analysis and interpretation, as well as programming, modeling of physical processes of materials, understanding their nature and areas of application,* *3) will be able to practically apply knowledge of fundamental issues, current discoveries and development trends of certain fields of materials science and engineering,* *4) will be able to reasonably choose, plan and independently use methods and equipment for obtaining, processing and characterizing materials and products, as well as methods for processing, analysis and modeling of results,* *5) will be able to summarize, compare and discuss at the level of their competence the results of the research and / or production process in scientific works or technical instructions, reports etc and present these results to both industry professionals and the general public,* *6) will be able to participate in the implementation of innovative scientific and producer-oriented projects in accordance with the project call, market requirements and available resources, to perform quality control and technical expertise of the manufacturer's products, to critically evaluate the importance of the introduction of modern materials and innovative technological solutions in research and production processes,* *7) will be able to explain the technical means, programming and modeling approach, the use of results processing and analysis methods for solving technical problems of manufacturers' products.*
Final examination upon the completion of the study programme	*Final examination, Bachelor thesis.*

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)	*General or vocational secondary education*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Bachelor degree of engineering science in materials engineering*
Qualification to be obtained (in english)	-

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

Full time studies - 3 years - english

Study type and form	*Full time studies*
Duration in full years	*3*
Duration in month	*0*
Language	*english*
Amount (CP)	*120*
Admission requirements (in English)	*General or vocational secondary education. The assessment of the level of English language proficiency under the requirements specified in regulatory enactments.*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Bachelor degree of engineering science in materials engineering*
Qualification to be obtained (in english)	-

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

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.

Academic study program "Materials engineering" with the ascribed education classification code 43526 is licensed by the decision of the Study Quality Commission of the Ministry of Education and Culture of the Republic of Latvia (the decision of the meeting of June 30, 2021, license no. 04051/194). This study program has been developed in the framework of the project "Reducing the fragmentation of study programs of Riga Technical University and strengthening the sharing of resources" of the 2nd call of the specific support objective (SAM) No 8.2.1 "Reduce the fragmentation of study programs and strengthen the sharing of resources". The study program "Materials engineering" replaces since the 1999/2000 study year launched academic bachelor's study program "Material Sciences". Together with the newly developed Master's study program "Materials Science and Nanotechnology", the "Materials Engineering" study program forms a unique complex of study programs for higher education in the field of materials science, the only one in Latvia.

Based on recommendations stipulated in the report of the licensing committee, the following amendments have been taken into account and implemented:

1) All the academic staff involved in the implementation of the study program publish the results of their research in the peer-reviewed scientific journals;

2) In the framework of promotion of the new study program, since academic year 2021/2022, potential foreign students have been addressed. Internship options for local and foreign students have been considered and potentially should not cause any problems either at the institutes involved in the implementation of the study program or at certain companies (e.g., TENACHEM Ltd., Kinetics Nail Systems Ltd.). At the same time, more intensive involvement of these companies is being discussed with their representatives, cooperation will imply organizing guest lectures and offering students opportunities to elaborate qualification papers at the companies;

3) Descriptions of the study courses have been updated and the list of literature has been extended, including also the examples of available literature on the most recent trend in the field of specialization;

4) All students enrolled in the Bachelor study program “Materials Science” plan to finish their studies by the end of accreditation of the running study program in June 2023. Thus there will be no necessity to matriculate the students of the this study program in the new study program "Materials Engineering".

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 specialists who complete study programs in the study field “Physics, Materials Science, Mathematics and Statistics” are competent to get involved in the performance of a wide range of socially important work tasks starting with solving business challenges to fundamental research in Physics, Materials Science, Mathematics and Statistics. The academic multidisciplinary program “Materials Engineering” particularly offers to acquire advanced theoretical knowledge and on-the-job experience to perform the duties within the high responsibility scope in cooperation with the leading Latvian companies dealing with the processing of various materials (including wood, glass, ceramics, metal, polymers and their composites) and manufacturing of different goods (construction products, packaging, clothing, heat insulation products, varnishes, paints, etc.), which allow the program graduates to build their professional careers in the manufacturing sector or to continue studies in any of the higher level study programs in the field of Materials Science. Taking into account the multidisciplinary nature of the study program, the Licensing Committee ascribed code 43526 to the study program “Materials Engineering” on 14 July 2021 based on decision No. 2021/22-L taken at the meeting of the Educational Quality Committee 30 June 2021, according to which graduates of the study program are awarded a Bachelor of Engineering degree in Materials Engineering. In this way, within the current regulatory framework, it is possible to fully reveal the multidisciplinarity of the "Materials Engineering" study program from the perspective of various material groups (polymers, wood, ceramics, glass, metals and their composites). Although, according to the existing national regulations (Appendix No 4 of the Regulations No 322 of the Cabinet of Ministers of the Republic of Latvia), the set of educational programs on material sciences is distinguished separately, it is attributed to the group of educational program "Mechanics and metalworking" (the third, the fourth and the fifth digits of the assigned code are "521"), thus not fully reflecting the content of the current "Materials Engineering" study program. A more detailed description on the compliance of the study program to the field of study and the assigned educational program code is given in the appendix “The review on the implementation of the recommendations given by the licensing experts for the academic bachelor's study program "Materials Engineering"”.

The study program corresponds to Level 6 of EQF and LQF, and thus it is intended for the applicants with the general secondary education or 4-year vocational secondary education according to effective Latvian regulations. The aim of the study program is to satisfy the urgent labor market demand for competent, independent, and responsible specialists with appropriate theoretical and practical training in the field of product manufacturing and quality assessment for the performance of highly complex technical tasks. The main tasks of the study program “Materials Engineering” are to ensure that program graduates are competent to engage in the production of various materials and products, their quality control, expertise, as well as management of conservation and restoration works. In this regard, the curriculum of the study program is designed so that the aims of the study courses included in the study program and their learning outcomes would be consistent and complementary to promote the achievement of the program aims and learning outcomes.

Thus interrelationship between the title, the awarded degree, the field of specialization, the aims and tasks, the learning outcomes, as well as admission requirements is established.

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

The economic and social rationale of the study program “Materials Engineering” on the one hand is determined by the urgent labor market demand for independent and responsible specialists who are capable to work in control of technological production of different materials and/or products, as well as the development of innovative materials and technological approaches, but on the other hand, by the growing social demand for high-quality products. At the same time, the necessity of the specialization Conservation and Restoration in the study program “Materials Engineering” is defined by the public willingness to preserve the cultural heritage not only of the past but also the current generation in the context of smart sustainable social development.

Graduates of the study program can be employed almost in any field related to the development of new materials and property modeling for the design of various innovative customized products, selection of the corresponding materials for production of technologically, ecologically and economically sustainable composite materials, processing of natural and synthetic materials (including, wood, polymers, rubber, textiles, silicates, metals, biomaterials, semiconductors) as well as treatment and/or machining of various material shapes (e.g., monolithic body, particulate (regular, fiber- or platelike), coating, aerogel/hydrogel) for manufacturing of a certain products to be applied in civil engineering, transport, energy, electronics, medicine, agriculture, and other industries. In the academic or commercial environment, graduates of the study program will be able to:

- take part in the management of new material design,

- manage materials processing,

- provide quality assurance,

- argumentatively persuade investors on the most promising investments in the development of innovative products,

- develop a scientifically grounded strategy for the preservation of tangible and intangible heritage,

- develop scientifically grounded conservation and restoration methods through evaluation of the reasons for the aging of artifact materials.

Thus, the scope of activities of the graduates of the study program includes startup companies developing innovative products, new product development laboratories, biomaterial, non-organic material, polymer material processing and composite development companies, product conformity assessment and quality control laboratories, centers for technical expertise of materials and products and certification, state and private institutions that operate in the field of conservation of cultural heritage.

The knowledge, skills and critical thinking-based competence acquired during the study program will let young specialists not only join the team of a company successfully operating in the local or international market but also with a high likelihood start their own innovative business. In parallel, graduates of the study program have a wide range of opportunities to continue studies for a Master degree at some of the leading universities or research centers in Latvia or abroad, for example, at the RTU academic Master program “Chemistry and Chemical Technology” and “Materials Science and Nanotechnologies”.

Considering that the "Materials Engineering" study program received a license only in 2021/2022.

study year, currently no one has graduated from the study program. Some of the employment examples of the graduates from previous academic study program "Materials Science": E. Osis (founder of SIA DEROX and chairman of the board), S. Gaidukovs, J. Ločs, D. Loča, A. Šutka (RTU professors), Z. Grigale-Soročina (Chemist of SIA Kinetics Nails R&D department), A. Borisova (LATAK leading assessor), M. Bārtule (Danone, Quality Manager, Latvia), K. Kalniņš (Hansa Matrix Ventspils, Latvia), E. Saušs (Light Guide Optics International, Līvāni, Latvia), K. Nikitina (SIA Vincents Polyline, Riga, Latvia), J. Ruža (Massachusetts Institute of Technology, the USA).

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.

Considering that the first admission to the academic study program "Materials Engineering" took place in in the study year of 2021/2022, it is currently not possible to present statistically significant data about this study program. Therefore, statistical data on students in the academic study program "Material Sciences" have been analysed. Considering that all students of the "Materials Science" study program plan to complete their studies by the end of the license of this study program in 2023, currently it is not planned to transfer any student of this study program to the new study program. If, due to unforeseen circumstances, a student of the study program "Materials Science" will not have the opportunity to complete the studies by June 2023, an individual study plan will be drawn up for this student to ensure learning the curriculum in accordance with the new study program "Materials Engineering".

Analyzing the statistical data on the number of students in the study program "Materials Sciences", it can be concluded that the total number of students was variable during the reporting period, with a general tendency to decrease: 39 students in academic year 2012/2013, 45 students in academic year 2015/2016 and 22 students in academic year 2021/2022 (together with in the 1st study year matriculated students of the new study program "Materials Engineering"). There are several reasons for this trend, including:

- decrease in the number of students due to the demographic situation in the country,
- emigration, mainly to Great Britain and Ireland,
- increased offer of studies abroad and increased solvency of students and/or their parents,
- negative impact of Covid-19 pandemic that limited full-time studies, worsened the population health in general, and the mental health state in particular.

Still, taking into account that since 2019 the Bachelor study program in Materials Science has been implemented not only in Latvian but also in English, foreign students are gradually beginning to take interest in the program. It is expected that the new study program “Materials Engineering” will give additional impetus to attract foreign students. Unfortunately, this could fade down due to the current unstable geopolitical situation in the region.

The graduate number dynamics is directly related to the number of students in their final year of studies. In this regard, the situation during the reporting period also has been fluctuating, mainly due to the mentioned above reasons, and to student dropout caused by academic failure.

Analyzing the student dropout, expulsion for academic failure should be mentioned as the main reason, furthermore, it is quite explicit at the beginning of studies. This indicates that students did

not have the necessary level of prior knowledge to acquire the courses in mathematics, physics and chemistry.

Fewer students get expelled on their will. Usually, this occurs due to health issues or family circumstances.

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 curriculum of the study program has been developed in compliance with the defined aims and tasks of the Specific Support Objective project “8.2.1. Reducing Fragmentation of Study Programs and Strengthening Sharing of Resources” of the operational program “Growth and Employment”, as well as based on the requirements towards academic Bachelor study programs stipulated in the Law on Higher Education Institutions and RTU regulations “The Procedure for Application, Development and Amendments to Study Programs”.

The study program is implemented in the full-time on-site mode, its duration is 3 years divided into 6 study semesters. In this period, students have to acquire compulsory study courses, compulsory elective study courses, including study courses in humanities and social sciences developing communicative and organizational competences, and free elective study courses. They also have to undergo internship and develop a Bachelor Paper. Students select the field of specialization in the 3rd semester depending on the student’s interest area or choose one of the study courses offered within the specialized profiles in the fields of conservation and restoration, biomaterials, inorganic materials or polymeric materials and composites.

The scope of the study courses is determined by the “RTU Uniform Requirements for Study Programs”, which have been developed in accordance with the requirements of the state regulatory enactments regulating higher education in the Republic of Latvia. Thus, the amount envisaged for the compulsory study courses of the study program is 80 CP (120 ECTS), which consists of

- the study courses in the amount of 31 CP (46.5 ECTS) covering the guidelines, principles, structure

and methodology of the field or sub-field of science, including

- study courses in mathematics in the amount of 13 CP (19.5 ECTS),

- study courses in physics in the amount of 8 CP (12 ECTS),

- field-specific theoretical study courses in the amount of 10 CP (15 ECTS), including study courses “General Chemistry” (4CP (6ECTS)), “Organic Materials and Technology” (3CP (4.5 ECTS)) and “Inorganic Materials and Technology” (3CP (4.5 ECTS)),

- study courses dedicated to the history of development and the current problems of a field or sub-field of science, the curriculum of which includes introductory information on the field of study and research methodology in the amount of 14 CP (21 ECTS), including study courses “Introduction to Materials Science” (3CP (4.5 ECTS)), “Introduction to Unit Operation of Chemical Engineering” (6CP (9 ECTS)), “Chemistry for Materials Scientists” (3CP (4.5ECTS)), and “Information Literacy in Chemistry and Materials Science” (2CP (3 ECTS)),

- study courses in the amount of 30 CP (45 ECTS) dedicated to the characteristics and problems of the field or sub-field of science, including “Structure and Properties of Materials” (3CP (4.5 ECTS)), “Material Surface Processes” (3CP (4.5 ECTS)), “Composite Materials and Technology” (4CP (6 ECTS)), “Material Selection, Ageing and Recycling”(6CP (9 ECTS)), “Management of Materials and Processes” (4CP (6 ECTS)),“ Materials Research Methods ”(4CP (6 ECTS)), “Fundamentals of Graphics Communication” (2CP (3 ECTS)), “Introduction to the Programming Language MATLAB” (2CP (3 ECTS)) and“ Programming in Materials Science” (2CP (3 ECTS)).

- study module for the development of professional competence in entrepreneurship, technology transfer and product development “Innovative Product Development and Entrepreneurship” in the amount of 4 CP (6 ECTS);

- study course “Civil Defense” in the amount of 1 CP (1.5 ECTS);

- study course “Environment and Climate Roadmap” in the amount of 1 CP (1.5 ECTS).

The part of the study program comprising the compulsory elective study courses consists of study courses in the field of professional specialization, as well as study courses in humanities and social sciences developing communicative and organizational competencies in the total amount of 20 CP (30 ECTS).

Professional specialization study courses in the amount of 15 CP (22.5 ECTS) provide an opportunity to acquire in-depth theoretical knowledge and practical skills on the most important and topical theoretical and practical aspects of certain fields of Materials Science and Engineering (biomaterials, polymers and composites, inorganic materials), making a focus on student’s independent work and cooperation with the manufacturers to promote career development of the future specialists.

Within the compulsory elective study courses of the study program, additional 5 CP (7.5 ECTS) are allocated for study courses in humanities and social sciences, including 3 CP (4.5 ECTS) - for foreign language study courses for the acquisition of terminology in the industry.

Teaching staff responsible for study courses regularly review the content of their study courses, adapting them to scientific trends and the needs of the labor market as far as possible. The most significant changes that are introduced are discussed at the meetings of the implementing institutions, as well as coordinated with the content of the related study courses. The successful conduct of this process can be ensured by the active scientific activity of the teaching staff involved in the study process, which is confirmed by the scientific publications of the teaching staff. At the same time, the successful implementation of this process is ensured by the study program's close

connection with entrepreneurs (mandatory practice, the opportunity to develop qualification papers on topical aspects for entrepreneurs, guest lectures by company representatives).

The study program also comprises free elective study courses in the amount of 4 CP (6 ECTS).

Foreign students have to acquire the study course VSL711 “Latvian for Foreign Students” within the compulsory part of the study program amounting to 1 CP (1.5 ECTS) to help them integrate in the RTU community.

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).

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 academic Bachelor study program “Materials Engineering” is designed to satisfy the labor market demand for competent specialists, who would have both theoretical knowledge and skills to apply it in practice. Thereby, the study program is designed so that students have opportunities to acquire the necessary basic theoretical knowledge, as well as on-the-job knowledge about the core processing technologies of different materials, core methods of production of products from polymer materials, mineral materials and biomass, analysis techniques for characterization of materials and product structure and performance, selection of materials in design of sustainable innovative products. Depending on their scope of interests, students can study in one of the offered professional specialization fields (biomaterials, polymer materials and composites, traditional silicate materials and nanocomposites, conservation and restoration of materials) or acquire basic multidisciplinary skills in the fields, with the focus on specialization during the development of the Bachelor Paper in cooperation with a scientific institute or a manufacturer.

To ensure the acquisition of both necessary theoretical and practical knowledge, various learning modes are used within the studies: lectures for knowledge transfer, assessment tests for control of knowledge acquisition, case studies and discussions to check knowledge and understanding, as well as laboratory works and practical classes to strengthen theoretical knowledge. Observing the restrictions imposed by the pandemic, the approaches to implementing these learning forms not only as intramural studies but also as remote studies (to the extent possible) were developed. For example, students are offered opportunities to conduct individual group discussions of some relevant topics, as well as prepare and present a brief presentation of a solution for a certain

challenging situation (also using Zoom or MS Teams platforms). At the same time, after the assessment of student tests, an instructor analyzes the main mistakes together with the students and discusses their assessment modes. Both within the scope of a specialized study course (Information Literacy in Chemistry and Materials Science) and within the scope of practical tasks ascribed by the academic staff of certain study courses, student skills in working with information databases are developed making them competent to recognize and select the most relevant information. According to a level of student qualification, tasks of increased complexity are also offered. The guest lectures delivered by both local and international industry experts (Paulius Danilovas from Kaunas University of Technology, Emiliano Bilotti from Queen Mary School of Engineering and Materials Science, etc.) and representatives of companies (for example, TENACHEM Ltd, State Agency “Latvian National Accreditation Bureau” (LATAK), “Nordic Plast” Ltd, ALBA Synchrotron light facility (CELLS)) are regularly organized.

It should be noted that great emphasis is placed on changing the learning style to “learning to learn”. For this reason, research work is widely practiced, which includes the latest open scientific and patent literature research and analysis, as well as the work in laboratories. For example, during laboratory works student teams sharing duties among group members are given an opportunity to become acquainted and take part personally in some industrial technological processes (for example, extrusion, injection molding, pressing) or in the application of some techniques in the characterization of materials structures or properties (for example, microscopy, rheology, thermal analysis). In parallel, students need to process the parameters of the used technological processes, assess achieved parameters of characterization techniques for materials structures and properties and provide justified expertise of the analyzed materials. In the scope of certain courses (for instance, Innovative Product Development and Entrepreneurship SDD701), groups of students or individuals are given the task to choose an economically and environmentally feasible material for the manufacturing of a certain product. Thus, based on the theoretical knowledge acquired at lectures, students are encouraged to apply the knowledge and skills in practice. In parallel, when carrying out and defending their laboratory assignments via presentations (usually in Microsoft PowerPoint format), students also enhance their communication skills and learn to defend their opinion with scientifically justified argumentation. When practicing different kinds of teamwork students are oriented towards independence, responsibility growth and promotion of mutual respect. In their feedback, students positively appreciated such teamwork and the opportunity to participate personally in technological processes, in selection of materials for production and expertise of a certain product. In the acquisition of technological processes, students are also offered on-site tours to potential employers – local manufacturing companies. Local producers, for instance, SAKRET Ltd, TENACHEM/Soudal Ltd, Kinetic Nail Systems Ltd, offer students scholarships for development of the themes of their interest, which can be covered within the scope of their Bachelor Papers.

Already in the first year of studies, the student interest in research work is encouraged, and students are invited to take part in the research work of scientific institutes involved in the implementation of the study program. However, greater interest in the research work of the scientific institutes is observed at the end of the 2nd academic term and at the beginning of the 3rd academic term, after exams in such basic study courses as “Physics”, “Chemistry” and “Mathematics”, as well as when students start choosing topics of their Bachelor Papers.

It should be noted that upon acquisition of the core study courses during the first 3 academic terms, within a variety of professional study courses students shall elaborate individual papers, also in cooperation with the manufacturers, for example, within such courses as Composite Materials and Technology ĶPI766, Material Selection, Ageing and Recycling ĶPI780, Polymer Adhesives ĶPI784, Recycling of Polymer Materials ĶPI786, etc. In cooperation with manufacturers, certain

laboratory works were designed to make sure students get better insights into the specifics of the manufacturers' production.

Taking into the account that, by launching the "Materials Engineering" study program, a small number of students is possible, especially in the English language stream, an action plan has been developed to ensure students a full-fledged learning of the study program. One of the most important elements of the action plan is the careful creation of the students' individual plans, which helps to assemble larger groups of students (as far as possible, by combining students from different study years, as well as by offering study courses with a certain regularity (e.g. once a year or even once every second/third year). At the same time, in the case of a small number of students, the study content is acquired via seminars by teacing staff delivering key lectures, students giving presentations on the most important issues of the study program and active discussion between the teaching staff and the student, keeping the minimum number of contact hours during these classes. In the case of a small number of students, laboratory assignments are combined with related laboratory assignments from the study courses with a larger number of students. At the same time, the assignment of individual work tasks is practiced.

The summative assessment system is used in the calculation of the final grade within the study courses – the final grade is formed from numerous components, as a result, students contribute to their final grade throughout the semester. The assessment criteria for study courses and individual tasks / home tasks are published in advance in the ORTUS system. The grades for the home tasks, tests, reports, presentations, and other tasks performed during the semester are ascribed a certain weight in the final assessment. Members of the academic staff can take into account and assess class attendance. Attendance of the lectures/practical classes is compulsory for the 1st year students to reduce student drop out after the first year of studies to the degree possible. For this purpose, it is also recommended that the 1st year students after preliminary assessment results also attend additional tutorials within the study courses in chemistry, mathematics or physics. The academic staff determine the assessment structure for the study course they deliver, considering the decision of the RTU Senate that the examination grade may not contribute more than 50% to the final grade.

Taking into account that students know the submission schedule for individual/group/home tasks, for duly justified reasons (for example, illness), they can submit their tasks individually, upon agreement with an instructor.

Students can discuss the issues of concern with the academic staff during the allocated consultation time (at least 2 academic hours per week), or at an individual tutorial agreed with the tutor. Also, joint discussions of ambiguous issues together with all participants of a study course are practiced (both in the classroom and online, using Zoom or MS Teams platforms).

Knowledge assessment results of the students of the academic Bachelor study program "Materials Engineering" are discussed at least twice a year at meetings of the organizational units responsible for the implementation of the study program. The results are also summarized and evaluated by the program administration. Together with student survey results, they serve as a basis for further improvement of the study process.

When analyzing the methods used in the implementation of the study program and assessment of learning outcomes, it should be concluded that student-centered learning principles are followed consistently:

- the student community and the diversity of their interests are taken into account and respected by establishing appropriate learning paths;
- different methods of study program implementation are used;

- according to students' abilities and needs, the academic staff apply diversified pedagogical methods and promote students' propensity to be autonomous, whilst ensuring their supervision and support;
- organization of studies in the study program promotes mutual respect in educator-student relationships because the principle of democracy is respected and the program's administration takes into account students' opinions;
- assessment is consistent, fair, applies to all students, and is carried out according to approved procedures (assessment methods and grading criteria are published in the descriptions of study courses, and the academic staff also familiarize students with them at the start of a study course);
- the assessment reflects achieved learning outcomes and students are given an opportunity of receiving feedback;
- the academic staff continuously improve their teaching competencies for enhancement of teaching methods and learning outcome assessment methods at academic conferences and seminars.

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).

The fifth semester of the third year of the study program includes an internship in the volume of 6 CP (9ECTS). The internship procedure is stipulated by RTU FMSAC "Regulation on Internship", approved by RTU FMSAC Faculty Council (https://www.rtu.lv/lv/mlkf/par-mums-mlkf/dokumentacija/mlkf_nolikumi). Students can undergo internship at some materials treatment, recycling or high-tech company, museum, Latvian State Archive, Latvian National Archive, or at a specific scientific research institution. The main objective of an internship is to get on-the-job experience at some of manufacturing companies, public service institutions and scientific institutes in their fields of specialisation. According to the Regulation on Internship, starting their internship students are clearly explained the aims and tasks of the internship. The tasks of the student internships are defined in the descriptions of the specialization internships, which describe the study results to be achieved and their assessment. Relationships between the tasks of specialization internship and the achievable results of the Study Program are shown in the Study Course Mapping document. The Senate decision on "Internship Organization Procedure at RTU" is enclosed in Annex 12. The internship coordinator at the organizational unit helps students to find places for internship. In parallel with the selection of places for internship, student suggestions are also analyzed, if any. In case some additional help is needed, the Career Centre provides assistance, whereas a career consultant and a project manager help students with finding a place for internship and writing a cover letter, and with help of various events promote the development of career management skills, which can ensure successful results of the internship.

Once a year, RTU Career Centre organizes RTU Career Day, during which students also have the opportunity to meet company representatives and communicate about future career opportunities.

More information about the event and the participants in the previous years can be found at: https://www.rtu.lv/lv/studentuserviss/karjeras-centrs-ssc/karjeras-diena. Following the constraints imposed by the Covid-19 pandemic, in 2021 and 2022, the event was organized in a virtual environment. In 2022, more than 60 companies took part in the Virtual Career Days. An additional resource that has been developed since 2015 is a website where companies are invited to post vacancies that are topical for RTU students (https://ekarjera.rtu.lv/). Students can connect with the university username and follow the internships and later job opportunities that are topical in their field. Additional support for the advancement of practical skills is RTU Development Fund (https://www.rtu.lv/lv/attistibasfonds). During the year, several hundred competitions for the advancement of practical skills are offered, which are organized in cooperation with companies and where students could acquire practical skills. Every year, the university signs cooperation agreements with companies and organizations agreeing to provide places of internships for the students. Information about cooperation partners is available at: https://www.rtu.lv/lv/valorizacija/.

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.

Considering that the first admission to the academic bachelor study program "Materials Engineering" took place in the study year of 2021/2022, the self-evaluation report provides information about the students of the previous academic bachelor's study program "Materials Science" and their final theses. Regarding the qualification works of new study program "Materials Engineering", it is intended to apply the same criteria for choosing the topic of the Thesis as in the case of the former study program, namely scientific novelty and practical applicability.

Graduation papers are developed considering the research topicalities in the fields of professional specialization of the study program, and normally they are aligned with challenges of research and market-oriented projects implemented by scientific institutions involved in the implementation of the study program. This allows familiarizing the students with research carried out by the scientific institutions and recognizing their theoretical and/or practical significance.

In the professional specialization field “Biomaterials”, the themes of graduation papers were related to

- modification of calcium phosphate bases with biocompatible polymer coatings/
- development of calcium phosphate coatings for titanium implants;
- hydrogels for biomedical research;
- synthesis of raw components of calcium phosphate bone cement;
- in vitro study of ion release in modified hydroxyapatite bioceramics;
- use of sol-gel methods in titanium implant coatings;
- research in drug delivery systems;
- hydrogel research in biomedicine.

In the professional specialization field “Inorganic materials”, the themes of graduation papers were related to

- development of innovative catalysts in modification of porous ceramics;
- modification of layered silicates (including, organic modification);
- study of glass fiber production;
- research in options of hydrogen storage;
- synthesis and properties of segnetoceramics.

In the professional specialization field “Polymers and composite materials”, the themes of graduation papers were related to

- development of different thermoplastic polymer matrix-based (polyethylene, polypropylene) microcomposites (using lignocellulosic biomass-derived microfibers) and study of their properties;
- development of different thermoplastic polymer (polyurethane, polyethylene, polypropylene, polyoxymethylene) matrix-based nano- and hybrid composites with carbon nanoparticle fillers (graphene, carbon nanotubes), nanostructured clays, metal oxide fillers (ZnO, TiO_2), nanofibers derived from renewable resources and study of their properties;
- development and research of properties of various biodegradable polymer matrices (thermoplastic starch, polyhydroxyalkonates, polybutylene succinate, polylactide) nanocomposites;
- development of different thermoplastic elastomer and rubber matrix-based composites for mechanical and chemical sensors (for sensing of volatile organic compound vapor concentration in ambient environment);
- research in the development of hybrid thermoresponsive polymer (epoxy resins, polyurethanes, acrylates) composites and their properties;
- study of piezoresistive effect in polymer nanocomposites;
- production and modification of polymer mixtures from waste materials (e.g., carton packages, soft drink bottles);
- characterization of raw lignocellulosic biomass in the production of promising eco composites;
- obtaining innovative adhesives for gluing wood;
- textile fiber treatment for hydrophobization, acquiring antimicrobial properties and reduction of combustibility;
- dyeing and printing of textile materials;
- polymers for triboelectric nanogenerators;
- recycling of waste polymers (e.g., tyres, waste foams) and production of composite materials on their basis;
- research on photopolymerization and 3D printing ;

In the professional specialization field “Conservation and Restoration”, the themes of graduation papers were related to

- ageing and conservation of film reel;
- ageing and conservation of paper products.

Individual Bachelor Papers were developed in cooperation with scientific partners from the University of Latvia, Institute of Solid State Physics, Latvian State Institute of Wood Chemistry, Riga Stradiņš University, RTU Faculty of Civil Engineering, University of Latvia, Faculty of Chemistry, as well as state and commercial partners from the Latvian National Museum of History, MassPortal Ltd., Tenachem Ltd., Milzu! Ltd., Kinetics Nail Systems Ltd. etc.

At the beginning of the assesment period the graduation papers were traditionally assessed by the qualification paper assessment committee of the responsible department. However, in order to get a comprehensive view of the quality of qualification papers, in academic year 2020/2021, the viva voce examination was made centralized in front of the joint Qualification Paper Assessment Committee. In view of Covid-19 limitations, the experience of remote qualification paper examination was acquired in academic years 2019/2020 and 2020/2021.

The grades for the graduation papers demonstrate academic performance and the acquired knowledge and skills of the graduates. 90% of students complete the study program with a graduation grade “8, very good” or higher grades. 5% of graduation grades are “10, excellent”.

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 studies are mainly provided by RTU FMSAC academic staff, lab technicians, and other technical personnel. The study program is implemented by the following RTU FMSAC units:

- Institute and Department of General Chemical Engineering, as well as Rudolfs Cimdins Riga Biomaterials Innovations and Development Centre;

-Institute of Applied Chemistry and Department of Chemistry;

-Institute of Technology of Organic Chemistry and Department of Chemistry of Biologically Active Compounds;

- Institute of Polymer Materials, Polymer Testing Laboratory accredited according to LVS EN ISO/IEC 17025 and the Department of Polymer Materials Technology;

-Institute of Materials and Surface Engineering;

-Institute of Technical Physics and its organizational units.

FMSAC is continuously monitoring the compliance of premise and equipment quality to the requirements following the latest trends in technologies. To ensure qualitative studies, renovation and refurbishment works are constantly going on in all involved organizational units in order to promote development of FMSAC and ensure the compliance of classrooms, lecture halls and laboratories to international standards.

The staff of FMSAC institutes, departments and laboratories are involved in educational and methodological activities according to their competencies by writing and updating descriptions of the study courses, providing delivery of appropriate parts of study courses (including, seminars, practical classes, and laboratory works), supervision of graduation papers and viva voce examination, as well as carrying out other activities related to academic, methodological and research work.

The laboratory technicians prepare standard laboratory equipment, as well as technological and research equipment for the planned laboratory works and practical classes, ensure compliance with the safety rules when working with laboratory equipment and necessary chemical agents. The professional administrative staff help in implementation of the study program – the Vice Dean for Academic Affairs together with responsible secretaries and technicians.

To ensure compliance to the joint RTU requirements, as well as to the specific study program requirements, several other institutional units of RTU are included in implementation of the study program, such as the Department of Labor and Civil Safety, the Department of Computer Engineering Graphics, the Department of Engineering Mathematics, the Faculty of E-learning Technologies and Humanities, Faculty of Engineering Economics and Management and the Study Department.

Description of the available IT infrastructure for implementation of the study program is given in part 2.3.4. of the study field.

The organizational units implementing the study program “Materials Engineering” are concentrated in RTU Ķīpsala Campus (Campus). More detailed description of the environment and the available infrastructure is given in part 2.3.2. of the study field.

The institutional units involved in the implementation of the study program maintain a wide range of modern technological and scientific research equipment, including rapid prototyping and pilot equipment, which allow implementing the study process in compliance with global trends, and scaling up from lab to industrial production of certain new materials. The summary of the currently available most significant FMSAC technological, training, and research equipment is provided in the Appendix.

In addition to the equipment mentioned above, to widen the range of the acquired skills and according to the aims of the study courses, the institutions involved in the study program have vast opportunities for employment of facilities of research partners, including the research infrastructure of the National Research Centre (https://www.cfi.lu.lv/petnieciba/projekti/vnpc/), as well as the clean rooms and transmission electron microscope for the acquisition of high added-value technologies. Certain technological equipment is also available from cooperation partners in the commercial sector - TENACHEM Ltd, MassPortal ltd, “Latvijas Finieris”, etc.

An important source of information required for implementation of study program “Materials Science and Nanotechnologies” is RTU Scientific Library, which is described more in detail in part 2.3.3. of the study field.

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).

The amount of the state funding for study programs is calucalted according to the Regulations of the Cabinet of Ministers No 944 of December 12, 2006 (please refer to part 2.3. Resources of study direction and it provision). State budget grants and student funds are used for the implementation of the study program. Tuition fee for the academic year of 2022/2023 is 2800 EUR per student. The tuition fee is determined in accordance with the instructions of the State Audit Office defining that the tuition fee for students who study together with budget students cannot be less than the state funding for this service.

The determined tution fee is the utmost minimum required, and it is aligned with the existing annual fees for mastering RTU engineering study programs.

By considering the previously mentioned, the budget for acquisition of the 3-year bachelor study program “Materials Engineering” is estimated for 8400 EUR per student. During the reporting period, the state budget subsidy for the study program, both in terms of total funding and per student, has fluctuated year by year, however, by showing increasing trend. Concomitant progressive increase in RTU costs has been experienced (costs for municipal services, premises, etc) year after year.

By performing approximate cost estimation of only invested contribution for implementation of study process, total expenses already exceed the amount of subsidy of Latvian state. The cost estimation is indicative and it is based on the average costs of the study program “Materials Engineering” in 2021:

Cost position	*Sum EUR*	*% from the total*
The reader costs	78 500	64.23
Support staff costs	25 500	20.87
Other costs	2 100	1.72
Consumer goods and services (for ensuring laboratory assignments)	5 000	4.09
Infrastrucure costs (from the regulations of RTU Senate, in the amount of 10 % from direct costs)	11 110	9.09
Total costs	122 210	100.00

These very basic costs for ensuring the study process are largely related to the multidisciplinarity of the study program, requiring involvement of specialists from various fields of material science and

engineering. In order to increase the revenues of the study program, it is important to attract the largest possible number of students to the study program, including from foreign countries. Therefore, advertising activities of the study program started in the study year of 2021/2022 have been performed in order to attract not only local but also foreign students. In the new study program in its first year of implementation 14 students have been matriculated, unfortunately, until now it has not been suceeded to attract foreign students. This has obviously been affected by the Covid-19 pandemic, as well as the unstable geopolitical situation in the region. Despite this, it should be noted that the "Materials Engineering" study program is unique, as it is the only materials science and engineering study program in Latvia and its graduates are important for the development of the Latvian economy, especially in the fields of innovative materials and modern technology development. This was also mentioned by potential employers at the meetings of the Council of Councilors of the Faculty of Materials Science and Applied Chemistry.

Information on the application of the minimum number of students in the RTU study program “Materials Engineering” is given in the appendix to the self-evaluation report "On the minimum number of students in study programs".

Director of the study program as well as the hosting faculty is responsible for specific development of the study program. For general development of all study programs, the funding is unitary allocated for replenishment of library funds, renovation and maintenance of shared auditoriums, ensuring public relations and marketing activities, development and mainenence of information technology systems, development of Kipsala study complex/the Campus and other activities.

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.

46 members of the academic staff, including 29 responsible instructors, are involved in the implementation of the study program. All responsible instructors of the study program are elected employees of RTU. The majority of responsible instructors hold a PhD degree, and they are experts of the Latvian Council of Science in the corresponding subsector.

Selection criteria for the academic staff include their specific knowledge, scope of scientific and on-the-job experience taking into account the specifics of the study program and study courses therein. The study program invites professionals in the field of new materials synthesis, treatment of materials, and advanced technologies, and conservation/restoration.

The study program also involves the academic staff from other institutional units of RTU. Elīna Gaile-Sarkane, a professor at the Department of Innovation and Entrepreneurship, is the responsible instructor for the compulsory study course “Innovative Product Development and Entrepreneurship”. As a responsible instructor, Jeļena Malahova, the associate professor at the

Department of Labour and Civil Safety, is involved in the implementation of the compulsory study course “Civil Protection”. As a responsible instructor of the compulsory study courses “Mathematics” and “Supplementary mathematics (for materials sciences)” is Līga Ramāna, the assistant professor at the Department of Engineering Mathematics. Oksana Pavļenko, an associate professor in probability theory and mathematical statistics, is a responsible instructor at the compulsory study course “Probability Theory and Mathematical Statistics”. Modris Dobelis, professor at the Department of Computerized Engineering Graphics, is a responsible instructor at the compulsory study course “Fundamentals of Graphics Communication”. Māris Tērauds, an assistant professor at the Department of Electronics, is involved in the implementation of the compulsory study course “Introduction to the Programming Language MATLAB” as a responsible instructor. Along with the experienced members of the academic staff, the study program involves younger lecturers and researchers, whose fields of activities and research are related to a wide range of sub-fields in materials science and nanotechnologies.

In the appendices of the description of the study direction more detailed list of all members of the academic staff involved in the study program is given along with their biographies (Curriculum Vitae) and the list of scientific publications related to the study program. The total number of scientific publications written by the academic staff involved in the study program during the last 6 years is 472, including highly-ranked Q1 and Q2 publications with Hirsch index of 100 and higher.

The compliance of the qualifications of academic staff to the requirements stipulated in Paragraph 55 of the Law on Higher Education Institutions is evidenced by the following qualitative and quantitative indicators – the study program involves 13 elected professors – doctors of science, whose scientific and pedagogical qualifications meet the regulations on criteria for assessment of a candidate’s scientific and pedagogical qualifications; 10 elected associate professors – doctors of science, whose scientific and pedagogical qualifications meet the regulations on criteria for assessment of a candidate’s scientific and pedagogical qualifications. Assistant professors (8), lecturers (3), leading researchers (4), researchers (4), and visiting lecturers also participate in the implementation of the study program. All members of the academic staff involved in the study program have appropriate qualification and experience to ensure efficient study process.

The majority of the members of the academic staff in the study program are certified experts of the Latvian Council of Science in their fields. They regularly strengthen their professional and academic knowledge at methodological seminars, conferences (national and international), and in scientific and research work, as well as in different projects.

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.

The personnel changes made to the study program during the reporting period are mainly related to the engagement of new members of the academic staff in the study courses, thus proceeding with the renewal of the academic staff. New specialists have been recruited or academic loads have been increased for the existing younger specialists, promoting the establishment of new study courses (e.g., study courses in 3D printing technologies, textile materials, selection and design of materials, historical heritage conservation and restoration, as well as manufacturer-oriented courses in polymer coatings and paints), and introducing new pedagogical approaches, especially in the context of remote studies. Thus, the following academic staff joined the study program: professors (e.g., Andris Šutka), associate professors (e.g., Nelli Batenko), assistant professors (e.g.,

Līga Grase, Santa Stepiņa), lecturers (e.g., Māris Rundāns), assistants (e.g., Artis Linarts), leading researchers (e.g., Arita Dubņika), researchers (e.g., Lauma Laipniece, Agnese Stunda-Zujeva, Anda Barkāne), lecturers (e.g., Oskars Platnieks, Imants Kreicbergs), scientific assistants (Sergejs Beļuns). Some of the members of the academic staff retired (e.g., Skaidrīte Reihmane, Jānis Grabis) or have significantly decreased their workload (e.g., Mārtiņš Kalniņš, Laimonis Mālers). Once the employment relations were terminated due to the fact that a person started a career in the industry, which offers much higher remuneration (assist. prof. A. Borisova).

In general, changes in the composition of the academic staff promoted the decrease in the average age of the members of the academic staff. The trend to recruit PhD students and PhD graduates as new members of the academic staff tends to continue, thus making it possible updating of the educational materials with the latest scientific discoveries that younger members of the academic staff studied in their Doctoral Theses. Younger members of the academic staff are actively improving their competencies and participate in mobility programs, which promotes experience exchange and allows optimizing the curriculum of the study program.

To promote further renewal of the academic staff, Master and senior students are being engaged in the teaching activities. As evidenced by experience, a part of them continue their work in research projects and over some time start building their academic career.

At the moment, RTU is implementing the project of the European Social Found SSO 8.2.2. “Strengthening of Riga Technical University academic staff in the fields of strategic specialization”, where one of the tasks is to renew the academic staff. The aim of the project is to strengthen RTU academic staff in the fields of strategic specialization covering 10 study fields, including Materials Science. The project activities are oriented toward four aspects:

- involvement of PhD students in the academic work at RTU;
- engagement of foreign academic staff at RTU;
- improvement of the academic staff competencies, including undergoing internship at a commercial company;
- specialized English language courses for the academic staff

During the project, certain members of the academic staff involved in the program took an active part in these activities to the extent possible.

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).

There is a mechanism promoting mutual cooperation between academic staff working in the study program, which ensures improvement and integration of the study courses. Both the results of the annual student surveys and the graduate surveys allow receiving feedback, which indicates individual shortcomings. Consequently, the improvement of the study courses takes place on a regular basis, based both on the suggestions expressed by the students and on the industry development trends. In the process of implementation of the study program, close cooperation of the academic staff takes place, which is also manifested in the following activities:

1. Discussion of the results of student and graduate surveys at the meeting of the Department, discussing student comments, suggestions, and possibilities for prevention of negative feedback;
2. Discussion of the results of the graduation papers and the quality of reviews at the meeting of the Department, discussing the possibilities for improving the quality of the graduation papers;
3. Mutual integration of classes, discussions on laboratory and practical work carried out within the framework of classes, in order to promote the provision of complementary practical skills;
4. Cooperation within projects where academic staff use the experience gained in the study process;
5. Joint study tours, where educators together with the students get acquainted with the current events in the field, are used in practical case studies during the practical classes in the auditorium.

For the moment of submitting the self-assessment report, the student-educator ratio in the study program is 27 responsible instructors per 15 students, or two instructors per one student. A large number of instructors is connected with a wide range of specialization study courses, as well as the necessity to provide students with the opportunities to use the ample research infrastructure of FMSAC under the guidance of competent specialists.

Within the framework of the study program, the cooperation of academic staff may be assessed as promoting the achievement of the learning outcomes. When reviewing and updating the study program, the academic staff mutually agree on the most appropriate and effective solutions for the evaluation of student achievements and attainment of performance indicators. By periodically discussing and reviewing the curricula of the study courses, thematically coordinated and complementary acquisition of the study program is achieved, and duplication of the content considered within different courses in one study program is avoided.

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	Diploms (grads Materialu inzenierija).zip	Diploms (grads Materialu inzenierija).zip
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)	Nr21 Materialu inzenierija- AIP atzinums Nr_09_RTU_bk.edoc	Nr21 Materialu inzenierija- AIP atzinums Nr_09_RTU_bk.edoc
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	Student Statistics, MATERIALSCIENCE.xlsx	Studentu Statistika, MATERIĀLZINĀTNE.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	MI ENG P6 (2).docx	MI P6 (2).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	Mat inž kartējums_ed 130822.xlsx	Mat inž kartējums 120822.xlsx
The curriculum of the study programme (for each type and form of the implementation of the study programme)	BSc studiju programmas MATERIALU INZENIERIJA plānojums (F010622EN).docx	BSc studiju programmas MATERIALU INZENIERIJA plānojums (F010622LV).docx
Descriptions of the study courses/ modules	MI Study courses EN.rar	MI studiju kursi LV.rar
Description of the organisation of the internship of the students (if applicable)	Internship.rar	Prakse.rar
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)	Confirmation - on compliance of the academic staff.edoc	Apliecinājums - AL 55. pants par prof. skaitu akadēmiskās programmās.edoc

Particle Physics and Accelerator Technologies (51443)

Study field	*Physics, Material Science, Mathematics, and Statistics*
ProcedureStudyProgram.Name	*Particle Physics and Accelerator Technologies*
Education classification code	*51443*
Type of the study programme	*Doctoral study programme*
Name of the study programme director	*Toms Torims*
Surname of the study programme director	*Mārcis Auziņš*
E-mail of the study programme director	*toms.torims@rtu.lv*
Title of the study programme director	*Dr.sc.ing. Toms Torims; Dr. habil. phys. Mārcis Auziņš*
Phone of the study programme director	*+37120200195*
Goal of the study programme	*The aim of the program is to provide the students with an opportunity to undertake scientific research and obtain a doctoral degree in high-energy particle physics and accelerator technologies in Latvia and to prepare world-class scientists with highly sought-after skills and competencies.*
Tasks of the study programme	*The tasks of the program are:* *- to prepare world-class specialists in high-energy particle physics and accelerator technologies;* *- to provide students with such experience as to make them a sought-after workforce both in science and in the wider economy;* *- to strengthen the scientific research community in Latvia and to strengthen the scientific collaboration between Latvia and CERN.*
Results of the study programme	*At the end of their degree students will obtain a doctoral degree in physics and astronomy or mechanical engineering and mechanics. As a result of their studies, students will have acquired and developed all of the skills necessary to successfully continue their career in research, individually undertake research activities and lead and organise the scientific work of others. The student will have obtained the theoretical knowledge via the study courses, attended at least one international conference with a talk or a poster and attended at least one international school in their field of research.* *After completing their studies, the students will have achieved the following results and abilities:* *1) Student has acquired the necessary basic theoretical knowledge in their respective study direction;* *2) Student is able to compile scientific literature and other information as to enable their research;* *3) Student is able to identify the current open questions in their field of study and to identify appropriate research strategies to work towards answering these questions;* *4) Student has acquired all the basic skills necessary in order to be able to self-sufficiently continue with their research;* *5) Student is able to direct the work of others and to advise on best research strategies for given topics;* *6) Student is able to explain their research to others and to defend their scientific opinion and stance.*

Final examination upon the completion of the study programme	*At the end of their studies a student will have successfully defended their thesis (dissertation).* *A doctoral degree is awarded when a doctoral thesis, containing scientific novelty and appropriate scientific data, analysis and results, is successfully submitted and defended by the student in their respective scientific field. The quality of the dissertation is evaluated by the State scientific promotion commission, experts from the Latvian Council of Sciences and the promotional council of the respective field of research. The evaluation if performed taking into account the following criteria: is the scientific task finished and contains appropriate scientific novelty and quality; does the dissertation contain the use of up-to-date scientific methods and data analysis strategies; if the candidate has authored appropriate scientific publications and if the scientific results have been presented in appropriate scientific conferences. Decision on the award of the degree is taken by an open vote of the promotional council.*

Study programme forms

Full time studies - 4 years - latvian

Study type and form	*Full time studies*
Duration in full years	*4*
Duration in month	*0*
Language	*latvian*
Amount (CP)	*192*
Admission requirements (in English)	*Master of natural sciences or engineering, or comparable education*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Doctor of science (Ph.D.) in mechanical engineering and mechanics*
Qualification to be obtained (in english)	*-*

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

Full time studies - 4 years - latvian

Study type and form	*Full time studies*
Duration in full years	*4*
Duration in month	*0*
Language	*latvian*
Amount (CP)	*192*
Admission requirements (in English)	*Master of natural sciences or engineering, or comparable education*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Doctor of Science (Ph.D.) in Physics and Astronomu*
Qualification to be obtained (in english)	*-*

Places of implementation

Place name	City	Address

Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

Full time studies - 4 years - english

Study type and form	*Full time studies*
Duration in full years	*4*
Duration in month	*0*
Language	*english*
Amount (CP)	*192*
Admission requirements (in English)	*Master of natural sciences or engineering, or comparable education. The assessment of the level of English language proficiency under the requirements specified in regulatory enactments.*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Doctor of Science (Ph.D.) in Mechanical Engineering and Mechanics*
Qualification to be obtained (in english)	-

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

Full time studies - 4 years - english

Study type and form	*Full time studies*
Duration in full years	*4*
Duration in month	*0*
Language	*english*
Amount (CP)	*192*
Admission requirements (in English)	*Master of natural sciences or engineering, or comparable education. The assessment of the level of English language proficiency under the requirements specified in regulatory enactments.*
Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english)	*Doctor of Science (Ph.D.) in Physics and Astronomu*
Qualification to be obtained (in english)	-

Places of implementation

Place name	City	Address
Riga Technical University	RĪGA	KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050

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.

The study programme was licenced on 29 September 2021. Its implementation started in the autumn semester of 2021 by enrolling five doctoral students, and no changes in parameters of the study programme have been made so far. No changes are planned within the direction assessment procedure.

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.

Within the study programme, students will acquire theoretical and practical skills for experimental high-energy physics research and become world-class specialists in this field of science. High-energy physics or particle physics is a branch of physics focused on research of the most fundamental laws of nature and their interactions. Consequently, particle physics is one of the most advanced and popular branches of physics in the world, attracting the best doctoral students and young researchers. High-energy physics research is carried out mainly using grandiose physics experiments that collect data and carry out studies in particle collisions, which in turn are created using particle accelerators. These particle accelerators are benchmarks for modern engineering equipment, and their creation and operation includes a huge set of interdisciplinary physics and engineering solutions. For example, the Large Hadron Collider (LHC) located at CERN is the largest and technologically most sophisticated man-made piece of equipment in the world. Accordingly, research and development of technologies involved in the development of particle accelerators attracts a large number of enthusiastic young scientists, researchers and engineers.

The primary objective of the study programme is to ensure the possibility of performing doctoral studies and obtaining a doctoral degree in high-energy physics and accelerator technologies in Latvia.

The objectives of the study programme resulting from the primary objective are:

- to prepare internationally competitive researchers and scientists to work in universities and research laboratories, as well as a highly qualified and innovative workforce in general;
- to provide opportunities otherwise unavailable in Latvia for research in high-energy physics and accelerator technologies, thereby providing a counterweight to the brain drain from the

country;
- to grow Latvia's scientific capacity in high-energy physics and accelerator technology research, as well as capacity of natural sciences and engineering sciences in general.

The following tasks of the study programme should be set for the achievement of the objectives of the study programme and should be fulfilled by students in the study programme:

- carrying out independent research work on the selected topic in the branch of high-energy physics or accelerator technologies with a view to obtaining a doctoral degree; publishing results in scientific journals and making them public; drafting and defence of a doctoral thesis;
- in-depth learning of relevant theoretical knowledge in high-energy physics and accelerator technologies by attending specific post-graduate study courses, as well as relevant international schools, conferences and seminars;
- acquisition of adequate practical knowledge and skills needed to develop a successful further research career in high-energy physics and accelerator technologies, including by having traineeships in an appropriate international scientific centre (e.g., CERN);
- improving communication and knowledge transfer skills to be able to successfully explain own research work, its results and its need for different target audiences, as well as to be able to successfully use the acquired skills by selecting other career paths in the future;
- strengthening pedagogical skills with a view to continuing academic and scientific careers in branches of high-energy physics and accelerator technologies and training of future generations of researchers.

The duration of the study programme is up to four full years with a minimum duration of studies of three years. All the tasks defined in the study programme are achievable and executable within the time limits defined in the study programme. The expected measurable results of the performance of the tasks of the study programme include:

- the results of independent work, assignments and final examinations included in the study course plans;
- an independently drafted doctoral thesis, which includes new knowledge and/or results in high-energy physics or accelerator technologies, as well as the successful defence of such paper;
- traineeship at an appropriate international scientific centre (e.g. CERN);
- successful participation in at least one international doctoral school;
- participation in at least one international level conference with a presentation or poster;
- participation in at least one conference with a presentation or poster;
- obtained status of a co-author in publications of a relevant experiment, such as Compact Muon Solenoid (CMS), and/or status of an author or co-author of at least one publication published in a Q1 level journal during studies.

Knowledge to be learned. Graduates of the study programme will acquire a full theoretical knowledge base and have a deep understanding of the selected specialisation of the study programme. This theoretical knowledge will be acquired by attending study courses specially designed and adapted for the study programme, as well as by attending appropriate schools, conferences and seminars during the course of studies. High-energy physics students will learn in depth the theory of particle physics, including the basic principles of quantum field theory, the Standard Model, and physics beyond the Standard Model. Accelerator technology students will learn in depth the theory of the physical operating principles of particle accelerators, basic principles of engineering solutions used to construct them, as well as the theoretical principles of the currently

most advanced and researched accelerator technologies. In order to promote interdisciplinarity, study courses dedicated to learning of the main theoretical knowledge of two specialisations will be provided in divided times, encouraging students to learn not only the theoretical knowledge base the need most but also the theoretical knowledge of the second specialisation. In addition to the above, students from both specialisations will gain an in-depth understanding of the design of particle detectors, the theory of statistical and systematic analysis of data, and theoretical basic knowledge of radiation safety. Theoretical knowledge and understanding acquired during studies will make it possible for graduates of the study programme to become highly qualified and internationally competitive researchers and scientists in high-energy physics and accelerator technologies.

Skills to be acquired. Graduates of the study programme will acquire the skills to carry out independent scientific and research work, which includes the ability to find and understand causal links, to carry out qualitative and quantitative analysis of the data obtained, to apply existing most advanced research methods in high-energy physics or accelerator technologies, and to create and develop new research methods and tools by gaining new scientific and technological insights. These skills will be cultivated by carrying out independent scientific and research work during the development of the doctoral thesis. When drafting a doctoral thesis, students will use theoretical knowledge acquired in study courses and, by gaining new insights when drafting the paper, will widen the existing theoretical knowledge limit in high-energy physics or accelerator technologies. In addition to the above, students will acquire a broad range of interdisciplinary and transferable skills, such as computer programming and data processing, analysis and long-term preservation skills. Over the course of the study programme, the student will develop and strengthen scientific and general communication skills.

When attending study courses, schools, seminars and conferences, as well as training lower-level students at the university, doctoral students will acquire the skill to communicate scientific concepts and insights of general sciences, as well as those specific to their branch and their research activities to different target audiences.

Competences to be acquired. During the study programme, the student obtains the ability to plan, structure and to perform in the long-term and large-scale research work in high-energy physics and accelerator technologies. The student will be able to identify gaps within the existing knowledge limit, as well as to recommend, justify and perform scientific activities to fill such gaps and to extend the existing knowledge limit. The student will acquire the ability to lead scientific research activities of other researchers and scientists, as well as to recommend best research methods for achieving specific results. In addition, the graduate of the study programme will be able to introduce, demonstrate and approbate new research approaches and methodologies. The student will acquire sufficient above-mentioned theoretical knowledge and skills to be able assess and understand the existing state of the branch of research as a whole, and explain the strategic vision, necessity and potential contribution of the branch to the scientific community, the general public and action policy makers. Graduates of the programme will acquire the level of competence in high-energy physics or accelerator technologies competitive in the world to become internationally competitive scientists able to play a leading, accountable role in the further organisation and performance of research work in their branch.

The above-mentioned tasks of the study programme rare inextricably linked and can be performed during the defined period of the study programme. Their fulfilment, as well as the acquisition of the necessary knowledge, skills and competences, will be assisted by an extended traineeship, which will be completed at an appropriate scientific centre, such as CERN. During this traineeship, the student will have easy and permanent access to an extremely wide range of high-energy physics and accelerator technology experts, as well as the possibility to carry out a variety of practical

works, outside of their specific research work, which will allow for the extension, supplementing and application of theoretical knowledge and skills acquired.

The primary condition for enrolment to the study programme is a Master's degree obtained in an appropriate, compatible branch of research or science. Appropriate and compatible branches of science and research include branches of physics, astronomy, mathematics, computer science and engineering industries. The primary language of the study programme is English. The study programme enrols students who are able to demonstrate their knowledge of English corresponding to at least level CEFR B2. If necessary, students will be given the opportunity to improve their level of English during the study programme.

The duration of the study programme is 4 years broken down into 8 semesters (48 weeks x 4 = 192 weeks).

The volume of doctoral studies is 192 CP (1 CP/week x 192 weeks). The volume of the programme and the total duration of studies is the same for students with different prior education: 192 CP–full-time studies. Research work during studies is performed in cooperation with appropriate international scientific centres, for example, CERN, and by including into an appropriate research experiment and/or group, for example, in the CMS experiment. During the study programme, students are intended to spend a long-term attachment (LTA) in the specified international research laboratory. The time spent in LTA is considered a traineeship time. The optimal time spent in LTA is from 12 to 24 months in the second and/or third year. If for justifying reasons the student cannot spend time in an international laboratory, the student talks with his/her work supervisor finding a proper solution for continuing studies in Latvia. By individually assessing the amount of work performed and with the agreement of the work supervisor, the thesis can be submitted in an accelerated manner, but not earlier than three and a half years after the commencement of studies to provide the full scope of knowledge, skills and competences to be learned.

The study program has four tracks: one awarding a degree in physics and astronomy (particle physics) and one awarding a degree in mechanical engineering and mechanics (accelerator technologies), with both of these tracks duplicated in Latvian and English. The different degree tracks are needed in order to award the student with a degree, which his maximally aligned with their actual research. The program is predominantly implemented in the English tracks, as it aims to attract foreign students, however, the program can also be implemented in Latvian tracks in years, where the entire cohort is made up of Latvian students.

In view of the above, the study programme is fully in line with the study field "Physics, Material Science, Mathematics and Statistics".

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

Graduates of the study programme, scientists with a doctoral degree in high-energy physics and accelerator technologies, will have acquired appropriately high knowledge, skills and competences so that they can continue their careers by choosing from an extremely broad range of employment options. Young scientists will be able to pursue academic and scientific careers in Latvian, foreign and international universities, laboratories and research centres; graduates will also be able to continue their careers in both the private and public sectors, such as information technology and engineering companies, the financial sector, as well as in local governments, ministries and other

public administration institutions. According to the study carried out by the European Science Foundation in 2017, 89% of natural sciences PhD recipients in Europe find a full-time job immediately after they acquire the doctoral degree (57% find permanent work, 32% contract work) and in engineering and technologies these are 93% of PhD recipients (75% permanent work, 18% contract work). The great difference between natural sciences and engineering in the percentage of permanent and contractual work is due to the fact that the PhD recipients in natural sciences are most likely to choose a post-doctoral research path.

To describe physics PhD recipients and potential employers we can refer to the study of the American Institute of Physics of 2019 (https://www.aip.org/statistics/reports/physics-doctorates-initial-employment-2016). This study shows that 94% of physics PhD recipients are employed immediately after getting the degree, with 47% continuing their research career as a post-doctoral researcher, 40% getting potentially permanent employment in the private or public sector, and 7% being employed in other short-term jobs, for example, in the development of different projects. Of those employed in the private and public sectors, most PhD graduate continue careers in the business and financial sector, information technology companies and engineering companies. Although the labour market in the United States and Latvia is not directly comparable, they are very similar in terms of the traditions and opportunities of the labour market, which allows for the provision of the statistics mentioned above about the potential employment directions of physics and engineering PhD recipients.

Graduates of the study programme will be a highly qualified workforce with excellent data processing and analysis skills, able to work across a broad range of professions, such as the financial sector, the ICT (information and communication technologies) sector, engineering companies and other sectors. There is evident lack of such STEM (Science, Technology, Engineering, Mathematics) degree recipients in Latvia. Graduates of this programme will make a strong contribution to filling this gap.

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.

The implementation of the study programme started in the autumn semester of 2021. Taking into account that the study programme was not implemented before, it is not possible to carry out an analysis of the dynamics of the number of students and assessments.

Six doctoral students funded by the state budget from Latvia and Italy, as well as one foreign student from Montenegro, have been enrolled to the programme at the time of drafting this document. Taking into account the composition of international students, as well as the fact that several study courses are mastered by students from foreign teaching staff, in close cooperation with the researchers of CERN Baltic Group, CERN and other researchers, the study programme is implemented in English.

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 implemented in cooperation between two of Latvia's leading universities – RTU and University of Latvia. Graduates of the study programme will acquire a scientific doctoral degree in physics and astronomy or mechanical engineering and mechanics.

The universities implementing the study programmes are the leading scientific institutions in Latvia and cover complementary scientific directions for each other. The University of Latvia is Latvia's leading university in natural sciences while RTU is Latvia's primary engineering university. Cooperation fully provides these institutions with all they need for the successful implementation and development of this study programme. Despite the above, both universities work in close cooperation and jointly implement all study parts, each bearing responsibility for the study courses under their control.

The two partner universities are selected due to being the two strongest and largest universities in Latvia, which allows this program to offer greater access to resources for the students.

The development and partly the implementation of the study programme was carried out by a working group and now Study Programm working group composed of representatives from RTU, University of Latvia, CERN and CERN Baltic group. The rights, duties and responsibilities of the study program council are stipulated in the cooperation agreement concluded on January 15, 2021 between RTU and LU on the implementation of the joint doctoral study program "Particle Physics and Accelerator Technologies".

All activities for the development and implementation of the study programme are carried out in close cooperation with CERN Baltic Group (CBG). CBG is an official, statute-based, international group, in which leading Baltic universities and research institutes, whose scientific activities are linked to CERN, cooperate. CBG consists of eight universities and institutes in Latvia, Lithuania and Estonia:

- National Institute of Chemical Physics and Biophysics (NICPB), Estonia;
- Tallinn University of Technology (TalTech), Estonia;
- University of Tartu (UT), Estonia;
- Riga Stradiņš University (RSU), Latvia;
- University of Latvia (LU), Latvia;
- Riga Technical University (RTU), Latvia;
- Kaunas University of Technology (KTU), Lithuania;
- Vilnius University (VU), Lithuania.

CBG partners were involved in the development of the study programme mainly as experts and in the implementation – as experts and teaching staff. In the development process, the task of the experts was to make recommendations, as well as to carry out a thorough study of the content of the study programme, including the mapping of the study programme, the content of study courses and the objectives of the study programme, the possibility of achieving them and assessment.

The study programme development working group was complemented by experts from CERN, as well as representatives of Latvian businessmen and employers, who were involved both as experts and as consultants. Doctoral students, whose research work corresponds to the target audience of the study programme, were also involved in the development of the study programme.

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 duration of the study programme is four full years, with the possibility of graduating faster, but not earlier than three and a half years after the beginning of the studies. The study programme includes two main specialisations of studies – high-energy physics or accelerator technologies. The study programme is implemented as lectures and independent work, which also includes independent scientific and research work, including by having a traineeship in an appropriate scientific centre, such as CERN, as well as the drafting of a doctoral thesis.

Study courses to be attended within the framework of the study programme are divided into compulsory, restricted elective and free elective courses, receiving 15, 21 and 6 credit points, respectively. Attendance of all lecture courses is planned in the first year of studies, while the rest of the studies is mainly intended for research work. Study courses are taught at Riga Technical University [RTU] and the University of Latvia [LU]

The compulsory study courses intended for students in the high-energy physics specialisation (hereinafter – physics specialisation) are the Particle Physics Theory, Particle Detectors, Computing and Programming for Physicists, Statistical Methods in Data Analysis and Radiation Safety. The compulsory study courses intended for students in the accelerator technologies specialisation (hereinafter – accelerator specialisation) match with physics specialisation courses, while the accelerator specialisation course replaces the Particle Physics Theory course. These five compulsory courses have been selected in such a way as to allow students to acquire all the necessary basic knowledge in their respective study specialisation and in-depth knowledge in their respective study specialisation.

The study programme includes the following compulsory study courses:

Particle Physics Theory, 8 credit points, 12 ECTS, [RTU]. The main course in the physics specialisation will provide a full overview of the theory of the modern particle physics theory, from symmetry groups and the basics of the quantum field theory, to the description and phenomenology of the Standard Model of particle physics. This course will provide students with a modern appropriate theoretical knowledge base, which will enable students to continue their research activities in this field of science independently.

Accelerator Technologies, 8 credit points, 12 ECTS, [RTU]. The main study course in the accelerator specialisation will provide a review of the most advanced accelerator technologies and the full review of theoretical knowledge needed for accelerator physics. This course will provide students with a modern appropriate theoretical and practical knowledge base, which will enable students to continue their research activities in this field of science independently.

Particle Detectors, 2 credit points, 3 ECTS, [RTU]. This course will include a full review of particle-matter interaction and provide students with an understanding of the design of experimental high-energy experiments. The course will include a theoretical base of particle-matter interactions, and allow students to understand more deeply the way experimental high-energy physics data are

obtained and how particle accelerators are controlled.

Computing and Programming for Physics, 2 credit points, 3 ECTS, [RTU]. This course will provide the students with computing and programming skills vital to further research in high-energy physics or accelerator technologies, including basic skills in Python and C++ programming languages. In addition, the course will provide the student with basic knowledge of the use of auxiliary software such as Git and LaTeX.

Statistical Methods in Data Analysis, 2 credit points, 3 ECTS, [LU]. This course will provide the student with the required base of mathematical and statistical analysis to be able to successfully carry out independent research work both during and after doctoral studies. The knowledge acquired will allow the student to understand more deeply the data and information obtained during the research work, their quality and their relevance.

Radiation Safety, 1 credit point, 1.5 ECTS, [LU]. This compulsory study course is necessary to provide students with an absolutely necessary level of understanding in relation to ionising radiation. The course will provide information on different types of ionising radiation, on methods to avoid negative radiation effects, and on how to ensure personal safety and safety of others when handling sources of ionising radiation. In addition to understanding, students will also get a radiation safety certificate that will allow students to handle sources of medium hazard radiation.

The content of compulsory study courses is fully relevant and sufficient to prepare highly qualified and internationally competitive researchers in the respective scientific directions. In addition to compulsory study courses, the study programme will also offer specially designed restricted elective study courses: Introduction to Particle Physics, Mathematics in Particle Physics, Relativity and Cosmology, Particles for Medical Physics, Data Science for Physics, Laboratory Exercises in Electronics and Introduction to CAD. These courses will not only provide students with a wider set of relevant knowledge, but will also help to further and more closely link the content of compulsory courses, allowing students of both specialisation to acquire an interdisciplinary knowledge base.

The study programme includes the following free restricted elective study courses:

Introduction to Particle Physics, 2 credit points, 3 ECTS, [RTU]. The aim of this course is to assess and align the theoretical level of knowledge of students in the physics specialisation, and to offer students of the accelerator specialisation an understanding of the foundations of high-energy particle physics.

Mathematics for Particle Physics, 4 credit points, 6 ECTS, [LU]. This course will allow interested students to understand even more deeply the basic theoretical and mathematical principles of particle physics, such as Lie algebra and Fourier transformations.

Relativity and Cosmology, 4 credit points, 6 ECTS, [LU]. Modern cosmology is the second of the two most fundamental directions of research in physics, which, unlike high-energy physics, studies our universe at the greatest scale. This course will provide students with an opportunity to further understand the laws of physics in our universe by covering fundamental physics theories such as General relativity.

Particles for Medical Physics, 4 credit points, 6.0 ECTS, [RTU]. The purpose of this course is to familiarise students with the application of particle physics and accelerator technologies in medicine. Students will be given an in-depth insight into radiotherapy, brachytherapy and radiosurgery and prepare students for a potential career in radiology.

Data Science for Physics, 4 credit points, 6 ECTS, [RTU]. This course will give students the opportunity to acquire basic knowledge and a general understanding of modern data science and machine science and will set out in detail and allow them to learn basic aspects of data science and

machine science that are widely used in high-energy physics experiments.

Laboratory Exercises in Electronics, 3 credit points, 4.5 ECTS, [RTU]. The purpose of this course is to familiarise students with the operating principles of electronic components used in particle detectors and accelerators. Within the course, the student will acquire a general understanding of materials, equipment and systems that are widely used in the above-mentioned research directions and provide basic skills for their use.

Introduction to CAD, 3 credit points, 4.5 ECTS, [RTU]. Computer modelling is an extremely widely used design and prototyping technique in engineering and is indispensable in the development process of high-precision equipment, such as particle detectors and accelerators. As part of the course, students will be familiarised with computer modelling software as well as basic skills in its use.

The above-mentioned compulsory and restricted elective courses are about basic principles considering modernity, relevance and interdisciplinarity. The main courses of the specialisations of the study programme, the Particle Physics Theory and the Accelerator Technologies, which must be studied by students of the physics specialisation and accelerators specialisation, respectively, offer the most advanced scientific review of the specific research direction. For the promotion of interdisciplinarity, these same study courses are offered to students of the other specialisation as restricted elective courses. Similarly, all remaining compulsory and restricted elective courses have been selected in such a way as to promote interdisciplinarity between the fundamental science and engineering aspects offered by the study programme. The study courses proposed are comprehensive, relevant and fully sufficient to provide students with all the necessary knowledge, competence and skills to pursue a successful research career. During the study programme, students perform research work of 150 credit points based on an individual plan in high-energy physics and/or accelerator technologies.

The program is predominantly implemented in the English tracks, as it aims to attract foreign students, however, the program can also be implemented in Latvian tracks in years, where the entire cohort is made up of Latvian students. There are no substantive differences between the Latvian and English tracks, with the exception of the availability of guest lecturers, who would give their lectures in English even for the Latvian-tracked students.

The study programme is implemented as lectures and independent work, which also includes independent scientific and research work, including by having a traineeship in an appropriate scientific centre, such as CERN, as well as the drafting of a doctoral thesis. Learning of all lecture courses is planned in the first year of studies, while the rest of the studies (three years) is mainly intended for research work.

Since the licence was received too late, in the study year 2021/22, the timetable of study courses has a slight shift, resulting in some courses being offered to students enrolled this year in their second year of studies. In future years of studies, the study programme will be implemented based on the initial plan.

The main role of the partner institutions is to provide access to the experts and teaching staff in Latvia. UL is Latvia's leading university in natural sciences, including physics, whilst RTU is the leader in Latvia in technology sciences. Together the two universities are able to provide an appropriate level of expertise in the both fields of science concerning this study program.

The chief aim of the study courses offered is to provide the students with an appropriate level of knowledge and skills in order for them to successfully carry out independent research during their studies and beyond, which is fully in line with the overall aims and achievable results of the study program as a whole. The course offered by this program are highly topical and provide students

with the knowledge and skills that are highly sought after in the modern labour market, such as statistical analysis of data, programming and machine learning.

Study courses are designed so that graduates are not only world-class research staff, but also so that graduates are able to integrate into a broad range of labour market sectors.

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).

Modern high-energy physics studies mostly take place in grandiose experiments. For example, the CMS experiment at CERN is a 14,000 ton, 21x15x15 meter experiment that requires huge human and monetary resources to ensure its operation. Such resources are not available to any individual national science programme. This means that, in general, all modern high-energy physics experiments take place in international scientific cooperation, laboratories and experiments, and national scientific programmes should ensure participation in them to enable national researchers to carry out scientific work. Students in the study programme will perform particle physics analyses analysis and/or develop detector components in CMS or other equivalent experiment. About 1,000 doctoral students from around the world participate in the CMS experiment at any time. In this programme, students will develop a doctoral thesis comparable in quality and methodology to the standards adopted in this field.

Such physics activities require continuous improvements in accelerator technologies and innovations, which will be carried out by students in the accelerator specialisation during studies.

With growing capacity, Latvia's involvement in other experiments is expected both in CERN and in other scientific laboratories. For example, involvement in one of the neutrino physics programme experiments in the United States or Japan is possible and recommended in the future. Neutrino physics is a rapidly growing sub-field of experimental high-energy physics with an extremely high potential for fundamental discoveries.

The 27 km-long LHC development programme was approved in 1994, the first beams were injected into it in 2008 and the end of its physics programme is planned for 2040. In parallel, an active study of future accelerators and their high-energy physics experiments is underway. One of the potentially grandiose and, at a given moment, the most realistic projects is the Future Circular Collider (FCC). This 100 km accelerator based at CERN uses the existing LHC as one of the pre-accelerators. In the event of the final approval of the FCC, Europe will continue to be the leader in high-energy physics and the development of accelerator technologies at least until the end of the 21st century.

According to the above, high-energy physics and the development of accelerator technologies are a modern field of science that is expected to be topical for a very long time. Therefore, this programme also has an extremely high prospects of development and topicality. In this programme, students will submit doctoral theses that will be evaluated based on the highest standards, and the quality of the submitted papers will be at least equal to the doctoral theses drafted by students from other countries performing research at CERN.

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.

Oral, written and combined study and assessment methods are used during study courses and in tests.

A variety of techniques for acquiring and strengthening knowledge, such as introductory lectures, interactive lectures, summary lectures, problem-oriented lectures, are used in studies. Practitioners, professionals from different institutions are invited to teach individual lectures in study courses to promote the unity of theory and practice. Practical tasks, seminars, individual, pair and group work, discussions and project development, field trips to industry organisations are widely used. Employers are involved in the implementation and improvement of study courses (invited to lead individual seminar classes, classes are often organised as experience exchange visits to the workplaces, etc.).

In order to promote the development of students' research competences, students in successive courses have the opportunity to analyse and study in depth the problems of their interest in the field. Senior students are involved in leading peer teaching-learning.

Seminars during study courses promote the speech, presentation and discussion skills of students.

In order for students to achieve the learning outcomes – learn and strengthen knowledge, skills and develop competences – methods where student activity is important dominate in the students' activities. The study process uses methods to promote student communication in the performance of study tasks, resolving real problems of the field, modelling situations.

The student evaluation methods ensure that the student will obtain an appropriate level of understanding in each of the study courses in order to be able to independently utilise this knowledge in their research work or in the broader job market. The methodology for the studies and acquisition of the necessary skills is based on intensive study courses and maximising the time allocated for the research work. This allows for the optimum development of the research skills, which is fully in line with the overall aims of the study program.

The physical environment of studies is also gradually changing: auditoriums can be easily transformed for group work, individual work, students can use digital technologies. Lecturers mostly use methods that encourage active participation of students, critical thinking and reflection. The e-study environment will be used in the study process and to promote independent studies. For each study course, an e-study environment (Moodle) has been established, where students have access to lesson materials, task descriptions, additional training materials related to course topics, as well as study tasks (tests, forums, seminars, conferences, etc.). All assessments of interim and final examinations of study courses are recorded with an explanation of the mark and made available to students in the e-study environment.

The running of the study program is overseen and regulated by the study program council, with

representatives from RTU, UL, CERN and the CERN Baltic group. The council ensures that the two partner universities are implementing the study program in a cohesive manner both in terms of the study courses and the evaluation of the student's research performance. The students themselves are closely involved in the planning of their own research work for the entire duration of their studies. Students are involved in the development of the study program as well via provision of recommendations to the study program directors and/or the management of the structural units responsible for the implementation of the study program. Likewise, the students are asked to provide informal feedback on the quality and content of lectures directly to the lecturers in order to improve and optimise individual study courses.

The student-centred approach is followed when updating study programmes and their study courses, with a particular focus on meaningful formulation of learning outcomes, in order to promote dialogue between lecturers and students on the content of studies, forms and methods of organisation. In turn, properly formulated study results contribute to students' understanding and co-responsibility for their learning, self-assessment and understanding of the assessment they have received. In the study process, lecturers use methods, test forms and assessment criteria relevant to the objective of the studies and the planned learning outcomes.

In the study process, students receive support and feedback from lecturers. The assessment criteria for giving marks have been published in advance. The assessment gives students the opportunity to show, to what extent they have achieved the expected learning outcomes.

In line with the principles of student-centred studies, student mobility (recognition of learning outcomes) is promoted, students engage in research and social activities initiated by academic staff in the community, thereby gaining significant experience using in practice what was learned during studies. When implementing internal quality assurance policies, study programmes are implemented in such a way that students are encouraged to be actively involved in the improvement of the study process. There is a procedure for submitting of proposals by students and resolution of complaints, examination of appeals of students. The results of student surveys are assessed and taken into account in the improvement of the study process. Students willingly make their recommendations for improving the study programme and the process in talks with lecturers, programme directors.

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 promotion of the student is the responsibility of the university, to the Doctoral Council of which the student has submitted his/her doctoral thesis. The study programme provides that students may defend their doctoral theses in universities in already existing doctoral councils: RTU – Mechanical engineering and mechanics science branches; LU – Physics and astronomical science branches.

Students also draft their doctoral theses independently with the support of the work supervisor and the relevant scientific group in CERN and Latvia. The quality of the drafted paper is assessed primarily by the work supervisor, based on whose recommendation the student submits the doctoral thesis for the final assessment. The student's work supervisor provides the student with the possibility to perform one or more pre-defences not earlier than three and a half years and not later than four years after the commencement of doctoral studies, unless the student's time period for the submission of the paper is extended. Following a joint decision of the student and his/her work supervisor, the defence of the student is organised in the relevant doctoral council.

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.

This study programme is in its first year and a description of the analysis and evaluation of topics of graduation papers is not yet available.

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 study process of the study programme is ensured by RTU and LU in close cooperation with CBG, as well as with support of CERN. The RTU structural unit responsible for the study programme is the Centre of High- Energy Physics and Accelerator Technologies (HEP&AT Centre). The compulsory, restricted elective and free elective courses are provided by the HEP&AT Centre, involving other relevant RTU faculties and structural units where necessary. The LU structural unit responsible for the study programme is the Faculty of Physics, Mathematics and Optics (FPMO). The compulsory, restricted elective and free elective courses are provided by FPMO, involving other relevant LU faculties and structural units where necessary.

In the study programme, the matriculation of doctoral students takes place at RTU, LU includes these students in the register of students. Nevertheless, all students in this programme have access to the informative and methodological supplies of both universities provided to students matriculated at each individual university.

The study programme offers students full access to the infrastructure and material and technical supplies specified in Part II, Section 3, Paragraph 2.3.2, as well as the methodological and informative supplies described in Paragraph 2.3.3. Finances are provided in accordance with the procedure set at LU laid down in Paragraph 2.3.1.

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).

The two universities involved, as well as CERN, are able to offer free access to necessary scientific databases, including SpringerLink, ScienceDirect, SCOPUS and the Web of Science. Similarly, the Primo Discovery database search tool is offered for the use of students from both universities, allowing for the search literature on specific topics in all available databases at each university, as well as in the LNB catalogue.

Taking into account that the study programme is implemented in close cooperation with CERN, the scientific database CERN Document Server (CDS) is available for doctoral students, including abstracts, conference presentations and similar publications available to CERN, as well as access to CERN's scientific library. The students involved in the programme have full access to the relevant CERN experiments and their data, as well as access to an extremely broad and strong range of experts.

In high energy physics, it is widely accepted that all scientific results published in scientific journals should also be published in free-access databases such as arXiV. As a publicly funded international science organisation, CERN has defined that all scientific results published using resources offered by CERN, such as the CMS experiment, or conducted in close cooperation with CERN, should also be published in one of free-access scientific databases. Therefore, the academic staff and doctoral students involved in the study programme have free access to the latest scientific results and insights in the field.

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).

Income of the programme

To provide the funds necessary for the implementation of the study programme Particle Physics and Accelerator Technologies, RTU uses:

1. state budget grant from the Ministry of Education and Science, which is EUR 9300 for full-time intramural studies for academic year 2021/2022;
2. tuition fee, taking into account all the factors listed in the "Finances" section, which has been

defined for academic year 2021/2022:

- For full-time intramural studies – EUR 9300 per year;
- Tuition fee for full-time intramural studies for foreign students – EUR 9300;

In view of the above, the total expected budget of the study programme is EUR 199 thousand, details are shown in the table.

Type of studies	Number of students	Tuition fee/state grant	Total income
FTI (budget)	24	8 313.56	199 525.46
FTI (fee)	0	0	0.00
Total			**199 525.46**

When making a calculation of optimal necessary costs per study place, costs amount to EUR 14,773.44. Total costs exceed the amount of Latvian state budget funding. The detailed calculation is attached in the annex "studiju_vietas_izmaksu_aprekins".

The calculation is indicative, because it is not based on actual costs of DSP “High Energy Particle Physics and Accelerator Technologies”, but on average costs of 2020:

Cost item	Total (RTU/LU)	
	amount	% of total
Costs of teaching staff	3 801	25.77%
General staff	2 851	19.33%
Other expenses	314	2.13%
Infrastructure expenses	1 481	10.05%
Property and services	6 300	42.72%
TOTAL COSTS	14 747	100%

Taking into account that all students are matriculated at RTU, receiving all the funding, an agreement is concluded every year between RTU and LU on the fee of each credit point for a study place financed by the state budget and on the fee of each credit point for a study place financed from the funds of a natural or legal person. Obtainable funding for study places financed from the state budget is determined proportionally to the number of credit points according to the study plan of the Program, applying to each study course the study cost coefficient of the thematic field of education with the minimum value, and the number of students at the beginning of the academic year.

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.

Highly qualified teaching staff from LU and RTU, as well as attracted external experts from CERN and CERN Baltic Group are involved in the implementation of the study programme. Seven teaching staff participate in the implementation of the study program from RTU, all of whom have been elected to the positions of professor (3), associate professor (1), docent/lecturer (2), as well as leading researcher (1).

The qualifications of the teaching staff are fully in line with the specifications of this study program; the teaching staff are researchers in high energy particle physics or are involved in projects aimed at the development of particle accelerator technologies. In certain cases, where a study course is aimed at other specific topics, the lecturer is selected such as to reflect the needs of this course.

The particle physics course and other closely related courses are either taught by active researchers in the field (Dr Kārlis Dreimanis) or researchers with an extensive and high-quality experience in the theory of particle physics (Prof Yuri Dokshitzer). Likewise, the responsible for the accelerator technology course and the supervision of the accelerator technology students is a researcher involved in projects aimed at the development of accelerator technologies (Prof Toms Torims).
The aforementioned points allow the students to achieve high-quality research and study outcomes in their respective fields of research.

The most qualified teaching staff of the relevant scientific directions available in Latvia are involved in the development of the content of the study programme. The involvement of Yury Dokshitser in the implementation of the physics specialisation should be particularly emphasises. Yury Dokshitser is a world-renowned professor of theoretical physics who has spent his career in Europe at prominent research institutes, including CERN. The involvement of LU professors Mārcis Auziņš and Vjačeslavs Kaščejevs, as well as the Head of the LU FPMO Physics Department Dr. Guntars Kitenbergs and Director of the RTU Center of High Energy Physics and Accelerator Technologies Dr Kārlis Dreimanis in the implementation of the study programme should also be emphasised. Latvian primary expert in accelerator technology, RTU Professor Toms Torims is involved in the development and implementation of the Accelerator Technologies specialisation.

The main objective of the study programme is to be able to provide students with world-class scientific education and experience. The qualifications of the involved teaching staff is more than sufficient to achieve all the objectives set in the study programme and to ensure the highest possible quality of the studies for students.

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.

The implementation of the study programme started in the autumn semester of 2021. Taking into account that the study programme was not implemented before, it is not possible to analyse changes in the composition of teaching staff in the reporting period.

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).

12 doctors of science are involved in the implementation of study courses of the study programme, of which 10 are LSC experts in natural sciences, engineering and technologies:

1. Prof., Dr.habil.phys. Mārcis Auziņš, LSC expert in physics and astronomy;
2. Prof., Dr.sc.ing. Toms Torims, LSC expert in engineering and technologies;
3. Prof., Dr.phys. Vjačeslavs Kaščejevs, LSC expert in physics and astronomy;
4. Prof., Dr.phys. Jurijs Dehtjars, LSC expert in physics and astronomy, LSC expert in mechanical engineering and mechanics, LSC expert in medical engineering;
5. Prof., Dr.phys. Juris Blūms, LSC expert in physics and astronomy, LSC expert in material science;
6. Dr.phys. Anatolijs Šarakovskis LSC expert in material science;
7. Dr.phys. Guntars Kitenbergs, LSC expert in physics and astronomy;
8. Dr.phil. Kārlis Dreimanis, LSC expert in physics and astronomy;
9. Dr.sc.ing. Artis Kromanis, LSC expert in mechanical engineering and mechanics;
10. Dr.chem. Elīna Pajuste LSC expert in chemistry;
11. Dr.sc.ing. Māris Tērauds;
12. Dr.phys Yury Dokshitser.

Overall, in the period from 2017 the RTU teaching staff are authors or co-authors of more than 200 publications, of which 37 representative publications can be emphasised, a list of representative publications is attached.

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).

In the period from 2017, the academic staff implementing RTU doctoral study programmes has been involved in 21 research projects, including 11 as scientific supervisors.

Teaching staff	Project title	Source of funding	Position
Kārlis Dreimanis	Top quark and Higgs boson studies in the CMS experiment, development of crystal scintillators, CMS sub-detectors and particle accelerators for applied use, in cooperation with CERN (2020-2022)	NRP	Project manager
Artis Kromanis	Technology for manufacturing of seamless aluminium alloy pressure vessel shells with walls of different thickness, increased heat conductivity and reduced weight for high-precision automated assembly and welding lines (2017-2018)	Other	Project manager
	Development of calculation and optimisation methodology for electromagnetic induction pumps for industrial use	Other	Researcher
	Improvement of a vertical wind tunnel security system and development of a safety network prototype in cooperation with SIA “Aerodium”	Other	Project manager
Jurijs Dehtjars	MULTILAYER SILICA NANOCAPACITOR WITH IMPROVED DIELECTRIC LAYERS (2017-2020)	ERDF	Project manager
	PLANAR FIELD EMISSION MICROTRIODE STRUCTURE (2020-2023)	ERDF	Project manager
	THIN LAYERS WITH NANOPARTICLES FOR DOSIMETRY OF IONISING RADIATION (2018-2021)	ERDF	Scientific supervisor
	METHOD FOR IDENTIFICATION, SORTING OF UNMARKED CELLS BASED ON LENGTH OF TELOMERES (2020-2023)	ERDF	Scientific supervisor
	REGULATED SURFACE PLATFORM FOR IMMOBILISATION OF MICROORGANISMS (2018-2021)	FARP	Project manager
	CONCERT-EUROPEAN JOINT PROGRAMME FOR THE INTEGRATION OF RADIATION PROTECTION RESEARCH’ (2018.-2020.)	UN	Participant

	STRENGTHENING THE COMPETENCE IN RADIATION TECHNOLOGIES AND SAFETY FOR BIOMEDICINE AND MATERIALS SCIENCE (2020.-2021.)	UN	Participant
	BIODEGRADABLE AND NON-BIODEGRADABLE ORTHOPEDIC IMPLANTS WITH BACTERICIDAL COATINGS AND CONTROLLABLE DEGRADABILITY –COATDEGRABAC (2019.-2021.)	ERA-NET	Scientific supervisor of RTU team
	Bioactive Cardiovascular Stent For Antiatherosclerosis Treatment And Reduced Restenosis (2021-2023)		Scientific supervisor of RTU team
	High performance Carbon-based composites with Smart properties for Advanced Sensing Applications (2020.-2023.)		Representative of Latvia, participant
Māris Tērauds	Development of a new generation cyber physical infrastructure for water quality monitoring and pond management to increase the productivity of aquaculture sites (2019-2021)	EMFF	Leading researcher
	Development of extended functionality high-capacity water acoustic transmitter for reduction of damage caused by seals in Latvian coastal fishing (2017-2018)	EMFF	Leading researcher
Toms Torims	HITRIplus-Heavy Ion Therapy Research Integration plus (2021-up to now)		RTU project manager
	PRISMAP: the Production of High Purity Isotopes by Mass Separation for Medical Application (2021-up to now)		Participant
	I.FAST-Fostering Innovation in Accelerator Science and Technology (2021 - up to now)		Leading researcher
	ARIES PoC –Development of hybrid electron accelerator system for the treatment of marine diesel exhaust gases (2018-2020)		RTU team leader

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 study programme was developed by a study programme development working group with participation of experts from CERN Baltic Group and CERN, as well as the lecturers of courses of the study programme from RTU and LU. The biggest job, where the working group experts made their contribution and provided their evaluation, was the content of the courses, as well as the interlinking between them. Later, at the beginning of the study year 2021/2022, the Council of the Study Programme, composed of leading experts in the field from RTU, LU and CERN, and ensuring the quality management of the study programme, repeatedly analysed the interlinking of courses and the calendar plan of their implementation. At the end of the semester, directors of the study programme are expected to present again the results of the study programme, as well as draw attention to possible changes as needed. Such a management mechanism also planned further.

During approbation of the study programme and in the future, the cooperation of the teaching staff is promoted through participation of teaching staff in the CERN Baltic Group sub-group – the Study Programme Working Group. The implementation of the teaching staff cooperation mechanism through this group provides not only an opportunity for the potential development of cooperation between RTU and LU, but also for CERN Baltic Group partner staff, which, accordingly, provides access to a wide range of highly qualified visiting lecturers for the study programme. This is particularly important because the study programme, in order to promote internationalisation, interdisciplinarity and diversity in the content and presentation of study programmes, focuses in particular on attracting skilled visiting teaching staff. Visiting professors and cooperation with foreign academic staff also contribute to the development of scientific activity, joint research and creation of publications, ensuring the interaction between studies and science. It is essential that in the year of studies 2021/2022 four highly visiting lecturers were involved: Assoc.Prof. Stefan Groote (University of Tartu, Estonia), Assoc.Prof. Thomas Gajdosik (Vilnius University, Lithuania) and assistant Prof. Toni Ščulač (University of Split, Croatia) and Dr. Maurizio Vretenar (CERN, Switzerland).

The study programme working group is convened as often as necessary, but at least once a quarter.

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	Diploma_paraugs.docx	Diploma_paraugs.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)	AIP tulkojums.docx	AIP_atzinums.edoc
Compliance of the joint study programme with the provisions of the Law on Higher Education Institutions (table) (if applicable)	translation (2) (1).docx	Kopīgās studiju programmas atbilstība Augstskolu likuma prasībām (2) (1).docx
Statistics on the students in the reporting period	On student statistics in the doctoral study program.pdf	Par studējošo statistiku doktora studiju programmā.pdf
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	study course mapping.pdf	studiju_kursu_kartejums .rtf
The curriculum of the study programme (for each type and form of the implementation of the study programme)	study courses plan.pdf	pilna_laika_studiju_planojums.rtf
Descriptions of the study courses/ modules	kursi_ENG.zip	Kursi_LV.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)	Confirmation - on compliance of the academic staff of the doctoral study programmes.edoc	Apliecinājums - LZP eksperti doktora programmā.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)	Confirmation - on compliance of the academic staff.edoc	Apliecinājums - AL 55. pants par prof. skaitu akadēmiskās programmās.edoc