# APPLICATION

## Study field "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering" for assessment

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| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| Title of the higher education institution | *Rīgas Tehniskā universitāte* |
| Registration code | *3341000709* |
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# Self-evaluation report

Study field "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering"

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 directions and number of study programmes in December 2021:

| **Study direction** | **Number of study programmes** |
|---|---|
| Architecture and Construction | 20 |
| Economics | 3 |

| Study direction | Number of study programmes |
|---|---|
| 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* |
| Production and Processing | 6 |
| Translation | 2 |
| Management, Administration, Real Estate Management | 21 |
| Environment Protection | 6 |
| **Total:** | **163** |

* Eight study programs 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 14 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 December 2021, 13,237 students studied at RTU – 9,791 studied at undergraduate study programmes, 2,951 studied at graduate Master degree programmes and 495 – 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 systems 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 must be established by 31 January 2022, a new Constitutional Assembly must be elected by 30 April 2022, and a new Constitution must be developed and adopted by 1 June 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.

Amendments to the Law envisage the introduction of a new internal management institution in higher education institutions established by the state – the council of the higher education institution. It will be 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 will consist 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 will allow 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 will also have a representative nominated by the President of Latvia, thus facilitating strategical focus of the university according to development goals of the state. Until the establishment of the council, the senate shall continue to perform its functions as provided for by the constitution of the higher education institution.

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 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.**

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| 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 directions and study programmes, the changes to the study directions and programs and the annual reports of the improvement of the study directions. At RTU, the operation of the internal quality assurance mechanism takes place at the level of the Rectorate, faculties, study directions 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. |

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|---|---|---|
| 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. |

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|---|---|---|
| 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 at the Meeting by the resolution of RTU Vice-Rector for Academic Affairs No 02000-1.1-e/8 as of 1 February 2021of RTU Senate on 27 January 2014, Minutes No 577). 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 3.1. of the self-assessment report. |

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| 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 direction, internal quality is ensured by the Faculty Council, the Study Direction Committee and Directors of the study direction, 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 Direction Committees monitor academic activities in the relevant study direction and are responsible for the curriculum and quality of the study programmes within the study direction, including the accreditation of the study direction. Inclusion of employer representatives in the Study Direction Committee is a mandatory requirement. Study Direction Committee acts in accordance with the "Regulation of the Study Direction Committee" (approved by the Resolution of RTU Senate Meeting on 2603 December April 20212, Minutes No 594649). The basic tasks of the Study Direction 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 direction 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 direction self-assessment report as well as the annual reports on study direction 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 directions; (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.

The title of the study field "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering", alongside with mechatronics and transport, covers all programs in this field at Riga Technical University (RTU). The implementation of the programs included in the course of studies is in full conformity with the basic operational tasks of RTU as defined in Article 6 of RTU Constitution: "The task of RTU is to educate and train scientists, engineers, economists, administration and management specialists, architects and pedagogues at international level, to ensure the indivisibility of studies and research work and to develop the science sectors relevant to RTU profile, paying particular attention to the priority science sectors of the national economy.

The main objective of RTU Strategy for 2014-2020 is to ensure the implementation of the leitmotivs of the National Development Plan of Latvia for 2014-2020 – to implement the economic breakthrough in Latvia.

The vision of Riga Technical University is to become the leading science and innovation university of the Baltic States by 2020, while RTU Strategy for 2020-2025 (approved by RTU Senate on 21 December 2020) further specifies it: to implement RTU vision by 2025 – an internationally competitive, dynamic and modern university of research and technology. In order to implement this vision, three objectives of the University have been defined in the previous strategy – a quality study process, excellent research and sustainable innovation and commercialization (valorization) activities. The new strategy has been supplemented with the fourth objective – institutional excellence – improvement of the University support function and the development of internal governance. Six sub-objectives have been defined for institutional excellence: digitalization, sustainable development, effective financial and administrative development, internationalization, communication and cooperation, human resources development. All objectives identified in the strategy have the specific tasks and performance indicators defined allowing to monitor the implementation of the strategy and allowing RTU to implement its vision by 2025.

The Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA), which changed its name in 2015 (by 2015 – the Faculty of Transport and Mechanical Engineering), has made significant structural changes by reducing the number of institutes, identifying new tasks and fully integrating in the fulfilment of the strategic tasks of RTU by 2025, promoting the establishment of the internationally recognized, modern and prestigious Riga Technical University, leading research and innovation  institution of the Baltic States as a fundamental cornerstone of the educational and scientific development of the Republic of Latvia. The main goal is to ensure training of specialists that would be competitive in the Latvian and international labor markets within the study field “Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering”.

The implementation of study programs of the study field also complies with the main goal of the FMETA, as set out in Part 2.1 of the FMETA Statute: the goal of FMETA operation is “to provide competitive and internationally recognized high quality studies to enable students to obtain the Bachelor, Master and PhD degree and professional qualifications in engineering, as well as to promote scientific and applied research development, innovation and technology transfer and lifelong learning in mechanical science, transport and aeronautics.”

In conformity with RTU strategy, the goal of study programs of this study field is to ensure professional Bachelor, Master, PhD education in "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering", as well as in engineering of road transport, railways, aviation and transport systems, heat power and heat engineering, design and manufacturing of machinery and apparatus, medical engineering and physics, in order to provide undertakings in that sector with the required number of specialists of appropriate qualifications, and the required performance of scientific research and innovation.

Every year, the FMETA, represented by its dean, concludes an agreement with RTU Rector on the performance of the study process and the scientific process indicators, thus stimulating the achievement of the strategic objectives of all organizational units involved.

The initial stage of the Bachelor program “Heat Power and Thermal Engineering” is also implemented at RTU Daugavpils (academic years 1 and 2) and Liepāja Study and Science Centers (academic year 1).

A significant place in the development of the study field is given to a new joint infrastructure of the FMETA in Ķīpsala – the Laboratory House to which some FMETA laboratories moved and the study process was started in academic year 2017/2018. In the autumn of 2017, renovation of the new FMETA study facility was launched in Ķīpsala where the former Faculty of Architecture and the Faculty of Civil Engineering were located, and at the end of 2018, transfer to the new premises took place, as envisaged by RTU Strategy, by concentrating resources in Ķīpsala campus – "City within the City". On 1 September 2019, the FMETA started studies in the new premises at 6B Ķīpsala Street. Currently, only the Institute of Aeronautics (hereinafter – AERTI, which was established in 2012 by merging the Institutes of Aviation and Transport) is partly located in the old premises on Lauvas Street, where the study process is also taking place. Preparations have been launched for the construction of a new hangar of AERTI in Ķīpsala for ensuring the process of studies and research in order to unite the entire training process of the study field in Ķīpsala.

The purpose of setting up shared laboratories is:

- to increase the capacity of the laboratory premises;
- to exclude duplication of laboratory equipment;
- to achieve high-quality implementation of the common courses of the FMETA by concentrating the laboratory resources;
- to ensure the obtaining of a high-level engineering education in the study field "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering" for students of RTU Foreign Students Department (FSD) in English.

A major link of the study field to RTU Strategy is the internationalization of the study process, which aims to increase the number of foreign students relative to the total number of students. The table provided below shows the evolution of the study field addressed in the Annual Assessment of Performance of Strategic Indicators for 2015-2021. Five Bachelor study programs, five Master study programs and three PhD study programs are being implemented in English.

| No | Indicator | Study level* | AY 2015/2016 | AY 2016/2017 | AY 2017/2018 | AY 2019/2020 | AY 2020/2021 |
|---|---|---|---|---|---|---|---|
| 1.1. | Number of students | K | 58 | 33 | 16 | – | – |
| | | B | 1721 | 1724 | 1698 | 1599 | 1 492 |
| | | M | 375 | 341 | 351 | 446 | 339 |
| | | D | 91 | 84 | 72 | 87 | 58 |
| 1.2. | Number of graduates | K | 18 | 19 | 12 | – | – |
| | | B | 195 | 173 | 239 | 192 | 158 |
| | | M | 122 | 108 | 88 | 131 | 119 |
| | | D | 7 | 2 | 2 | 4 | 8 |
| 1.4. | Number of foreign students out of the entire number of students | K | | | – | – | – |
| | | B | 165 | 190 | 272 | 338 | 281 |
| | | M | 68 | 78 | 140 | 242 | 123 |
| | | D | 5 | 5 | 6 | 14 | 7 |

The data in the table above demonstrate an increase in the number of foreign students. The number of students of the Master programme is decreasing and correspondingly the number of graduates of the Master programme. The College programmes are gradually closed. Overall, there are 20 study programmes at the undergraduate, graduate and postgraduate levels .

The programmes of the study field educate and train multiskilled engineers who can work at Latvian enterprises operating in machinebuilding, metalworking, woodworking, food production, health care and other areas, as well as are able to conduct research. The programmes also educate specialists for the industrial and research needs of other countries by training foreign students. In recent years, intensive modernisation processes have been taking place in the industry enterprises; foreign companies with new technologies are coming to Latvia, and cooperation with companies from other countries is expanding. The FMETA has very tight cooperation with the Association of Mechanical Engineering and Metalworking Industries of Latvia (MASOC), which unites over 160 leading machinebuilding and metalworking manufacturing enterprises and the related industry companies. MASOC enterprises, in total, have about 10000 employees, and the total turnover of the enterprises in 2017 exceeded EUR 730 million (*https://www.masoc.lv*). According to the MASOC data, the production volume increases by 10–15 % annually, the demand for highly skilled engineering specialists is growing rapidly, more so because the Latvia's long-term economic strategy approved by the Cabinet and the guidelines for industrial development set the task to stimulate knowledge-based and scientific development-based industrial growth with the use of high-tech and skilled workforce, which results in increased industrial efficiency and competitiveness on the global market. There is a high demand for specialists with design competencies in the development of end products.

There are five science-intensive areas set in Latvia. As part of this industrial policy, these areas are at the forefront of the debate, taking into account their contribution to the national economy and their future potential transformative nature towards higher value-added activities. The areas where Latvia has resources and competencies available and which form the concept of the Latvian Research and Innovation Strategies for Smart Specialisation (RIS3) are the following:

1. Science-intensive bioeconomy;
2. Biomedicine, medical technologies, pharmacy;
3. Photonics and smart materials, technologies and engineering systems;
4. Smart energy and mobility;
5. Information and communication technologies.

Although the restrictions caused by *Covid-19* affect the economy in a negative way at the moment, still economic development challenges such as the need to increase exports and productivity of Latvian goods and services do not change in the medium term. The previously started initiatives of the European Commission have been also retained, e.g., the European Green Course and Digitalisation [Guidelines on National Industrial Policy for 2021-2027 [viewed on 12 December 2020]; 86 p. https://www.em.gov.lv/en/industrial-policy-1].

Latvia has not only developed the ability to adapt to climate change as one of the prerequisites for future competitiveness, but also manged to become one of the leading countries able to create new business models, develop innovation and offer competitive world-class solutions to climate change challenges, using it as an opportunity for Latvia's economic development. With account of the horizontal impact of the area on all sectors of the national economy, support for this area and competitiveness is particularly important. Demand for green energy generation and integration solutions will only grow.

In December 2020, the Parliament and the Council reached a preliminary political agreement on the EU Space Regulation, bringing together all components of the EU space programme and a budget of EUR 13 billion (the largest in the field of aerospace in the EU so far). The new regulation reflects the EU's increasing engagement and ambitious aerospace objectives beyond the Copernicus and Galileo Framework Programmes, including new actions to support space security, independent access to space and space entrepreneurship. It lays down new requirements for high-level professionals in sectors where it is not yet possible to define the skills of professionals required by higher vocational training at the level of occupational standards. Therefore, the proposal of the study field is a change in the name of transport system engineering programmes and a transition from professional programmes to academic ones.

In all transport areas, demand for specialists with knowledge in technological and technical support of transport systems will increase in the coming years. In the international division of labour, transport activity depends on the quality and effectiveness of the development of external economic links for each country. The most advanced technologies related to so-called multimodal and intermodal transport, which include the use of all major modes of transport (railway, road, marine, aviation and pipeline) in their optimal combination, play a particular role in modern transport systems. The direction indicated is one of the most sophisticated and intensive from a technical and technological point of view.

Road transport plays a major role on the freight and passenger transport market – up to 39% of freight and 64% of passengers are transported by road.

Latvia has developed transport infrastructure and the National Transport Development Programme approved by the Cabinet prescribes the main guidelines for the training of highly skilled specialists in road transport.

Riga Technical University has been educating and training road transport engineers since 1977 and is currently the only higher education institution in Latvia where higher education can be obtained in this speciality.

The professional Bachelor and Master study programmes “Railway Engineering” educate and train speicalists in the railway transport sub-sector; the graduates are able to work at railway undertakings and organisations, as well as at research and educational establishments performing development and maintenance of efficient technological systems and processes for railway transport related to the technical, organisational and management support of freight and passenger transport. The professional Bachelor study programme “Railway Engineering” also prepares students for further studies at the graduate level.

According to Cabinet Order No 746 of 12 October 2017 “On Priority Areas in Science in 2018-2021”, the priority areas in science are defined as technologies, materials and engineering systems for increasing the added value of products and processes and for meeting cybersecurity needs.

The field of medical engineering and physics involves innovative and improved materials, smart technologies (multifunctional materials and composites, nanotechnologies), as well as public health, including the development of prevention, diagnostics, treatment methods and technologies, medicines and biomedical technologies. The FMETA implemens study programmes in medical engineering and physics, as well as in nanoengineering. These study programmes are based on knowledge and scientific achievements in physics, engineering, medicine, manufacturing, environmental protection, economics, entrepreneurship, etc. The development of study programmes involves and will continue involving in the coming years leading specialists in the status of guest lecturers, whose area of operation is medical engineering and physics, as well as nanoengineering, thereby improving the content of study courses. The themes of study projects and graduation papers are not isolated from practical life, they are proposed by future employers at places of internship – they address real problems, improve existing and build new equipment.

Recruitment of new scientific staff and academic staff is promoted through post-doctoral projects.

The Institute of Aeronautics of RTU FMETA is the only state-funded university which offers the possibility of acquiring professions such as an aircraft maintenance mechanical engineer, aircraft maintenance avionics engineer and transport systems engineer. Moreover, it is the only institute offering integrated professional Bachelor studies and training in accordance with Regulation (EC) No 1321/2014, Parts 66 and 147, when graduates receive not only a diploma for obtaining a professional Bachelor degree but also a certificate for the acquisition of the profession recognised in the industry.

Studies are provided by a maintenance training organisation of the Institute of Aeronautics, which introduced a training and quality management system in 2014 that complies with the requirements of the European Aviation Safety Agency (EASA) and the Latvian Civil Aviation Agency (LV CAA), which allows educating and training certified aircraft maintenance specialists.

The AERTI study process, in accordance with the requirements of EC Regulation 1321/2014, parts 147 and 66, is attested by the Approval Certificate issued by the Latvian Civil Aviation Agency of the European Union — Reference LV.147.0003 of 8 September 2014 awarded to the Institute of Aeronautics. The maintenance training organisation is supervised by the LV CAA and EASA, which perform regular and extraordinary audits.

The first EASA extraordinary audit took place in 2017. Every year, a supervision audit is held by the Latvian Civil Aviation Agency quarterly.

During the audit, the premises of the study process and the related laboratories, lecture rooms, practice laboratories are checked and expert assessment of the AERTI library funds is provided. The expert opinion was positive in the reporting period. As the only institute in Latvia, the AERTI can continue the integrated training of students, take examinations for issuing recognition certificates approved by the EASA.

The academic Bachelor and Master study programmes “Engineering Technology, Mechanics and Mechanical Engineering” offered by RTU Institute of Mechanics and Mechanical Engineering are the only academic programmes of such type in the Baltics. Out of all EU neighbouring countries (Lithuania, Poland, Sweden, Finland, Estonia), such academic programme (*Engineering Mechanics*) is available only in Sweden (KHT – Royal Institute of Technology).

In line with RTU Strategy, ESF projects of Operational Programme 8.2.1 Growth and Employment under the specific support objective “To reduce the fragmentation of study programmes and strengthen resource sharing” and Operational Programme 8.2.2 Growth and Employment under the specific support objective “To strengthen the academic staff of higher education institutions in areas of strategic specialisation” are implemented from academic year 2018/2019 to 2022. The projects have resulted in changes to the programmes of the study field. The professional Bachelor study programme “Railway Engineering” has been established during the implementation of the project, combining the study programmes “Railway Transport” and “Railway Electrical Systems”. Similarly, the professional Master study programme “Railway Engineering” was established, combining the study programmes “Railway Transport” and “Railway Electrical Systems”. These modifications have resulted in a reduction in the number of specialisations and a change in professional qualifications in line with the new occupational standards. The Doctoral study programme “Mechanical Engineering and Mechanics” has been established, combining the Doctoral programmes “Production Technology” and “Engineering, Mechanics and Mechanical Engineering.” The modified programme provides for the possibility to continue all Master study programmes and promotes mutual cooperation in the implementation of the study programme. A new Doctoral specialisation “Nanoengineering” has been established which will create conditions for the development of top-level research in the internationally recognised sector, using research facilities and research staff capacity available in the study field.

List of RTU Study Programmes of the Study Field "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology and Mechanical Engineering" is shown in Table.

| Code | Title | Level | Title and level from 2013 to 2021 | Organizational unit |
|---|---|---|---|---|
| MDT0 | Transport | PhD Study | | Institute of Aeronautics |
| MGL0 | Aerospace Systems Engineering | Academic Master Study | Transport Systems Engineering Professional Master Study | Institute of Aeronautics |
| MCL0 | Aerospace and Transport Systems Engineering | Academic Bachelor Study | Transport Systems Engineering Professional Bachelor Study | Institute of Aeronautics /AERTI |
| MCA0 | Aviation Transport | Professional Bachelor Study | | Institute of Aeronautics |
| MGA0 | Aviation Transport | Academic Master Study | Professional Master Study | Institute of Aeronautics |
| MDC0 | Mechanical Engineering and Mechanics | PhD Study | | Institute of Mechanics and Mechanical Engineering (IMME) |
| MMR0 | Production Engineering | Academic Master Study | | Institute of Mechanics and Mechanical Engineering (IMME) |
| MCN0 | Mechanical and Instrumental Engineering | Professional Bachelor Study | | Institute of Mechanics and Mechanical Engineering (IMME) |
| MCE0 | Mechatronics | Professional Bachelor Study | | Institute of Mechanics and Mechanical Engineering (IMME) |
| MMM0 | Engineering Technology, Mechanics and Mechanical Engineering | Academic Master Study | | Institute of Mechanics and Mechanical Engineering (IMME) |
| MBM0 | Engineering Technology, Mechanics and Mechanical Engineering | Academic Bachelor Study | | Institute of Mechanics and Mechanical Engineering (IMME) |
| MCX0 | Industrial Design | Professional Bachelor Study | | Institute of Mechanics and Mechanical Engineering (IMME) |
| MGG0 | Heat Power and Thermal Engineering | Professional Master Study | | Institute of Mechanics and Mechanical Engineering (IMME) |
| MCG0 | Heat Power and Thermal Engineering | Professional Bachelor Study | | Institute of Mechanics and Mechanical Engineering (IMME) |
| MGF0 | Medical Engineering and Medical Physics | Professional Master Study | | Institute of Biomedical Engineering and Nanotechnologies (IBEN) |
| MCF0 | Medical Engineering and Medical Physics | Professional Bachelor Study | | Institute of Biomedical Engineering and Nanotechnologies (IBEN) |
| MCH0 | Railway Engineering | Professional Bachelor Study | | Institute of Transport (IT) |
| MGH0 | Railway Engineering | Professional Master Study | | Institute of Transport (IT) |
| MCU0 | Automotive Engineering | Professional Bachelor Study | Automotive Engineering | Institute of Transport (IT) |
| MGU0 | Automotive Engineering | Professional Master Study | Automotive Engineering | Institute of Transport (IT) |

The main contractor and recipient of the personnel is the mechanical engineering industry. The Association of Mechanical Engineering and Metalworking Industries of Latvia (MASOC) indicates that production in Latvia has stabilised and demand for engineers is increasing; thus, the number of students can be planned to increase. According to the MASOC data, there are currently about 23000 people working in the sector. International experience has shown that the minimum number of engineering workers should be 10% of the total number of workers, and in order to develop the sector, the number of engineers should grow to 15%-20% of the number of workers. Also, an industry survey conducted by MASOC in February/March 2021 shows that for the industry to develop successfully, it needs about 270 new competitive engineers every year (designers, technologists, mechanics, mechatronics, industrial design engineers) who are able to identify market niches and create new products.

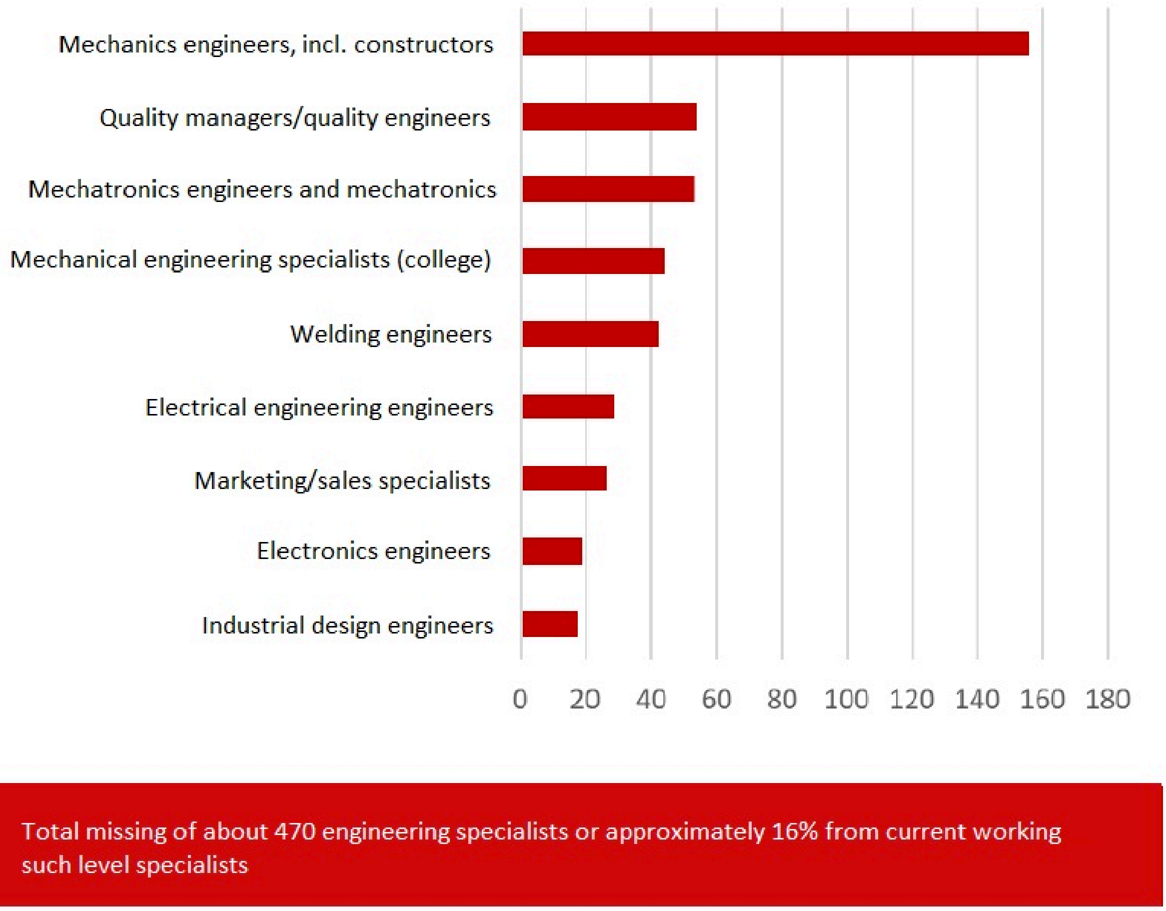



Fig. 1. Specialists required additionally for the machinebuilding and metalworking industry

According to the medium and long-term forecasts of the Ministry of Economics, the labor market situation will continue to improve gradually in the coming years, with the number of employees increasing by around 50 thousand by 2022, while the unemployment rate will reduce to 6%. However, the development of the national economy is increasingly affected by discrepancies between labor demand and supply: surplus of specialists in the fields of humanities and social sciences, a strong lack of high-skilled science, ICT and engineering professionals and the workforce with vocational training, a significant number of young people entering the labor market without a profession and a high share of the low-skilled labor force.

**Discrepancy between higher education supply and labor market demand.** The surplus of specialists in the fields of humanities and social sciences will increase in the coming years (surplus ~ 10 thousand in 2022), while shortages will occur for science, ICT and engineering specialists (deficit ~ 16 thousand in 2022).

**Shortage of workforce with secondary vocational education**. Over the last 10 years, the number of economically active residents with secondary vocational training fell by a fifth, with similar rates of labor supply decreasing further. This may result in a shortage of labor with secondary vocational education of ~ 30 thousand in the medium term, with a shortage of virtually all thematic education groups, particularly engineering and manufacturing.

**A high proportion of young people entering the labor market without specific specialties and skills.** Around 30% of graduates in general secondary education do not continue their studies at higher education establishments, while demand for such workforce is declining. If this proportion remains unchanged, in 2022 more than 25 thousand young people without obtained qualifications or skills will have problems in finding work.

In order to reduce labor market disproportions, substantial changes in the supply of education are needed, which would address both the qualitative aspects of the supply of education and ensure the necessary scale of impact on the labor market. In view of this fact, the Ministry of Economics considers that by 2020 the education supply should achieve the following objectives:

- to increase significantly the number of pupils in secondary general education who are able to pass exams successfully (to have at least 50% or to reach Level B2 of a foreign language) in mathematics – from 36% to 55%, in science – from 18% to 40% and in foreign languages – from 28% to 65% out of the total number of pupils who take centralized exams;
- in higher education, to achieve an increase of graduates in science and engineering from 20% to 30% out of the total number (Mid- and long-term forecasts of the labour market https://www.em.gov.lv/lv/aktuali/10556-darba-tirgus-videja-un-ilgtermina-prognozes).

In the process of training transport system engineers, contacts with the following leading organizations are maintained: Ministry of Transport, Latvijas Auto Association (LATAUTO), Latvian Passenger Carriers Association (LPPA), Latvian Transport Development and Education Association, Latvian National Association of Freight Forwarders and Logistics (LAFF), Latvian Transit Business Association, Civil Aviation Administration (CAA), DHL Latvia, DPD Latvia, Schenker, LAS-1 engineering and manufacturing company,  ANS, Rīgas Satiksme Riga municipal Ltd, organizational units of Latvijas Dzelzceļš SJSC, Lokomotīve JSC, Rīgas Vagonu Rūpnīca, passenger and freight railway and expedition firms, Spektrobalt vehicle repair firm, Mūsa Motors Rīga Ltd., AirBaltic Latvian national air carrier,  Aviatest, Auteco TUV Latvija Ltd, Skandi Auto Ltd, Domenikss Ltd, Folksvagen Cents Rīga,  LAPA, Metalserviss, BELAM-Rīga, KARSTEN Latvian Ltd, COLLA, RB Engineering, SIEMENS, Production MACHINERY, etc.

The study program “Railway Transport” is unique and the only one where the professional Bachelor and Master degrees in railway transport can be obtained, which is very much required by Latvijas Dzelzceļš SJSC and enterprises related to railways (Ritošais Sastāva Serviss JSC, Pasažieru Vilciens JSC, LDz Cargo Ltd, etc.). This is confirmed by the fact that, despite the large number of students enrolled for the state-funded study positions and the considerable number of part-time students, for the fourth year in succession (during the period from 2015 and 2019), the Institute of Transport has been admitting employees of Latvijas Dzelzceļš SJSC and its subsidiaries for part-time studies on a certain tuition fee basis. As of 1 September 2016, 302 students were trained at the study program “Railway Transport”, of which 72 were part-time students. In recent years, due to political circumstances, there has been a decrease in the number of employees of Latvijas Dzelzceļš SJSC, which has significantly reduced the number of students in the new study program “Railway Engineering”. There is an increase in the number of students expected due to the active start of the construction of the new RAIL BALTICA railway line, which requires civil engineering personnel able to provide maintenance on European railway standards and signaling systems. The challenge for young specialists will be the ability to develop the railway infrastructure on the European and also the old rails. The study programs have been supplemented with a large number of study courses related to information technologies and programming, which allows to expand the range of knowledge of the future specialist, not only in the field of railways, increase his competitiveness in the labor market providing further work also as a specialist with IT and programming skills in transport - related companies.

The labor market demand for specialists in the field of medical engineering and physics is growing steadily both abroad and in Latvia. New medical technologies and equipment requiring qualified installation appear on the market, and their maintenance requires appropriately educated specialists. There is a demand for a large number of Latvian specialists due to staff changes – a lot of the most active and erudite young people work at Latvian companies for a while, gain their work experience and practical skills, and then go abroad to extend their knowledge and stay working there. This is due to relatively low wages, inappropriate working and living conditions, etc.

The first graduates of the Medical Engineering and Physics program have been employed in Latvian hospitals since 1995. In accordance with the agreement concluded between Riga Technical University and Riga Stradins University on April 3, 2014, the bachelor's professional education study program “Medical Engineering and Physics” has been available since 2014/2015. academic year as a joint program of Riga Technical University and Riga Stradins University (according to the criteria of Article 55.1 “Joint Study Program” of the Law on Higher Education Institutions). From 2021, the standard of the profession of medical physicist for master's education in Latvia was approved and accordingly improved in the professional master's study program “Medical Engineering and Physics” in order to award graduates a 5th level professional qualification corresponding to the 7th framework level of Latvia. These changes are in line with the recommendations of the European Federation of Medical Physics Organizations (EFOMP) for the certification of medical physicists.

Currently, graduates of the Medical Engineering and Physics program work in hospitals (Riga East University Hospital, Pauls Stradins Clinical University Hospital, Daugavpils Regional Hospital, Liepaja Regional Hospital, Latvian Maritime Medicine Center, Riga 1st Hospital, etc.), enterprises providing calibration and inspection of medical equipment (INLab Ltd, Amerilat, Rola, etc.), equipment distribution and maintenance companies (ARBOR Medical Corporation Ltd, Siemens, Tradintek, A Medical, AB Medical Corporation), higher education institutions (RTU, P. Stradins Medical College, University of Latvia, RSU) and state institutions (State Environmental Service of the Ministry of Environmental Protection and Regional Development, Latvian National Accreditation Bureau, Health Inspectorate). A majority of the aforementioned enterprises are involved in providing internship for students. Students undertake the designer’s technological internship at different enterprises engaged in manufacturing and designing of equipment and materials, such as Severstallat Ltd, Alfa, etc. When interviewing employers on student knowledge and practical skills, 80% of them note that young professionals lack practical skills, but overall, the training complies with the market requirements. Some of the graduates work abroad: Thomas Hospital (UK), Heidelberg University Hospital (Germany), Euratom, International Atomic Energy Agency, etc.

Graduates who have developed their future careers abroad are able to express themselves creatively when dealing with a variety of complex engineering issues, they have a greater ability to focus on broad-profile issues compared with graduates from foreign universities. This may be due to the universal training approach, providing basic skills in computer science, electronics and mechanics – in all basic sciences related to equipment, their design in medicine, and the possibility of majoring in medical physics, biomechanics, prosthetics, medical electronics, computer science for medicine, biomaterial science, entrepreneurship in medical technologies.

The specialization of nanoengineering at the Doctoral study program “Mechanics and Mechanical Engineering” is incorporated based on the long-term research initially implemented by the Institute of Biomedical Engineering and Nanotechnology (IBEN) in cooperation with other researchers from RTU faculties. During the reporting period, students of the Master study program “Nanoengineering”, which included areas such as nanobiotechnology, nanomechanics, nanomedicine and environmental nanotechnologies, also gained practical skills during their internship. There is a demand for graduates of this program on the part of Sidraba JSC, Alfa RPAR JSC, Baltic Scientific Instrument JSC, while the main aim of the program is to educate and train specialists for the future, for the development of nanotechnologies in Latvia. In general, findings of the employer survey demonstrate that graduates of the study program are competitive in changing socio-economic conditions. The basic knowledge provided to students in the study program “Nanoengineering” is extensive; however, there is a small number of companies where students of this program have the possibility to undertake internship in Latvia. Due to a small number of students, the program is not directed for accreditation. In order to promote the development of companies operating in the field of nanoengineering in Latvia, it is necessary to educate and train specialists with relevant thinking skills and knowledge in nanoengineering. Work is still ongoing on the establishment of a new inter-university study program “Nanoengineering”, developing an occupational standard and approving it.

Students and graduates of the professional study program “Heat Power and Heat Engineering” are currently enjoying high demand on the labor market; there is lack of specialists in the sector and it is often difficult to meet the employers' demand. This is confirmed by the fact that practically 100% of Master students have found a job in their specialty, and most senior undergraduates of Bachelor studies are also working.

The organizational unit implementing the program – the Department of Thermal Power Systems of the Institute of Mechanics and Mechanical Engineering – ensures contacts and information exchange with employers and the industry enterprises to a large extent through the cooperation with the Latvian Association of District Heating Companies (LSUA, *www.lsua.lv*), which unites over 60 companies, and these are actually all enterprises of the industry, including Latvenergo JSC and Rīgas Siltums JSC, which cover the entire territory of the country.

For example, Rīgas Siltums JSC ensured at its facilities minimum five paid internship places for 26 weeks for students of the Bachelor study program “Heat Power and Heat Engineering”. Agreement No 533 on student internship for an infinite period was signed in December 2012. Since 2014, the student internship has been paid up also by Latvenergo JSC. In recent years, all students have been ensured paid internship places; several cooperation agreements have been concluded with employers, for example, with Eco-Air Ltd.

The cooperation with employers takes place during student internship, as well as by inviting leading specialists of the industry to deliver some lectures within particular study courses.

Prior to each graduation, polling of graduates is conducted in the ORTUS environment. The results are taken into account in the program development and are discussed at methodological seminars of the program.

As from 8 September 2014, a quality management system has been introduced at AERTI in accordance with Parts 66 and 147 of Regulation (EC) No 1321/2014, which ensures the training and examination of students in conformity with the Regulation and allows issuing internationally recognized certificates to graduates. The AERTI is the only institution of higher education in Latvia that can perform the integrated training of students and take examinations. Upon completion of studies, a recognition certificate approved by the EASA is awarded to graduates. In the future, it is anticipated to adapt the existing quality management system to other AERTI study programs.

From 2015 onwards and every year thereafter, a survey of entrants is conducted on the acquisition of information during the enrolment period prior to the commencement of studies. The results obtained show that the dissemination of information on opportunities for study is sufficient, while 55% take decisions on studies at a specific program after the new year. Comparing the results of the 2015 and 2016 surveys, the study program was recommended by existing students or those who studied at the program – 6% in 2015, 20% in 2016, approximately 21-22% between 2017 and 2020.

### 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 development of studies is drawn up each year and evaluated by an expert appointed by the Vice-Rector for Academic Affairs. The report is approved by RTU Senate. A mandatory section of the development report is a SWOT analysis which allows for a focused presentation of the work done and an indication of the problems. It is an essential tool for achieving the aims of the study field.

**SWOT Analysis of the Study Field**

**Strengths**

- Within the framework of the study programs, it is possible to educate and train specialists who already are and will be in high demand for the national economy;
- An opportunity of obtaining simultaneously the professional Bachelor and Master degrees and the professional qualification;
- Qualified academic staff with a high potential for scientific research and industrial cooperation;
- RTU Transport Institute is the only educational establishment in Latvia where it is possible to obtain higher professional education in railway transport;
- Large and modern library available round the clock;
- Continuous development of the study process, with the involvement of students. Maintaining tight connections with students that allows solving issues related to the quality of studies efficiently;
- Wide international cooperation with foreign universities and the opportunities to study there.
- Available internship during the period of studies that allows performing the respective work yet while studying;
- Opportunities to continue studies at the next study level;
- Implementation of the studies ensures efficient and tight connections with employers that allows obtaining topical information on the labor market needs in Latvia and the development of national economy, as well as allows obtaining technical assistance;
- Material and technical resources for mastering the programs are sufficient, but not complete;
- There are laboratories already that comply with the requirements of the best foreign universities, for example, Mitutoyo Measurement Laboratory, CNC Machine Tool Laboratory, BOSCH Autodiagnostic Laboratory, Micro and Nanotechnology Laboratory (clean area);
- Tight cooperation with the industry associations;
- Graduation papers are evaluated by the State Examination Commission, where specialists of manufacturing enterprises are involved;
- Different exchange programs are available, as a result of which support to development of the internship and study process is provided.

**Weaknesses**

- There is still a problem of renewal of academic staff, as it is impossible to involve young people in engineering and research in these sectors within the limits of existing funding;
- The lack of qualified technical staff poses particular problems as low wage rates are not competitive in the labor market;

- A fundamentally different level of initial training of foreign students, different understanding of the cultural and educational process and motivation;
- Students are forced to work outside the training process in order to provide themselves, which in turn encumbers the study process;
- The internal distribution model of funding does not sufficiently stimulate cooperation in the development of joint study courses;
- Insufficient international cooperation between academic staff and little use of mobility opportunities;
- The study process is not adapted to the wide scatter in the level of preparedness of young students, leading to a large drop-out in the first year of study.

**Opportunities**

- Possible further financing of the program development from the EU structural funds, as well as other funding sources of programs and projects;
- Solution to the problem of renewal of academic staff and their professional development is the attraction of PhD students in the academic work and their support. However, it is hard to be implemented with the existing financing;
- More use should be made of the *ERASMUS* opportunities in student training and qualification upgrade of academic staff;
- To improve and develop modern training methods based on new information systems and technical means;
- To involve students in scientific research more extensively and to create lifelong learning programs;
- Improvement of existing study programs and development of new ones by evaluating changes in the industries related to the study fields in conformity with tendencies on the labor market;
- Development of graduation papers with project parts contributes to strengthening the scientific potential of higher education and cooperation with manufacturing companies;
- Participation in the consortium of *European University of Technology – EUt+* provides an opportunity to promote RTU competitiveness at the international level, thus helping develop knowledge directly related to the economic, scientific and political priorities of our region, creating mutual synergies;
- The European Green Deal offers great opportunities for development and significant transformation of the industries due to the rapid development of environmentally friendly, renewable energy and smart technologies, which foster closer interactions between different sectors of the economy and the study field.

**Threats**

- Academic staff, especially professors, are of the pension or pre-pension age. It is required to attract young academic staff;
- There are problems with funding allocation, resulting in increased spending on infrastructure maintenance, and a lack of resources to support and further develop the study process, no visits to the latest technology and science exhibitions;
- Due to material circumstances, almost all students and also academic staff work beyond studies at RTU or are in search for such work, there is no clear and stable system for remuneration of employees;
- High load of academic and organizational work for academic staff, leaving less opportunities to engage in research;
- Internal and external migration of best professionals to better paid jobs in manufacturing, no financial means of recruiting industry-leading specialists and guest lecturers for student

training;
- Students can be left without textbooks in Latvian, as academic staff do not write and publish textbooks (related to low salaries at RTU);
- Students are not sufficiently involved in research activities of academic staff;
- Poor knowledge of mathematics and physics among graduates of secondary schools poses challenges at the early stages of their studies and threatens the overall quality of studies.

**Strengths of the study field planned to base the development on**

- Qualified academic staff with a high potential for scientific research and industrial cooperation;
- Very high scientific qualification of academic staff characterized by the participation of three academics of the Latvian Academy of Sciences in science and study process;
- Within the framework of the study programs, it is possible to educate and train specialists, who already are and potentially will be very much required for the national economy in accordance with priority industries for its development;
- RTU Transport Institute is the only educational institution in Latvia in which it is possible to obtain the highest vocational education in railway transport specializations;
- The study program “Aviation Transport” of the Institute of Aeronautics is the only program financed by the state budget that offers the possibility of acquiring professions such as the mechanical engineer of aircraft maintenance and avionics engineer of aircraft maintenance;
- The Institute of Aeronautics has a quality management system introduced and a certification received that complies with the requirements of the European Aviation Safety Agency and the Latvian Civil Aviation Agency;
- The IBEN is the only institution that has a radiological training laboratory in Eastern Europe and Northern Europe;
- The IBEN is the only institution in the Baltics that offers the opportunity to acquire professions such as engineer of physical technologies in medicine and medical physicist;
- Department of Thermal Power Systems is the only organizational unit in Latvia implementing professional Bachelor and Master study programmes “Heat Power and Thermal Engineering” and training engineers and leading engineers in heat power and thermal engineering;
- There are laboratories already that comply with the requirements of the best foreign universities, for example, the Metrology Laboratory and CNC Machine Tool Laboratory;
- The AERTI and IMME renovate the research infrastructure by actively and successfully participating in EU research projects and structural fund competitions and through cooperation with companies such as INSTRO;
- Long-term and good contacts with the leading companies of the industry allow ensuring paid places of internship, excursions and joint events, and promote the qualification upgrade of students and academic staff;
- Tight cooperation with the industry associations.

To improve the training quality of students in the programs of the study field, as well as to modernize and improve the programs, the following activities are planned for 2020–2025:

- To cooperate more effectively with the leading specialists of the industry in order to improve the content of the program within specialized study courses;
- To make more use of the problems offered by companies in study projects;
- To attract professionals in implementing the study process – leading specialists of the industry;
- To facilitate qualification upgrade of the academic staff involved in the program implementation;
- To attract guest lecturers in the study process;

- To continue attracting new academic staff in the study process;
- To continue attracting PhD students in the study process;
- To improve study courses and learning methodologies by providing advanced learning materials and developing e-learning tools for students;
- To improve the quality of methodological materials and create new materials;
- To continue developing teaching methodological tools in Latvian and English;
- To ensure the internationalization of study programs by promoting the implementation of study programs in English and by attracting foreign students;
- To develop modules of new study courses;
- To continue marketing activities on study opportunities at programs and maintenance and replenishment of FMETA homepage;
- To expand and develop the existing library fund with specialized literature;
- To develop and improve the material and technical base of laboratories by actively engaging in the deployment of the new FMETA laboratory building and hangar in Ķīpsala;
- During the study process, to advertise recent major research in scientific and technical expertise of FMETA scientific laboratories and centers, including in the field of accident and disaster prevention in nature, transport and at home.

**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.**

Internal quality control at the faculty and at the level of the study direction is ensured by the Vice Dean for Academic Affairs. The quality of the study programme is ensured by the Head of the study programme and the academic staff involved in the implementation of the program, whereas the whole process is controlled by the administration of the responsible institute or department. Once in an academic year the abstracts and curriculum of the study programme, the methodological materials, as well as recent study literature and methodological guidelines for study papers (reports, study papers, internship reports and graduation papers) are reviewed. The academic staff and the administration of the study programme participate in various experience exchange activities, cooperating with the higher education establishments in other countries, participating in the meetings with representatives of relevant institutions and entrepreneurs, as well as discuss the current developments in the field, analysing the results of the students' research papers and projects.

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

RTU has established a rigid system for the management and development of study programmes. Proposals to introduce any changes in the curriculum are made by the Study Direction Committee based on the recommendations of the academic staff, references from employers, suggestions from student self-government, as well as observing the latest trends in the national economy and the labour market. The Study Direction Committee requests the Faculty Council to review and approve them. Based on the decision of the Faculty Council, the RTU Senate approves changes in the study direction. Amendments in the structure of study programmes are approved by the order of RTU Vice Rector for Academic Affairs. Technical support of the study direction is provided by the study programme record keeping as well as IT service. Such cooperation in the implementation of the study programmes within the study direction is to be evaluated as efficient and stimulating the development of the study direction.

**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 Regulations of the Cabinet of Ministers 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 29-34 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 12 percent. An applicant with a CE in mathematics of less than 12 percent may apply only for a tuition fee.

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 Regulations of the Cabinet of Ministers 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 of Ministers 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.

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 Department, bringing the required documents, within the admission deadlines. Documents necessary for the competition are compiled by RTU Doctoral Studies Department. After the collection of documents, the Doctoral Studies Department 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, it is planned to introduce electronic application also for tuition fee studies with the summer of 2021.

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/wp-content/uploads/sites/65/2021/02/09.-Procedure_for_Recognition_of_Competencies_Developed_Outside_Formal_Education.pdfis 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 direction 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 1997, the Researcher Code of Ethics 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” (approved by the Law “On the Constitution of Riga Technical University”, the law was adopted in the Saeima on 23 October 2014 (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 direction is one out of 12 study directions 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 direction 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 directions and programmes to be newly created, as well as changes to study directions and programmes, evaluate annual self-assessment reports of study directions. The internal quality assurance mechanism of studies at RTU is functioning at the level of administration, faculties, study directions and study programmes of the university.

Study Direction Committees at RTU supervise academic activities in the respective study direction and are responsible for curriculum of the study programmes within the study direction, including accreditation of the study direction. Members of student self-government are involved in ensuring the quality of the study direction 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.

**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 Direction Committee. The responsibilities and activities of the committees are regulated by the “Regulation on the Study Direction 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).

Expert assessment of the study programme is performed by the Study Direction Committee, then – by the Faculty Council or the councils of several faculties involved. The expert assessment procedure is finalized by the Study Department. The Study Direction Committee evaluates the quality of the draft study programme and the compliance of its curriculum to the planned aims and tasks.

**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 Student 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 Procedures stipulate how RTU students may submit suggestions and complaints concerning the study process and other issues and determine the terms for consideration and reply (if the applicant has provided contact details) of applications and summary of application statistics.

Under the new arrangements, a total of 295complaints/proposals have been received between August 2019 and September 2021, 28 of which have been submitted anonymously. Of the submissions 251 were complaints and problems and 27 were suggestions across nine topics (subject: the number of complaints or problems / the number of proposals received):

- Study process: 98 / 17
- Sports: 4 / 2
- IT issues: 18 / 6
- Maintenance of infrastructure issues: 7 / 3
- Accommodation related: 75 / 1
- Scholarships: 9 / 4
- Foreign students' questions: 16 / 4
- Library: 2 / 0
- Other: 22 / 7

Evaluating the submitted complaints on the issues of the study process, 18 of them are related to the planning of study schedules, non-timely posting on the portal ORTUS e-study system, another nine are related to the communication between academic staff and a student. Complaints have also been received about remote and face-to-face lecture planning - students are not able to move from home to the faculty and vice versa within the breaks. Proposals have been received for the development of new study programmes, introduction of additional classes, development of training for teaching staff related to the use of *Microsoft Teams* and *Zoom*. It is offered to consider purchasing a *Grammarly Premium* subscription for students, as well as to develop additional materials in the e-environment in order to better learn study courses, especially through distance learning. There are several complaints about the work of specific lecturers and the procedure of questionnaires about study courses, as well as about the non-observance of the procedure for organizing internships. There have been complaints about difficulties in arranging laboratory work when studies were held remotely, as well as about the timely transmission of information when it is necessary to connect to remote lectures. The new students have suggestions for timely information on practical matters related to university life, and now, during COVID, suggestions for organizing the study process so that everyone can participate.

In economic matters, complaints have been submitted about the cleanliness of shared facilities in faculties and the quality of water at drinking water points. In student accommodations - for the unavailability of tumble dryers as well as uncertainties about the procedure for allocating places.

IT issues are mostly related to system overloads, due to which it is not possible for students to authenticate on the ORTUS portal. A recommendation has been received regarding the security of the ORTUS portal URL, which raises students' concerns about the secure transmission of their data. There is also confusion about the presentation of lecture schedules and joining portal ORTUS. Several uncertainties about RTU e-mail operation and connection.

Complaints about sports issues concern the amount of money awarded to sports undergraduate (100 euros) and graduate (10 euros) students.

The problem was reported regarding the availability of the library's electronic systems and several uncertainties regarding the submission of scholarship applications, as well as about the procedure for announcing the results.

It has been proposed by foreign students to provide additional Latvian language training. Complaints have also arisen about the recovery of the deposit and confusion about the degree titles. There have also been complaints about communication with clerks, as answers are not always received, as well as several comments about the presentation of the lecture schedule on the portal ORTUS and the quality of remote lectures. Complaints and problems are related to the acquisition of specific study courses and various issues related to the study process and the possibility to receive a scholarship.

Other complain were about alleged harassment, as well as threats from other students and two suggestions for infrastructure improvements – the construction of roofed bicycle sheds, the lack of facilities around faculties and student accommodations and some applications about study payment issues.

**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.**

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).
- Revenue from allocation of foreign financial study grants for research 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 direction. 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).
- Compilation of RTU information materials, press, etc.

In order to analyse study directions 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 Direction 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 direction 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)).

RTU *Quality Management and Sustainability Unit* regularly conducts a survey of freshman students. The most recent survey was performed from October 17 to 27, 2020. A total of 359 students participated in the survey, including 44 FMETA students.

The survey included number of questions that provide answers on student experience at RTU and the beginning of studies:

- Admission process – accessibility of information, main sources of information, application for studies, admission itself.
- Anticipation, study process and study environment – first impressions.
- Why and when choice was made to study at RTU.
- Preconceptions of the RTU and the selected study programme.
- How students' perception of their studies in RTU has changed since the beginning of their studies.

More detailed survey details are given in the Annex First course student survey2020 MTAF.

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).

The most recent results of semester polling have been compiled for the autumn 2020 and spring of 2021. Participation of FMETA students was 29.5% in the autumn semester and 26.5% in the spring semester. The questions asked in the survey provide answers on the skills and attitude of teaching staff.

Similarly, graduate survey is regularly carried out. This is done by sending an individual letter by email. Recent results have been obtained by polling graduates of the 2019/2020 academic year. The survey shows the satisfaction of graduates with the RTU, the study programme, the acquired knowledge, the study environment and the accesabilty of information.

The results of the survey of students and graduates in the Annex. Employers' surveys are presented under the relevant study programmes.

In general, the assessment of students and graduates in the study field programmes is below the average rating of the RTU. The average value of the assessment of the course of study programmes is 4 (on the five-barrel scale), while the highest highest rating in the graduate survey was obtained by Engineering mechanics and mechanical engineering and Railway engineering (transport and electrical systems) programmes, while the lower progrmma of the Mahatronics studios is in certain areas of assessment. More detailed data in the annex.

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 Direction 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 direction 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 directions, 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. E-platform (responsible person – G. Alksnis, Head of the Program Management and Curriculum Design Unit);

State Education Information System (responsible person – I. Pujats, Project Manager of the Information Technology Department).

## 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 of Ministers 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 labor 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 programs 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 programs in the thematic areas of education for Bachelor and professional study programs 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 programs 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 programs 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 programs in the relevant thematic area of education;

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

Sb – study seat social security expenses at undergraduate, professional and Master study programs (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 programs 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 program 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.

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 programs 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 program 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 programs, for several academic years, a significant amount of the funding received has been channelled to the head of study program, 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 programs – both by aligning funding allocation periods and principles. The new Methodology2 provides funding for the structural unit responsible for the implementation of the study program 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 program, 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 program.

Analyzing the financing procedure of the study programs 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 program, as well as the number of students at the study program 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 program 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 program, thus ensuring an even more appropriate amount of financing for the implementation of study courses included in the study programs. 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:

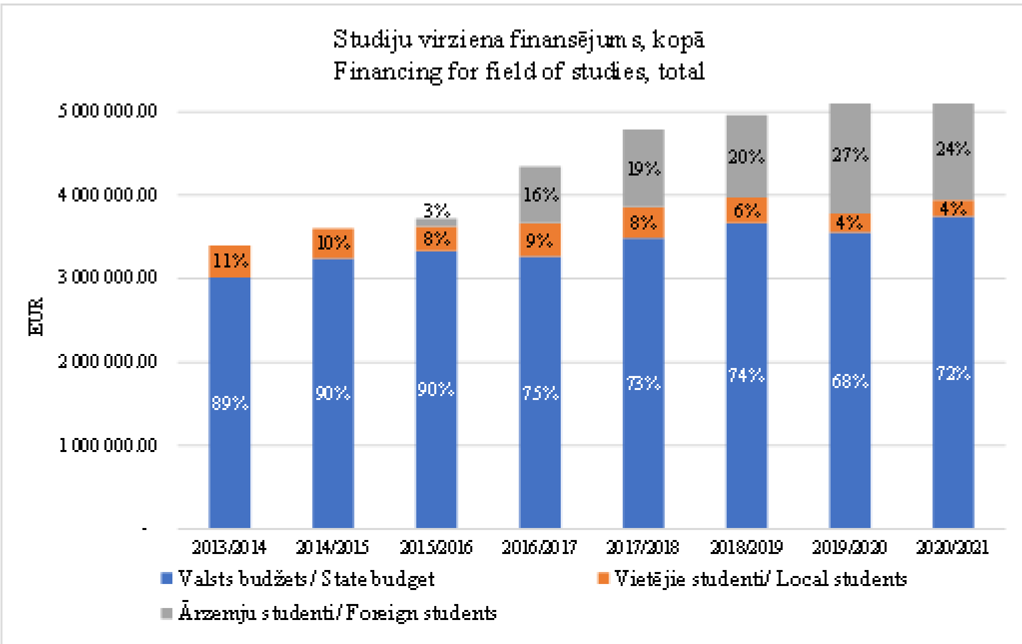
| Thematic area of RTU study courses | RTU coefficient |
|---|---|
| Architecture and urban planning | 3.5 |
| Aviation transport | 4.2 |
| Construction | 2.9 |
| Civil engineering and real estate management | 1.71 |
| Civil and occupational safety | 2.9 |
| Civil defence | 4.2 |
| Computing | 2.9 |
| 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 programs, where the total number of foreign students in all academic years is greater than or equal to 90. The study programs 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 programs.

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 50 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.

Funding of the study field “Mechanics and Metal Working, Heat Power, Heat Engineering and Mechanical Engineering” is stable and has a growing tendency. The main flow of funding for the study program is ensured by state budget subsidies. Meanwhile, revenue from tuition fees of students is growing with every year: in academic year 2013/2014, it constituted only 11%, whereas, with the increase of the number of foreign students, in academic year 2020/2021, revenue from tuition fees of local students (4%) and foreign students (24%) jointly constituted 28%.

During the reporting period, the total funding of the study field was EUR 35 203 162.59, of which the state budget funding was on average 78%, revenue from tuition fees of local students was on average 7% and that of foreign students was on average 15%. The amount of tuition fees of foreign students grew from zero in academic year 2013/2014 to EUR 1 426 801.49 in academic year 2019/2020 and slightly decreased up to EUR 1 247 525.56 in academic year 2020/2021, which could be explained by travelling restrictions asa result of the Covid-19 pandemic.




Financing of RTU study programs for field of studies “Mechanics and Metal Working, Heat Power, Heat Engineering and Mechanical Engineering”

Main organizational units using the FMETA funding of the study field “Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering”, and, thus, also funding to implement the study programs and activities involved in improving the study process (for example, scientific research bases) to support the included study programs are formed of the following sources:

- Subsidy from the state budget to implement the study program;
- Financing from undertakings and private individuals covering the tuition fee, including fees of foreign students;
- Financing from other sources (projects, contracted works, etc.): these funds are indirectly allocated to implementation of academic study programs – infrastructure was acquired for laboratories (equipment, inventory, etc.), practical classes (e.g., modelling computer programs) and lectures (e.g., scientific literature, databases of scientific articles);
- Indirect financing – (1) financing programs of the European Union and different countries for programs on upgrading the qualification of academic staff and (2) financing programs of the European Union and different countries for programs on implementation of exchange trips of academic staff and students. In view of the fact that such funds are not accounted directly at RTU financial systems, being often individual payments to academic staff and students, their financial summary is not available and is not reflected in the report.

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 centers 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 PhD students received a PhD research grant. Financial amount for one PhD grant was 10,000 EUR. Beneficiaries were elected to the position of research assistant or researcher. The aim of RTU PhD grants is to support research related to the PhD Thesis and to promote the viva voce of the PhD Thesis and to promote the viva voce of the PhD Thesis in the 4th year after the commencement of the PhD 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-2020/rtu.lv), which recognizes RTU Ķīpsala Campus as the 40th greenest campuses in the world and RTU – as the 95th 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 script 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 centers 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 dormitory (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 centers, 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 Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA) is located in Riga. A part of scientific laboratories is in RTU Laboratory House at 1 Paula Valdena Street. Some of the premises of the FMETA Institute of Aeronautics are at 8 Lauvas Street. There is a well-developed infrastructure at the FMETA location, with conveniently available public transport stops, cafes, a supermarket and a sports center.

The total area of the building at 6B Ķīpsalas Street is 12603 $m^2$. The occupied useful area of the FMETA building is 4365.9 $m^2$ with five floors, and WC facilities are provided on each floor. The Faculty has an access provided for people with special needs. Bicycle and car parking lots are available. The building has a specialized water drinking container, an elevator, an open student classroom/reading room, a number of recreational rooms, lecture rooms and rooms for academic staff, meeting halls, different laboratories, as well as automatic vending machines to buy various drinks and snacks.

Study Building at 6B Ķīpsalas Street

| Room type | Number of rooms | Useful area m² |
|---|---|---|
| Meeting rooms | 2 | 140.9 |
| Computer rooms | 6 | 387.3 |
| Auditoriums | 23 | 1424 |
| Teachers' rooms, cabinets | 53 | 1215.7 |
| PhD student premises | 1 | 55 |
| Library | 1 | 34.3 |
| Workspace / workshop | 3 | 72.8 |
| Laboratories | 17 | 793.6 |
| Offices | 4 | 154.2 |
| Recreation rooms | 2 | 53.1 |
| Student design bureaus | 1 | 35 |
| Total | 113 | 4365.9 |

Laboratory House /FMETA Laboratories/ at 1 Paula Valdena Street

| Room type | Number of rooms | Useful area m² |
|---|---|---|
| Auditoriums | 17 | 1650.7 |
| Teachers' rooms, cabinets | 2 | 39.5 |
| Laboratories | 3 | 331.4 |
| Auxiliary rooms | 10 | 168.4 |
| Total | 32 | 2190 |

Study Building at 8 Lauvas Street

| Room type | Number of rooms | Useful area m² |
|---|---|---|
| Meeting rooms | 1 | 63.8 |
| Computer rooms | 1 | 85.7 |
| Auditoriums | 21 | 1357.5 |
| Teachers' rooms, cabinets | 17 | 451.6 |
| Library | 1 | 169.1 |
| Laboratories | 5 | 378 |
| Auxiliary rooms | 1 | 20.1 |
| Total | 47 | 2525.8 |

With the support of ERDF funding, since 2019, the training process at the FMETA has been implemented in a new and modern house with a modern building management system with sensors, climate control systems, energy-efficient lighting and other things that serve also as an object of observation and research. Alongside with it, existing laboratories have been upgraded and new ones have been created:

**Computerized Work Table – CNC Laboratory**

The Computerized Work Table – CNC Laboratory, which is equipped in cooperation with the

Japanese company OKUMA and Naglis&Err company owned by RTU graduate Dzintars Naglis, was opened at 6k Ezermalas Street, Riga, on 13 September 2012. Now the laboratory is located in RTU Laboratory House in Ķīpsala at 1 Paula Valdena Street.

In the laboratory, students have two latest-generation CNC worktable machines with computerized lathe and computerized milling equipment. The agreement between RTU and the companies provides that, in about a half year, the existing devices are replaced by the next – even newer ones.

The equipment is used to train FMETA students and PhD students, OKUMA seminars are arranged in the laboratory and manufacturers of the respective fields are provided consultations.

Owing to the activity of NAGLIS & ERR Ltd, the manufacturer of tools Sandvik was attracted, this way developing the technical support of the CNC Processing Centre Laboratory even further.

**Mitutoyo Metrology Laboratory**

The Mitutoyo Metrology Laboratory, which is equipped in cooperation with the Japanese company Mitutoyo and with financial support from the Latvian company INSTRO, was opened on 25 September 2018 in Riga at Laboratory House of Riga Technical University (RTU), at 1 Paula Valdena Street.

The laboratory is equipped with the latest equipment developed by the Japanese company Mitutoyo, which is one of the most advanced measuring machines of this kind in the world. Students and academic staff have access to a variety of geometrical measurement machines, which are primarily used to control the quality of the manufactured parts, ranging from simple linear dimensions between two surfaces to complex control of the geometry of 3D surfaces and measurement of surface irregularity. The laboratory provides a detailed rounding control device, a contour meter, a 3D coordinate measuring machine, a 2D roughness meter, a non-contact 2D optical measuring microscope, parts height meters, as well as various hand tools for measuring.

The use of the laboratory for studies brings the skills and knowledge of young Latvian engineers closer to those of Germany, Austria, Switzerland and other countries that have long been known with their high level in practical terms, engineering skills thereby raising the quality level of RTU FMETA studies and making it more competitive and more relevant to the labor market.

**Automobile Operation Laboratory and Bosch Training Centre**

In cooperation with the Bosch technological company and with its financial support, the Bosch Training Centre was established in RTU Laboratory House, which is simultaneously the Automobile Operation Laboratory of RTU Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA). It was opened on 24 February 2016 in Ķīpsala, Riga, at RTU Laboratory House, at 1 Paula Valdena Street.

The latest technology developed by Bosch in the laboratory allows for theoretical and practical training of students and highly qualified car service workers.

It is possible to study electric and electronic automotive systems at the training center, which is particularly important when working with modern cars equipped with different electronic equipment. One can also learn how to operate modern car diagnostic devices, as well as interior air-conditioning systems and petrol and diesel injection systems.

RTU has concluded a long-term cooperation agreement with Robert Bosch Ltd that allows students of RTU Department of Automotive Engineering to work with the latest vehicle diagnostics equipment developed by Bosch. The equipment in this laboratory will be modernized in order to always provide the latest devices and computer programs. This way the goal is achieved — to allow students and academic staff to efficiently unite their theoretical knowledge with practice – real life and practical application.

**Welding Laboratory**

The Welding Laboratory, which is equipped in cooperation with the STOKKER company and with its financial support, was launched on 21 October 2017 at RTU Laboratory House, at 1 Paula Valdena Street.

In the laboratory, students will continue to have access to the latest generation of welding and cutting equipment. The laboratory consists of nine fully equipped welding cabins complying with modern safety requirements, equipped with welding or cutting equipment and having the necessary work protective devices, such as sound-insulating panels between cabins, curtains protecting against UV radiation and welding smoke filters. In each of the cabins, it is possible to perform welding activities safely and harmlessly for other people present.

The most important equipment installed in the laboratory is the Lincoln Electric PowerWave300C semi-automatic machine, which is equipped with dedicated computer programs for various types of welding processes, as well as an Internet connection that allows real-time monitoring of the operation, recording and analyzing the work parameters, setting restrictions on changes in the machine parameters and performing diagnostics of the machine remotely.

Another important equipment in the laboratory is SELCO Genesis 3200AC/DC AC/DC TIG 320A welding machine, which offers a full range of technologies currently available in the TIG welding industry, including the mixed AC/DC process for welding thick aluminium, etc.

The laboratory is also equipped with the plasma cutter Tomahawk 1025, the AC/DC TIG unit Invertec 205T AC/DC and the electrode welding unit Invertec 160SX. PLYMOVENT SFD filters with telescopic reception hands T-FLEX are installed for welding smoke filtration.

**Surface and Nanoobject Spectroscopy Complex – Laboratory of FMETA Institute of Biomedical Engineering and Nanotechnologies**

On 1 October 2021, a modern surface and nanoobject spectroscopy complex established by RTU FMETA was opened in the Laboratory House. The new equipment will allow students to obtain profound knowledge and will allow scientists to perform interdisciplinary research and have a tighter cooperation with the industry.

The complex provides for analysis of surface layers of one to 100 nanometers thick. For comparison, a human hair has a diameter of around 100 thousand nanometers. The new equipment allows for chemical and atomic composition analysis of compounds, reflected ion spectroscopy, low concentrations of material atoms and radicals, as well as nanomechanical tests such as measuring nanodentase, nanoscraping, nanthology and friction factors. The machines also allow testing of the surface properties of materials in a very wide range of temperatures — from plus 700 to minus 120 degrees. Names of the installed spectrometers: Thermo Scientific ESCALAB 250Xi (XPS), IONTOF TOF.SI MS 5 (SIMS).

Please find information about other laboratories in Section 3 comprising descriptions of the study programs.

### 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.**

The 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 a 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 direction “Mechanics and Metalworking, Heat Energy, Heat Engineering and Mechanical Engineering”, 736 new books were purchased by the SL amounting to 44759.88 EUR in the period of 2013 – 2020.

- At the request of the academic staff of the study programmes “Transport ”, “Automotive Engineering”, 99 new books were purchased by the SL amounting to 8739.2 EUR in the period of 2013 - 2020.
- At the request of the academic staff of the study programmes “Industrial Design”, “Engineering Design”, 43 new books were purchased by the SL amounting to 2952.49 EUR in the period of 2013 - 2020.
- At the request of the academic staff of the study programme “Heat Energy and Heat Engineering”, 56 new books were purchased by the SL amounting to 3945.71 EUR in the period of 2013 - 2020.
- At the request of the academic staff of the study programme “Engineering, Mechanics and Mechanical Engineering”, 61 new books were purchased by the SL amounting to 4233.86 EUR in the period of 2013 - 2020.
- At the request of the academic staff of the study programme “Medical Engineering and Physics”, 46 new books were purchased by the SL amounting to 7270.79 EUR in the period of 2013 - 2020.
- At the request of the academic staff of the study programme “Construction of Engine and Devices”, 69 new books were purchased by the SL amounting to 4975.24 EUR in the period of 2013 - 2020.
- At the request of the academic staff of the study programme “Technology of Production”, 56 new books were purchased by the SL amounting to 3578.22 EUR in the period of 2013 - 2020.
- At the request of the academic staff of the study programme “Mechatronics”, 14 new books were purchased by the SL amounting to 1024.82 EUR in the period of 2013 - 2020.
- At the request of the academic staff of the study programme “Aviation Transport”, 39 new books were purchased by the SL amounting to 2798.24 EUR in the period of 2013 - 2020.
- At the request of the academic staff of the study programme “Engineering of Transport Systems”, 253 new books were purchased by the SL amounting to 5241.31 EUR in the period of 2013 - 2020.

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 Search Complete EBSCOhost, Applied Science & Technology Source EBSCOhost, Business Source Ultimate EBSCOhost, EBSCOhost eBook Academic Collection, Wiley Online Library, SpringerLink, The International Monetary Fund.
- The SL also has access to databases funded by the Ministry of Education and Science: ScienceDirect, SCOPUS (Elsevier), Web of Science.
- Latvian databases: LETA, Letonika, Latvijas standartu datubaze (available only on library premises).

The use of RTU SL databases has been growing since 2016. The number of downloaded full texts in 2020 – 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 direction "Mechanics and Metalworking, Heat Energy, Heat Engineering and Mechanical Engineering" are located in the main building of the SL (5 Paula Valdena Street) and in the Transport branch (8 Lauvas Street, 101) in compliance with UDC indexes. The basic indexes for this study direction are 004, 005, 006, 33, 34, 51, 53, 620, 621, 629, 656, 658.

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 catalogue, one can simultaneously obtain information about the available resources in 12 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.

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 programs 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.

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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.

In order to support research activities, RTU has developed the Centralized Research Support System, which records all information on publications, patents, commercialization applications, PhD 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 PhD 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, as well as included 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).

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);
- Labour Law (https://likumi.lv/ta/id/26019-darba-likums);
- Immigration Law (https://likumi.lv/ta/id/68522-imigracijas-likums);
- 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);
- 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);

- 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 Program "Growth and Employment"" as of 9 January 2018 (https://likumi.lv/doc.php?id=296513);
- 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) (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".

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 analyzed each semester, as well as discussions with the representatives of faculties, student self-governments and the instructors themselves take place. 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 SOO 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 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;
- work productivity (time planning, conflict resolution, communication culture, stress management etc.);
- critical thinking;
- how to approach students with disabilities.

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 athttps://www.rtu.lv/lv/studentuserviss/karjeras-centrs-ssc/projekti-un-seminari/seminari-un-vieslekc ijas.

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 January each year, the Student Parliament of RTU organizes the contest "Annual Award of the Student Parliament of Riga Technical University". During the event, faculty academic staff members chosen by the students are awarded the honorary titles "Most Active Instructor of the Year" and "Instructor of the Year".

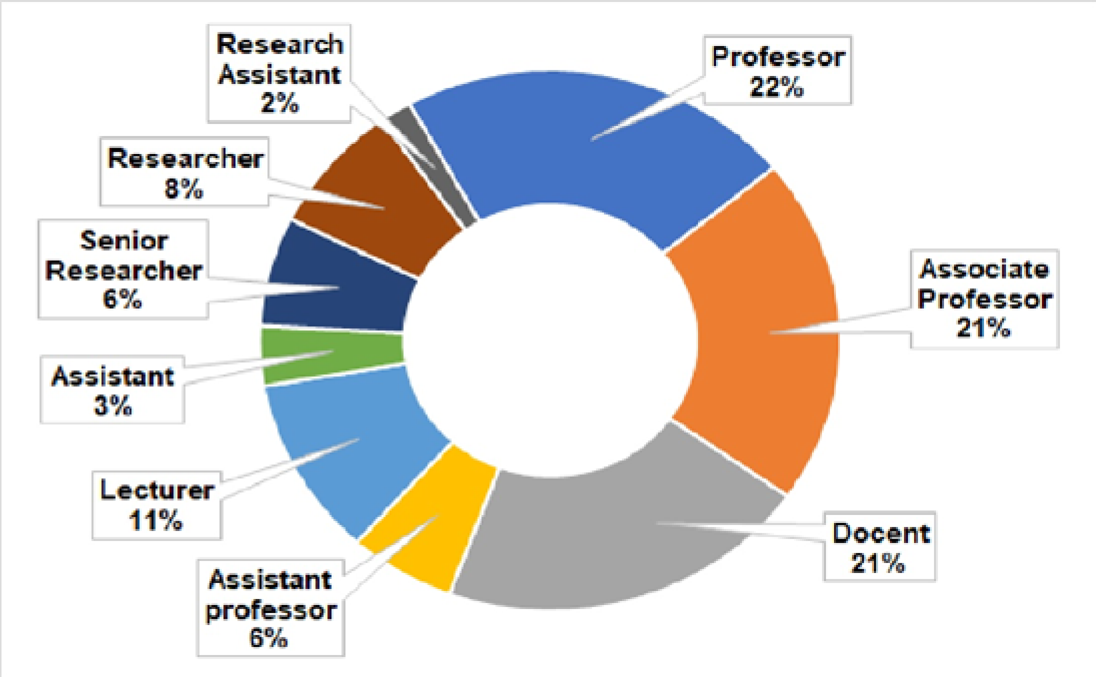
To recognize and appreciate RTU academic staff, since 2018, RTU has been organizing contests "Annual Academic Excellence Awards" and "Young Academic Staff Member of the Year" in cooperation with the foundation "Riga Technical University Development Fund" and Industry Service Partner Ltd. The aim of these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

Every year, RTU Student Parliament organizes together with student self-governments of faculties polling of each faculty to find out "Academic Staff of the Year" and "Most Active Academic Staff". This stimulates academic staff to better organize the study process and to establish tighter connections with students.

From 2007, the FMETA created the FMETA badge of honor "ZELTA ZOBRATS", which is made of pure gold. Its size is ~ 13mm in diameter, its mass is ~ 1.8 grams. The badge is awarded to employees of RTU Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA) (former Faculty of Transport and Mechanical Engineering – FTME) for their long-term (20-25 years) and honorable work at the Faculty and contribution to the Faculty development, as well as to persons who have contributed significantly to the development of the faculty, as well as in connection with their significant anniversary. As of the time of the report preparation, 24 persons have received such a badge. The awarding is most often held in RTU and FMETA anniversary years.

**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.**

Overall, 168 teaching staff are involved in the "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology and Mechanical Engineering" course, of which 155 are elected to one of the academic posts RTU, while 13 have been recruited on time to implement the study process. The professional qualifications of academic staff are fully in line with the implementation of the course of study programmes and 127 of the academic staff elected by the RTU are doctorate, 39 is a master's degree. Detailed information on all teachers in the course of study is available in the Annex: List of academic staff and CV.




**Picture**. Division of teaching staff by post (total number of 168)

In analysing the data on the academic staff elected by the RTU, it can be concluded that the doctorate was obtained in the science sector corresponding to the teaching course, most of which is in engineering but, depending on the course to be written, there are also academic staff representatives with a doctorate in economics, pedagogy, social sciences, etc.

Everyday, staff responsibilities overlap and all elected academics have both academic and research and, in some cases, administrative work. The RTU does not make a strict distinction between academic and research tasks, the proportion of which is determined individually for each academic staff representative when planning a staff load in the department, as well as, in the light of his or her position, involving in project implementation, professional expertise and experience. The qualifications of academic staff in the direction of studies are very high, particularly importantly, that the vast majority of academic staff with a PhD are leading professors and leading researchers in their field with significant international experience. Scientific performance of teaching staff shows this.

But no less important is the fact that those teaching staff who currently have only a master's degree are, in most cases, working under the leadership of professors and associate professors. Most of these teaching staff are doctoral students or degrees applicants.

#### 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 program 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 honor the best graduates and to promote new opportunities in the labor market;
- student summer camps for the development of career management and social skills and competences;
- online resource https://ekarjera.rtu.lv/;
- 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; o 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/lv/studentuserviss/studentu-serviss.

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

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 programs and to involve the heads of the study program in the seminars so that the students would get acquainted with the management of the program 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.

## 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).**

The study field "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering" at Riga Technical University is implemented by the Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA). Research and innovation of academic staff in the study field takes place at the FMETA by ensuring academic freedom, in line with the strategic objective of RTU and FMETA and the scientific activity of academic staff at RTU FMETA institute, department or scientific laboratory. The strategic long-term research objectives have been pursued in line with the overall Development Strategy of RTU, which is driven by a proactive link between university activities and the needs of the national economy, with a focus on high quality and efficiency. The basis for the activities of RTU and accordingly the study field is science, innovations and a study process developed in cooperation with the industry, which ensures the training of specialists needed for the Latvian economy, thereby serving as the basis for sustainable development of Latvia. RTU Strategy of the new planning period (2021-2025) is a follow-up to the previous university strategy for 2014-2020. One of its most fundamental goals is excellent science. This includes promoting and improving the quality of international competitiveness of scientific activities, ensuring an increase in scientific effectiveness and achieving internationally high levels of results. In order to achieve this goal, specific objectives to be performed are defined:

- Emphasis on high-level internationally recognized (quoted) publications; increasing the competitiveness of academic staff and promoting scientific results;
- Orientation on projects corresponding to the strategic, study and scientific priorities of the study field;
- Continuous renewal of scientific infrastructure.

The execution of strategies of RTU faculties and its connection with the overall strategy of RTU and the resulting performance indicators identified therein are monitored annually by RTU Rector concluding an agreement with the Dean of each faculty on the performance indicators to be achieved next year in the following three groups:

- Study process (for the period from September to August);
- Research process (for the period from January to December);
- Valorization process (for the period from January to December).

The objective plans of the study, research and valorization processes of the faculties for the next academic year, in accordance with the faculty strategy, are drawn up by the Deans of the faculties in cooperation with Deputy Deans and heads of institutes and they are approved by RTU Rector. The FMETA incorporates four institutes where research is performed. All institutes of the FMETA are unique in their area and participate in the implementation of the study field “Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering”.

The goal of FMETA is to be a powerful organizational unit of RTU that provides modern, internationally recognized education and is a center of science and innovation in the Baltic States in the fields of mechanical engineering, civil transport, aeronautics and biomedical engineering. The FMETA operates to provide and maintain the basis for continuous scientific development in these areas, taking into account the multi-sectoral nature of the Faculty. Ongoing efforts are being applied to ensure the sustainability of FMETA research funding by participating in competitive international and national programs and increasing the quality of research and recognition of FMETA among the international community of researchers. Since scientific publications are an important indicator of the research quality, the Faculty urges researchers to increase the number of publications that are directly high-level internationally recognized (quoted) and to perform research in cooperation with researchers beyond Latvia.

In addition to the study activities, RTU academic staff also actively participate in research work. On 28 June 2021, RTU Senate approved RTU Regulation “On the Procedure for Electing a Professor or an Associate Professor and the Procedure for Evaluating the Qualification of the Elected Professor or Associate Professor”. This Regulation lays down the procedure for the election of an applicant for the post of a professor or associate professor and the procedure for the evaluation of the qualification of a professor or associate professor in office, where one of the essential parts is the evaluation of the scientific activities of academic staff.

Whereas, only the academic staff with expert rights of the Latvian Council of Science (LCS) is authorized to supervise the PhD Theses.

In focusing on applied research, the academic staff and researchers involved in the study field “Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering” are seeking to develop closer cooperation with companies and social partners in order to meet the needs of the industry and society. The bulk of the research performed so far is applied research which can be used in the industry or in the development of new products and services. The share of fundamental research is relatively small – only 7 out of 36 research projects could be considered as such. Fundamental research mainly includes studies on optimization theory, non-linear mechanics, material breakdown mechanics, exposure of ionizing radiation to nanostructured materials and interaction of nanoparticles with live cells. The Faculty has set a target of preparing up to 12 commercialization offers annually, increasing the number of projects developed for commercial partners.

In line with the overall development plan of RTU, the FMETA seeks to make efficient use of existing equipment and to develop a sustainable equipment maintenance system. Whereas, RTU research support fund aims to provide financial support for a variety of research-related activities, such as supporting the maintenance of research equipment, protecting and licensing intellectual property, covering doctoral research costs, issuing scientific journals, attending and organizing scientific conferences, supporting researchers in the development of new laboratories in prospective areas of research.

Students of the Doctoral study programs “Engineering, Mechanics and Machine Building”, “Manufacturing Technology” (from 2021 “Mechanical Engineering and Mechanics”) and “Transport” perform major fundamental and applied research during their studies, resulting in a significant effect for the industry development. Most of RTU FMETA PhD students are involved in implementation of some scientific research or project at the time of their studies. The academic staff attracted to the study field and students are involved in projects financed by the Latvian Academy of Sciences (LAS), LCS, the European Union and others. More information about the projects can be found on the FMETA webpage: https://www.rtu.lv/lv/mtaf/zinatne-mtaf/zinatniskie-projekti-mtaf

Academic staff of the PhD study programs are also members of the Promotion Councils and reviewers of PhD Theses not only at RTU, but also at other Latvian and foreign universities. More information on the PhD study programs and their significance can be found in Section 3 of this report.

**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.**

The study process of the study field “Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering” is directly related to RTU FMETA scientific research areas. The results of research are used to update the content of study courses. Students of the study field are involved in research from the very start of their studies. The linkage of scientific research to the study process is ensured through the principles of knowledge transfer and continuous capacity building, by integrating research results into study courses, by involving students in research, by presenting students with current research results, enabling research activities to be carried out independently and in groups. Students have the opportunity to perform practical works with the latest equipment, which is also used to perform scientific research.

**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 involvement of academic staff in research and international cooperation positively influences the study process and increase its quality. The results obtained through scientific research are used for improving the content of the study courses and the teaching methods.

The most significant scientific and research work in the study field “Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering” is performed through participation in international projects, writing scientific publications and participating in international conferences. Most of the research performed within the framework of the study field is applied research; hence, its results are directly related to the national economy and respectively to the professional education.

**The most significant projects of the reporting period:**

1. Mobile Space Environment Testing Equipment Development of "Metamorphosis" Prototype for Transportation Intermodal Traffic, short title: "Metamorphosis", ERAF 1.1.1.1/18/A/133, 01.05.2019- 30.04.2022
2. Supporting the Smart Specialization Approach in the Silver Economy to Increase Regional Innovation Capacity and Sustainable Growth, short title: OSIRIS; #R080 Interreg Baltic Sea

region; 01.01.2019- 30.06.2021.

3. Design and Modelling of Aerospace System for Launching pico- and nano-Satellites to Low Earth Orbit; LZP-2018/2- 0344; 01.05.2020- 30.04.2023.
4. Contractual work on the production and testing of the most promising samples of magnesium coating technologies within the framework of project No. 1.1.1.1/19/A/148 “Innovative and Efficient Coating Development for Magnesium Components”, L8900.
5. Contractual work on the study of MgO-free (oxide-free) coating of magnesium products using a plasma electrolytic oxidation (PEO) and a physical vapor deposition (PVD) approach within the framework of project No. 1.1.1.1/19/A/148 “Innovative and Efficient Coating Development for Magnesium Components”, L8901.
6. Contractual work on the study of MgO-free (oxide-free) coating of magnesium products using a plasma electrolytic oxidation (PEO) approach within the framework of project No. 1.1.1.1/19/A/148 “Innovative and Efficient Coating Development for Magnesium Components”, L8902.
7. Development, Manufacture and Testing of a Single-Axle Single-Seat Helicopter Pilot Plant; LIAA voucher project (active 1.2.1.2/16/I/001); LV8881.
8. Development of a New Generation of Advanced Metal Alloys; LIAA voucher project (activity 1.2.1.2/16/I/001); LV8881.
9. The Development of an Unmanned Aerial Vehicle Platform Using Biodegradable Materials, the projects of RTU research platforms; ZI- 2021/7.2.
10. Contract work on the feasibility study on the conversion of a minibus from diesel to hydrogen, LIAA voucher project (activity 1.2.1.2/16/I/001); LV8906.
11. Development of Innovative Metal-Ceramic Nanostructured Coatings (McBLADE) for the Hot Section Parts of Gas Turbine Engines, 1.1.1.2/VIAA/1/16/126; 01.03.2018- 28.02.2021.
12. Multifunctional Nanostructured Coatings for Aircraft Structures (NANOCOAIRS), 1.1.1.2/VIAA/1/16/176; 01.02.2018-31.01.2021.
13. Development of Aircraft Structural Health Inflight Monitoring System (FLY-SAFE), 1.1.1.2/VIAA/1/16/104; 01.02.2018-15.10.2020.
14. Development of an Innovative High-speed Wind Tunnel Testing Facility for the Research of the Characteristics of Novel Aerospace Objects, 1.1.1.2/VIAA/2/18/321; 01.12.2018-30.11.2021
15. Development of an Integrated Sensor System for Material and Structure Monitoring, 1.1.1.2/VIAA/2/18/326, 01.11.2018-31.10.2021
16. Developing a Remotely Piloted Aircraft System for Solving Environmental Monitoring Problems in the Baltic Sea Area, 1.1.1.2/VIAA/4/20/650; 01.01.2021-30.06.2023
17. High Performance Erosion Resistant Multifunctional Coatings for Aircraft Composite Structures, (PEROMACS); 1.1.1.1/16/A/073; 01.03.2017–29.02.2020
18. Synthesis of textile surface coating modified in nano-level and energetically independent measurement system integration in smart clothing with functions of medical monitoring.,ERAF, 01.03.2017.- 31.12.2019.
19. EUREKA project “A direct drive SWT with aerodynamic pitch control of wind rotor blades and yaw oscillation damper” (OptiSWT) 2016.-2019.
20. European Regional Development Fund (ERDF) projects "Foundation of a Centre of National Importance for the Research of Acquisition and Sustainable use of Energy and Environmental Resources (Including the Development of the Transport and Mechanical Engineering Centre)" No. 2011/0060/2DP/2.1.1.3.1./11/IPIA/VIAA/007; 2014.-2021.
21. Baltic SEA integrated unmanned aerial vehicle multifunctional monitoring system for resurveying of shipping routes “ (SEAGLE), EUSBSR Seed Money Facility,-2019.
22. Bilateral project supported by the Latvian Academy of Sciences and Czechs Republic Academy of Sciences No. LZA-16-01 “Thin films for optoelectronics - preparation and defects

investigation”, 2016.-2018.

23. National Research Programme “Inovative Materials and Smart Technologies for Environmental Safety (IMATEH)”, project “Mechanical Micro- Nano- Scaled Features of Materials and Their Impact on Human Safety”, 2014.-2017.
24. A Novel Concept of an Extremely Short Take-Off and Landing All-Surface (ESTOLAS) Hybrid Aircraft: From a Light Passenger Aircraft to a Very High Payload Cargo/Passenger Version; FP7-AAT-2012-RTD-L0; 01.05.2012-30.04.2014
25. Development of a System for Unmanned Aircraft and the Creation of Industrial Prototypes for Unmanned Aerial Vehicles to Perform the Tasks of the Latvian National Economy No. 2010/0256/2DP/2.1.1.1.0/10/APIA/VIAA/070, 2011-2014.

**The most significant cooperation partners:**

The most important cooperation partners and the most typical types of cooperation:

University of Kielce (Poland) University of Technology Faculty of Mechanics Poland. Active co-operation takes place both in the form of guest lectures and in the conduct of joint research and the preparation of scientific articles and conferences. Cooperation of Kaunas Technical University (Lithuania) in the implementation of doctoral studies, including inviting reviewers of dissertations within the framework of dissertations. Rhine-Waal University of Applied Sciences Germany for the development of a joint bachelor's program in English (Professor William Megil). Wayne State University Detroit, USA, collaboration in engine research;

Joint research projects are currently being implemented with Hame University of Applied Sciences (Finland), Klaipeda State University of Applied Sciences (Lithuania), Tallinn University of Technologies (Estonia), VIA University College (Denmark),

Other cooperation within Ersmus and research is with Ilmenava TU, Chemnitz TU (Germany), Copenhagen TU (Denmark), Pennsylvania State University (USA), Tallinn TU (Estonia), Kaunas TU (Lithuania), Bialystok TU (Poland), North Kazakhstan TU (Kazakhstan), Powder Metallurgy Institute, (Belarus), Antanas Gusyaitis Aviation Institute of Vilnius Gediminas Technical University, Lithuania, University of Bergamo (Italy) Medical Engineering, Russian Academy of Sciences, Institute of Mechanical Engineering. (ИМАШ РАН).

### 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.

It is a requirement of RTU that academic staff are actively involved in research apart from their involvement in the study process. Professors and associate professors are re-evaluated and re-elected every six years. Candidates are obliged to comply with certain criteria in terms of scientific research, i.e., number of publications or patents, supervised PhD candidates, etc. (Decision of RTU Senate No. 649 “On approval of the RTU Regulations “On 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” in a new edition” as of 26 April 2021). In order to be allowed to supervise PhD students, the academic staff have to be approved experts in their fields, which is possible only if criteria regarding the number of publications/patents are met (decision of

RTU Senate No. 602 “On Amendments to RTU Regulation on Doctorate” as of 26 September 2016). Approval process for the experts is organized by the Latvian Council of Science. The database of the experts is published on the National Research Information System (NRIS; http://sciencelatvia.lv).

Every year, the Rector and faculty deans sign agreements by which each faculty undertakes to achieve certain key performance indicators, many of which are based on research output, e.g., the number of publications/patents, obtained research project funding, etc. Achievement of these indicators has an impact on financing received by the faculty from the so-called performance-based funds.

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 PhD 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).

**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 PhD studies and providing career opportunities during the post-doctoral period to young researchers.

PhD grants are provided to PhD 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 PhD 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 PhD students (attending conferences, publishing papers and thesis, etc.). Employment of PhD students and post-doctoral researchers at RTU went up from 0 FTE in the period of 2013-2016 to 88 FTE (PhD 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 PhD 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 PhD 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 programs, and ranging from first-year Bachelor students to PhD 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 programs 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. Jurģis Poriņš);
- wastewater treatment (group leader Prof. Tālis Juhna);
- energy efficient houses (group leader Leading Researcher Jānis 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 the industry.

A short description and assessment of the appropriate forms of innovation (e.g., product innovation, process innovation, marketing innovation, organizational innovation) in university/college activities, mainly in the study field to be assessed, providing examples and assessing their impact on the study process.

**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.**

RTU is a modern, internationally acknowledged university of science and technology, with a special focus in its goals on innovations and technology transfer. General modernization and the takeover of the world's best experience ensure dynamic and sustainable development of the FMETA and enable its graduates to compete on the international level. Innovation forms of study programs of the study field “Mechanics and Metal Working, Heat Power, Heat Engineering and Mechanical Engineering” are of different directions and levels.

In accordance with the Cabinet Regulation of 26 August 2014 “Regulations on the State Standards of the Second Level Professional Higher Education”, professional study programs must be supplemented with study courses, which include a module for the development of professional entrepreneurial competence. Such requirements are included in RTU Senate decision of 23 March 2015 “On the Unified Requirements to Study Programs of Riga Technical University” (Minutes No 588). The Study Field Commission reviewed reports from the heads of study programs on changes to the FMETA study programs and made appropriate changes in the Bachelor study programs in April 2017. These changes are related to the development of a new approach and require all students to be trained within the framework of the study module “Development of Innovative Products and Entrepreneurship”. In order to ensure this in a methodically uniform manner at the

FMETA study programs, a pilot project was implemented in academic year 2016/2017. A new lecturer Elīna Bože-Irbe was attracted. Assoc.Prof. Anita Geiņa-Ancāne, Assoc. Prof. Agrita Eiduka and lecturer Mārtiņš Irbe mastered the training methodology of the study module “Development of Innovative Products and Entrepreneurship”. In academic year 2017/2018, implementation of the module was started at all study programmes of the study field “Mechanics and Metal Working, Heat Power, Heat Engineering and Mechanical Engineering”.

The aim of the study course is to provide profound knowledge on the development of new products, technology transfer, entrepreneurship, as well as innovation and commercialization of their results, to promote the capability by using the acquired knowledge, skills and techniques in practice and professional development, starting commercial activities and creating companies, and managing team work.

To develop innovative thinking, creative skills and business capacity of students, RTU implements the project “Innovation Grants for Students”. Students of all levels are offered to involve in different activities and improve their business capacity, cooperate with the industry, develop early science-intensive business ideas, receive scholarship and support grant. Within the program “RTU Innovation Grants for Students”, the following eight activities are implemented: “DEMOLA LATVIA”, “Ideation Measures”, “Product Development Project” (PAP), “Vertically Integrated Project”, “RTU IDEALAB”, “Industrial Doctor”, “University Incubator”, where teams are engaged in solving problems of undertakings, developing really applicable products. Students are also involved in hackathons to create new technological solutions on the specific themes.

Students of study programs of the study field “Mechanics and Metal Working, Heat Power, Heat Engineering and Mechanical Engineering” participate actively in research themes with professors whose activity is related to startups, e.g., FMETA IBEN Professor Aleksejs Kataševs attracted students of the study program “Medical Engineering and Physics” to the development (spin-off) of the EHO Technologies startup.

Such activities increase the sustainability of study programs by encouraging students to engage in science, selecting further Doctoral studies, as well as PhD students, continuing their scientific activities after obtaining the PhD degree at the FMETA and other scientific institutions.

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## 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.**

Selection of cooperation partners takes place based on the existing experience of the study field and cooperation of experts with foreign institutions in studies, science, project development, participation in associations and other forms.

It is possible to achieve the goals of the study field “Mechanics and Metal Processing, Heat Power Engineering, Heat Technology and Mechanical Engineering”, as well as the set learning outcomes, successfully only through the process of cooperation, by involving different institutions. Since the very start of its operation, the FMETA has been successfully cooperating with entrepreneurs, organizations and state institutions. Each year, the cooperation is strengthening and new forms of cooperation are emerging, with a growing mutual interest in delivering a successful outcome. Cooperation with different professional organizations takes place both by organizing joint conferences and seminars and by means of scientific cooperation, by participating in associations, consultation on the sector development and the necessary improvements in the content of education.

Main fields and activities of cooperation within the framework of the study field are the following:

- Providing and improving the study process and its quality, including improving the content of programs and forecasts for the needs of specialists;
- Providing the professional development of students by offering internship places and jobs;
- Supervising and reviewing study and graduation papers, offering themes for graduation papers (formulating problems to be solved by undertakings so that students could develop the solutions required by the industry);
- Ordered research and approbation of scientific research results for undertakings, process development and optimization tasks for students;
- Involvement of professionals (company specialists) in the study process;
- Organization and implementation of other activities beyond studies, including company scholarships and support to students, as well as training trips to undertakings, Career Days (see more in Section 5.3);
- Representation of interests of the university and industry at governmental and international organizations;
- Regular participation in the annual international exhibition “Tech Industry” in the BTA international exhibition hall in Riga;
- Cooperation with secondary schools and teachers' associations (especially science) by organizing tours to the FMETA laboratories and by participating in school career activities, informing on the opportunities to study at RTU and selecting professions in study programs represented by the FMETA. The FMETA has established close cooperation with Latvian schools for attracting students. Cooperation agreements were concluded with several schools, including Riga Teikas Secondary School and Engineering High School of Riga Technical University. Within the framework of this cooperation, excursions of pupils to the Laboratory House are regularly arranged and practical classes for individual lessons in physics or practice.

There is cooperation with the associations of employers: Association of Mechanical Engineering and Metalworking Industries of Latvia (MASOC), Latvian Electrical Engineering and Electronics Industry Association (LETERA), Latvian Association of Heat Companies (LSUA). Within the framework of these associations, we can distinguish some LLC and corporations such as Baltrotors, Nākotne, Tehprojekts, Latvijas Finieris, RVR, RER, Sidrabe, Elmi, ABB, Biznesa inovāciju centrs, Latvenergo JSC, Rīgas siltums JSC, Komforts JSC, Rīgas namsaimnieks JSC, etc.

Serious work has been performed in training of engineers in the field of CAD and CAE through contacts with manufacturers in packing products, advertising agencies and small enterprises. Good work has been in cooperation with Peruza Ltd (its employees participated in commissions for public presentation of projects).

Major cooperation with employers takes place through former RTU graduates who have manufacturing undertakings and are looking for new staff, and who graduated from MTA faculty and are good specialists in engineering (e.g., skills to work with the SolidWork design program; skills to use MathCAD, Working Model, Ansys, etc.).

Major cooperation with professional organizations takes place through cooperation with the Association of Mechanical Engineering and Metalworking Industries of Latvia (MASOC), which unites over 160 leading machine building and metal processing undertakings and the related companies of the industry. In total, MASOC undertakings employ about 10000 workers; their total turnover in 2017 exceeded EUR 730 million (https://www.masoc.lv). A very active, long-term and tight cooperation is ensured through personal cooperation of the FMETA Dean Ē. Geriņš who is participating in the Council of this organization and MASOC Association management, whose head Vilnis Rantiņš has been Chairperson of the State Examination Commission of several study programs, a perennial representative of FMETA Convention and a representative of the Study Field Commission. From 2010, the headquarters of MASOC has been at the place where the Faculty is located – at 6 Ezermalas Street, Riga.

Regarding the cooperation of the Institute of Mechanics and Mechanical Engineering with Latvian undertakings / firms in the reporting period, the following cooperation partners can be mentioned: Severstaļlat JSC, the National Metrology Centre of Latvia, Latvijas standards Ltd, Valmieras stikla šķiedra JSC, Sidrabe JSC, FESTO Ltd, Instro Ltd, NAGLIS&ERR Ltd etc.

Through cooperation between Instro Ltd with Mitutoyo Ltd, Japan, the Measurement Laboratory with the latest measurement equipment was established in the Laboratory House, where students are trained and professionals are acquainted with the latest models of measurement equipment and research is performed for the needs of the industry undertakings.

Through cooperation between NAGLIS&ERR with OKUMA, Japan, the CNC Worktable Equipment Laboratory was established in the Laboratory House, where students are trained and professionals are acquainted with the latest models of OKUMA CNC processing equipment and research is performed for the needs of the industry undertakings.

The Institute of Mechanics and Mechanical Engineering has extensive cooperation with organizations in Latvia within the framework of the Mechanical Expertise Centre, performing complex interdisciplinary examinations at their request, e.g., in 2018 and 2019, the expertise statement to Dominium Legal Services Ltd on damage in the MWM TCG2016 V12 C motor and their reasons; the expertise statement to the insurance company If P&C Insurance JSC Latvian Branch on oil pump damage in the MWM TCG2020 V20 motor and their reasons; the expertise statement to VIZULO Lts on oil leakage defect etc.

The Department of Thermal Power Systems (DTPS) has cooperation contracts or agreements related to the program “Heat Power and Thermal Engineering” with a number of leading undertakings of the industry: Latvenergo JSC, Rīgas Siltums JSC, including agreements on guaranteed paid places of internship, Liepājas Enerģija Ltd, Inspecta Latvia JSC, BOSCH LATVIA Ltd and its subsidiaries Junkers and Buderus, HERZ Baltija Ltd and many others.

With the support of HERZ Baltija Ltd, the laboratory was established for studying thermal engineering means of automation in the form of student laboratory works.

On 15 July 2016, cooperation agreement No 03000-3.3.2/16/10 was concluded between RTU and EKO AIR Ltd, which is a new and modern manufacturing plant for plate heat exchangers, located in Salaspils. The DTPS graduates work at the company, there have already been a number of student classes and internship organized.

The Department of Thermal Power Systems has cooperation agreements or Letters of Intention related to the bachelor's and master's study programmes "Heat Power and Thermal Engineering" with a number of leading undertakings of the industry: Latvenergo JSC, Rīgas Siltums JSC, Liepājas Enerģija Ltd, JSC "Latvijas Finieris", Inspecta Latvia JSC, BOSCH LATVIA Ltd. and its branches Junkers and Buderus and many others, incl. agreements for guaranteed paid internships. With the support of HERZ Baltija SIA, a laboratory has been established for the acquisition of automation tools for thermal engineering processes in the form of student laboratory work. In 2016, a cooperation agreement was signed between RTU and SIA EKO AIR, which is the only plate heat exchanger manufacturer in the Baltics, located in Salaspils. The agreements are regularly renewed, for example, in 2021 the cooperation agreement with "Liepājas Enerģija" Ltd. was renewed for the next five years. Cooperation is also being expanded, for example, in 2021 a new cooperation agreement was concluded with Adven Latvia Ltd., which envisages incl. support for the implementation of study programmes.

Long-term and stable cooperation with several other manufacturing companies, scientific research and educational institutions allows to ensure a continuous study process and a stable and wide offer of internships.

Graduates of the study programmes "Heat Power and Thermal Engineering" and the academic staff of the Department of Thermal Power Systems participates as experts in the Ministries of the Republic of Latvia, cooperated on their initiative and also become members in such industry organizations as the Latvian Association of Heat Companies (LSUA, www.lsua.lv), whose collective members are more than sixty companies covering the entire territory of the State, etc. organizations. The Department of Thermal Power Systems involves industry organizations and their representatives in the educational process - within the framework of the implementation of the professional study programmes "Heat Power and Thermal Engineering". For example, A. Cars is an expert in hazardous equipment, the head of the Association of Technical Experts and a member of the Latvian National Accreditation Bureau Ltd. (LATAK).

In recent years, the staff of the department has been working closely with the Energy Sector Expert Council in the direction of the Green Deal and Sustainable industry Development in overcoming challenges and solutions of the industry's workforce. Active participation in the Expert Council of the Energy Sector, which represents experts from such companies as Jūrmalas siltums Ltd., JSC Latvenergo, JSC Rīgas Siltums, LSUA, GASO, etc., allows not only to follow the news of industry, but also to expand cooperation. For example, close co-operation was initiated with the Latvian Association of Refrigeration Engineers.

Most of the employers surveyed also support the efforts of their already employed employees to get higher education and are proactive in providing a training schedule.

**Participation in professional and public organizations and councils.**

Cers is the Chairman of the Board of the National Geothermal Association of Latvia, established on 13 August 2010, as well as Member of the Monitoring and Advisory Councils of Riga Energy Agency.

Cars is an expert in dangerous equipment and regularly participates in the operation of the Association of Technical Experts.

Bekmanis and A. Cers are Members of the Board of the Latvian Association of Heat Enterprises

(LSUA).

Rusovs and S. Jaundālders are Members of the National Geothermal Association of Latvia.

Valpēteris and A. Cers are LATAK experts.

Rusovs has been Member of the Hydraulic Institute Academic Partner Program (www.Pumps.org/Conferences.aspx) since 2017.

The Institute of Mechanics and Mechanical Engineering cooperates with different associations in Latvia, e.g.:

- with Latvian Biogas Association (in providing expert statements);
- with Latvian Association of University Professors (Prof. J. Vība is Member of the Presidium and participates in analyzing the study programs and in training of professors);
- with AVESCO Ltd (Witraktors) (its employee, Dr.sc.ing. Edgars Kovals was Member of RTU MTAF Convention in 2017 and 2018).

Academic staff of the Institute of Biomedical Engineering and Nanotechnologies (IBEN) cooperate with professionals of governmental institutions such as the State Environmental Service Radiation Safety Centre, the Latvian National Accreditation Bureau, the Health Inspectorate, consulting their staff on different issues. The IBEN has the Bachelor study program “Medical Engineering and Physics” established jointly with Riga Stradins University (see details in the program description). There is an ongoing cooperation with the biggest hospitals in Latvia in organizing internship for students and developing graduation papers such as Pauls Stradins Clinical University Hospital, Riga East University Hospital, Riga First Hospital, Latvian Maritime Medicine Center, “Piejūras slimnīca” in Liepaja, as well as undertakings operating in the field of medical engineering and physics, nanoengineering – INLAB Ltd, Integris, Amerilat, Siemens, A Medical, etc. Representatives of many enterprises are also involved in the study process as heads of engineering projects and scientific advisers and reviewers of Master Theses.

The BENI staff work actively in the Latvian Medical Engineering and Physics Society. Professor J. Dehtjars is a full member of the Latvian Academy of Sciences and respectively he participates actively in its operation.

The IBEN development policy and perspectives are viewed in the context of its cooperation with other local and regional authorities. The sustainability of the program is guaranteed by qualified academic staff. The Institute supports creative activities of academic staff as well as their activities in various educational, scientific and professional institutions.

The cooperation of the Institute of Transport in Latvia takes place similarly to other institutes and is coordinated by the Department of Automotive Engineering and the Department of Railway Engineering.

The Latvian automotive and road transport market for is highly fragmented and there are no highly dominant companies for which many specialists should be trained. Leading specialists of companies are invited to work in the State Examination Commission, where the development of the content of the study program is also discussed.

The Department of Automotive Engineering cooperates with professional organizations of employers - the Latvian Association of Automotive Engineers, the Automobile Association and individual companies. During the reporting period, the main cooperation partners are BOSCH LATVIA, CSDD, Zemgale Repair Center, Auteko & TUV Latvia, Latina, Ape Motors, AAS TestGeneral, Societies Road Transport Professional Competence Center, Mobility Education and Technology Development Center, etc.

In cooperation with the company SIA BOSCH LATVIA, the Autodiagnostics Laboratory has been set up in the Laboratory House, where both student training and professional training take place. In the laboratory service specialists are also trained to work with the latest "BOSCH" car diagnostic models, as well as research for the needs of industrial companies is conducted.

Active work on road safety issues is performed in the Latvian Road Traffic Safety Council and Think tank of the Ministry of Transport of the Republic of Latvia. The lecturers work in the Latvian Association of Automotive Engineers, the Terminology Commission of the Latvian Academy of Sciences, participated in the professional competence training of more than 300 Latvian road transport company managers, participated in the Latvian Car of the Year competition, issued advisory opinions on car and unit damage and performed road accident reconstructions to more than 60 companies and government organizations (State Police, State Border Guard, Latvian State Radio and Television Center, Rural Support Service, Latvian Road Maintenance company, Insurance Companies Balta, Baltijas Apdrošināšanas Nams, Compensa Vienna Insurance Group ADB Latvia Branch, ERGO Insurance SE Latvia Branch, If P&C Insurance Latvia branch, InterRisk Vienna Insurance Group, Seesam Insurance Latvian branch, Swedbank P&C Insurance Latvian branch, car dealer centers, a number of industry companies ALD Automotive, Auto Kada, Baltic Taxi, Kurbads and Co, Pata, Unitruck, etc.) and range of individuals, students were sent to internship in hundreds of Latvian companies.

In many study projects, students use the topics offered by companies when developing an engineering project and developing master's theses. Teachers with work experience in companies Mūsa motors, CSDD, FEV, UAV Factory, Auto rtu,, Autodati, State Forensic Science Bureau, etc. participate in the implementation of the teaching of specialized courses of the study process.

Staff of the Department of Railway Engineering coordinate the implementation of the study program “Railway Engineering” and the PhD study program “Transport”. Within the framework of the Specific Support Objective project, the development of the Bachelor and Master study programs “Railway Engineering”, being transformed from the programs “Railway Transport” and “Railway Electric Systems”, involved active participation of employees of the Infrastructure Department of Latvijas Dzelzceļš SJSC, Baltijas Dzelzceļa Līnijas Ltd, who recommended to modernize the previous professional study programs and were actively involved in developing new occupational standards of the sixth level of EQF/LQF and the seventh level of EQF/LQF and improvement of the programs. Their recommendations were also taken into account in the process of developing the study programs “Railway Engineering”.

The inclusion of new study courses in the study program will allow students to understand more deeply the principles of maintenance, repair and design of railway infrastructure and the performance technology, which will in turn contribute to their more successful integration into designing the new Rail Baltica line and its further operation.

During the implementation of the program, regular contacts are maintained with employers, railway transport and related undertakings. If recommendations of employers for supplementing the program do not contradict to regulatory documents, their recommendations are taken into account.

Local and international cooperation of the Institute of Transport:

Expert statements: LDZ Rolling Stock Service Ltd, Transport Accident and Incident Investigation Bureau, AWD Ltd, Balta IJSC, Baltijas Apdrošināšanas Nams IJSC, Baltikums Vienna Insurance Group IJSC, BTA Baltic Insurance Company IJSC, Ceļu Pārvalde JSC, KG KNUTSSON Ltd, TestGeneral Ltd.

In cooperation with Latvijas Dzelzceļš SJSC, the Model Laboratory for Railway Network Physical Simulation was modernized.

In cooperation with the Latvian Branch of Siemens Osakeyhtio, the Engineering Laboratory for Railway Microprocessor Systems was modernized.

The maintenance training organization of the Institute of Aeronautics (AERTI) has cooperation agreements concluded with the following undertakings on ensuring internship for the study program “Aviation Transport”: Air Baltic Corporation JSC, GM HELICOPTERS Ltd, Riga Scientific Experimental Centre AVIATEST LNK Ltd, Air Force Aviation Base “Lielvārde” of the National Armed Forces of the Ministry of Defence, Transport and Telecommunication Institute, Magnetic MRO (Estonia), Baltic Aviation Service, Primera Air. A cooperation agreement with the Border Guards of the Republic of Latvia is currently being drawn up.

Students of the study program “Transport Systems Engineering” undertake their internship at the following undertakings in Latvia: Kuehne+Nagel Ltd, ProTuning Ltd, AirBaltic Corporation JSC, Vervo Ltd, DHL Latvia Ltd, ITC Ltd, Severstaļlat JSC, DPD Latvia Ltd, DINOTRANS Ltd, Baltic Logistic Solution Ltd, VALPRO Ltd, Kreiss Ltd, XL Parts Ltd, Simeon Ltd, SILJA Ltd, Lars Prim Ltd, DLLB Logistics Ltd, Latvia Oil Service Ltd, Ministry of Transport of the Republic of Latvia, Intellog Ltd, Schenker Ltd, Rīgas satiksme Riga municipal Ltd, MS TRANSPORTĒ Ltd, EKOAIR Ltd, GEFCO Baltic Ltd, SmartLynx Airlines Ltd, LATVIJAS VALSTS MEŽI JSC, Havas Europe.

Cooperation of the AERTI with associations and clusters:

- Latvian Association of Remotely Piloted Aircraft Systems (LARPAS) (with RTU Rector’s order, AERTI representative is member of LARPAS Board)
- Latvian Space Cluster – AERTI is member of the cluster – participation in joint projects, trips, etc.).

A significant support for improvement of the study programs and future development of the study field is provided from cooperation with the FMETA Convention. At the meeting in October 2021, the FMETA Convention evaluated and gave very significant proposals to the FMETA strategy section within the new Strategy of RTU for 2020-2025. The Convention is composed of leading specialists representing all undertakings in the study field programs. The composition of the Convention is approved by the FMETA Council and it includes the Head of the Department of Clinical Skills and Medical Technology of Pauls Stradins Clinical University Hospital, President of the Latvian Medical Engineering and Physics Society (LMIFB), Head of the Infrastructure Department of the European Railway Line Rail Baltica, Chairman of the Road Transport Sub-council of the Industry Expert Council for Machine Building, Metal Processing and Mechanical Engineering, Chairman of the MASOC Council, Director of Instro Ltd, Deputy Chairman of the MASOC Council, Head of the Department of the Civil Aviation Agency of the Republic of Latvia, Director of Aviation Department of the Ministry of Transport, FMETA Dean.

**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 direction and cooperation of experts with foreign institutions in studies, science, project development, membership in associations, etc. forms.

Foreign cooperation partners are selected based on the past experience of the study field and expert cooperation with foreign institutions in the form of studies, research, project development, participation in associations, etc.

The cooperation and internationalization policy of RTU FMETA in the context of the study field implementation is primarily related to students of the Foreign Students Department (e.g., more than 100 students from all over the world, including from America, Singapore, India, Germany, France, etc., study at the study program “Engineering Technology, Mechanics and Mechanical Engineering”). In addition, students and academic staff of the study field use the possibilities to spend some semesters at foreign universities within the framework of ERASMUS projects.

Students and academic staff are actively using the opportunities offered by international mobility programs. The most popular is the ERASMUS mobility program, and its scholarships are used annually by a large number of students. Concluded mobility agreements allow students to choose part of the program, study modules and/or themes to be learned at any other partner university. The Institute regularly summarizes the study experience of participants in mobility programs who have returned from foreign universities.

Its implementation and impact on the study and research processes are very positive because, after foreign studies, information on the positive results obtained gets to RTU organizational units. In addition, foreign students, when returning to their home countries, inform their members about the prospects of studying in Latvia.

Cooperation with foreign countries covers widely all European countries, as well as the Eastern and US universities. There is a tight cooperation in the fields of reviewing PhD Theses and developing publications.

A number of cooperation agreements have been concluded (e.g., within the framework of the cooperation agreement concluded between RTU and the Mechanical Engineering Research Institute of the Russian Academy of Sciences (IMASH RAN)), joint development of scientific works and publishing their results take place (e.g., in the Latvian Journal of Physics and Technical Sciences, or in Vibroengineering Journal, etc.).

Regarding cooperation of the Institute of Mechanics and Mechanical Engineering with foreign undertakings / firms during the reporting period, the following cooperation partners can be mentioned: undertakings – Feinpruf Parthen GmbH, Germany, Rank Taylor Hobson Ltd, GB, Mitutoyo Ltd, Japan.

Universities – Ilmenau University of Technology and Chemnitz University of Technology, Germany; the Technical University of Denmark, Denmark; the Pennsylvania State University, USA; Tallinn University of Technology, Estonia; Kaunas University of Technology, Lithuania; Bialystok University of Technology, Poland; North Kazakhstan State University, Kazakhstan.

Staff of the Department of Theoretical Mechanics and Strength of Materials of the Institute of Mechanics and Mechanical Engineering cooperate with Kielce University of Technology, Poland, Kaunas University of Technology, Lithuania, etc., attracting reviewers of Doctoral Theses.

There is cooperation with Germany (Rhine-Waal University of Applied Sciences) on the development of the joint four-year Bachelor study program “Mechanics and Mechanical Engineering” in English (professor Willam Megill).

D.Rusovs - member of “Hydraulic Institute Academic Partner Programm” since 2017.

The Department of Thermal Power Systems also has international partners, such as the American Hydraulic Institute (USA); in Poland, KAN-therm Sp.z.o.o., etc.

The Department of Thermal Power Systems maintains contact with graduates of study programs who, along with general globalization, work in different countries. Maintaining such business contacts with industry also facilitates the expansion of cooperation. Participation in professional industry conferences and exhibitions also takes place, which helps to expand the range of new contacts, incl. in the field of education, which promotes the development of new directions of cooperation.

Cooperation with Tallinn University of Technology is anticipated in the study program “Mechatronics”. There are joint courses for training PhD and Master students.

Active cooperation of the Institute of Mechanics and Mechanical Engineering with foreign scientists takes place in Sweden, Finland (prof. A. Krasņikovs), Poland, Russia (prof. J. Vība), Germany (prof. A. Januševskis), Portugal, Italy (prof. J. Auziņš). There is a cooperation agreement concluded with the Mechanical Engineering Research Institute of the Russian Academy of Sciences (IMASH RAN) at the level of RTU Rector, within the framework of which guest lecturers Dr.habil.sc.ing, Prof. V. Krupenin and Dr.habil.sc.ing. G. Panovko had a seminar in Riga. Respectively, prof. J. Vība paid a return visit to IMASH as a guest lecturer in March 2016. In addition, in summer 2016, cooperation was established (prof. Rafals Chatys) with Kielce University of Technology and Warsaw University of Technology in Poland, which continued successfully during the entire reporting period. Currently, wide cooperation with foreign institutions has been started by Professor of the Institute of Mechanics and Mechanical Engineering A. Krasņikovs – within the framework of his competencies in the field of education and science (in 2017, he was elected Vice-President of the Latvian Academy of Sciences).

The cooperation with Wayne State University, USA. From 2017 to 2018, a guest lecturer from this university Professor M. Jansons worked at RTU FMETA Department of Automotive Engineering, who acquainted with the study process in the USA, conducted lectures and informed the FMETA academic staff on possible collaboration in research. With the Professor’s support, the Motor Laboratory of the Department of Automotive Engineering was improved.

Student teams of the study program “Automobile Transport” were participating in the international Aventic pneumobile competitions in Hungary from 2016 and up to COVID restrictions in 2020, winning a nomination every year, and winning four nominations in 2018 – pneumobile of the year, achieving the highest absolute speed, the fastest starting run and the highest mileage among the cars built by students.

During the reporting year, four lecturers of the Department of Automotive Engineering upgraded their qualification, visiting the BMW plant in Munich and the Automotive Testing 2017 exhibition in Stuttgart, as well as, in view of the cooperation with Riga Motor Museum, attended three large vehicle museums in Germany – The German Museum of Masterpieces of Science and Technology, Porsche Museum, Auto & Technik Museum Sisnsheim.

Since 2017, meetings have been held with academic staff of the automobile study program of the University of Tartu.

The IBEN has been accepting students from foreign universities, which has been especially active from academic year 2016/2017, when students from France were accepted. Within the framework of the student Erasmus traineeship, RTU IBEN was attended by students from Kaunas University of Technology, Lithuania.

In 2018, the IBEN, with the support of the International Atomic Energy Agency, conducted laboratory activities for eleven students of Tallinn University of Technology on medical imaging capabilities and technical capabilities in the Roentgen Laboratory of the Laboratory House.

At the initiative of IBEN Professor J. Dehtjars, from 20 August to 31 August 2017, the international summer school "Nonlinear Life" in the field of biomedical engineering was organized at RTU for the first time. 17 students from RTU and partner universities participated and supplemented their knowledge in biomedical engineering, nanotechnology and non-linear dynamics. Among the instructors, there were the IBEN academic staff – Prof. J. Dehtjars, Prof. A. Kataševs, Ass. Prof. I. Ļašensko; lectures were also conducted by high-level academic staff from universities of Italy and Germany (11 instructors in total). In 2018, the summer school was held in Riga; in 2019 – in Trieste, Italy, and then it was held until 2021, when it was organized remotely from Bergamo, Italy (https://www.rtu.lv/lv/universitate/masu-medijiem/zinas/atvert/noslegusies-rtu-un-bergamo-universitates-vasaras-skola-nonlinear-life?highlight=nonlinear+life).

The IBEN has tight cooperation developed with the University of Salento, Italy, and Professor Lucio Tomaso De Paolis, who is the head of the research group in virtual and expanded reality. Within the framework of the Specific Support Objective project, in 2021, Professor Lucio Tomaso De Paolis delivered a guest lecture "Virtual and Expanded Reality in Medicine and Surgery" to the FMETA students and academic staff. The field of the professor's research involves developing unique applications for patient diagnosis. The applications are based on virtual and expanded reality technologies, which enable the patient's health status information in medical images to be transformed into three-dimensional images, and contribute to the development of a new research area in medical education.

In 2017 and in 2018, Professor Franco Milano from the University of Florence during his visit to Riga delivered a guest lecture "Does Big Data Management, Complex Systems Science and Artificial Intelligence Open New Opportunities in Medical Physics Research?". Professor Franco Milano was awarded the title of RTU Honorable Doctor in 2012 for his significant contribution to the deployment of modern physical medical technologies, long-term cooperation in the Erasmus+ program, providing study and traineeship opportunities in Italy in the field of medical physics.

International cooperation and internationalization of the AERTI within the framework of the study field are promoted through:

- Indian summer school;
- An agreement with the Academy of Civil Aviation, Almati, Kazakhstan.

International cooperation and internationalization of the Institute of Transport within the framework of the study field:

- Under the student exchange program, six Master students from the Eurasian National University, Astana, Kazakhstan, were admitted in the autumn semester;
- Under the student exchange program, 13 Bachelor students from the Eurasian National University, Astana, Kazakhstan, were admitted in the spring semester;
- Prof. N. Tokmurzina from the Kazakh Academy of Transport and Communications was admitted for the training practice;
- In cooperation with the French university CNAM, the Master study course was developed;
- In cooperation with Kazimierz Pulaski University of Technology and Humanities, the Master study course was developed;
- There is ongoing cooperation with the Kazakh Academy of Transport and Communications, Karaganda State Technical University, the Eurasian National University, Pavlodar State Technical University on development of the double degree Master study programm;

- Cooperation agreement with “Deutsche Bahn AG” – one of the largest European railway corporations is prepared for signing, that offers students of the program “Railway Engineering” to undergo their internship in Latvia or in Germany;
- The online workshop was organized by the German state railway company “Deutsche Bahn” (DB) about the role and opportunities of railway in the future;
- RTU is a member of the international association EURNEX - the European Rail Research Network of Excellence that represents European research and education institutions. It unites 33 research institutions operating in the field of railway transport and mobility across Europe, Morocco and China. The goal of the association is to promote research and development of the railway system, to improve cooperation in research and education, as well as ensure knowledge transfer across the association members, European universities and research institutions, interested in railway research, including multidisciplinary facilities, in order to facilitate joint planning and implementation of research projects of the member-states and to establish sustainable research environment for the railway sector, to develop the links between the association members, industrial partners and operators in the railway sector, to improve understanding about special high quality research needs and cooperation opportunities with the railway sector, to promote railway contribution to sustainable transport policies, to improve competitiveness and economic stability of the railway sector and industry.

Full list of the cooperation universities can be found in Annex.

**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.

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.

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 2012/2013, indicating whether the student is pursuing undergraduate or graduate studies. The number implies only students enrolled in the first year.

**Foreign Students in the Study Field 2013.-2021.**

| | | 2013./2014. | | 2014./2015. | | 2015./2016. | | 2016./2017. | | 2017./2018. | | 2018./2019. | | 2019./2020. | | 2020./2021. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Bakalaura studijas | DIEN/DAY | 53 | 44% | 68 | 35% | 64 | 34% | 94 | 38% | 166 | 38% | 88 | 27% | 142 | 39% | 82 | 37% |
| Bachelor studies | MOB | 46 | 38% | 53 | 27% | 45 | 24% | 70 | 28% | 139 | 32% | 87 | 27% | 83 | 23% | 41 | 19% |
| Maģistra studijas | DIEN/DAY | 11 | 9% | 39 | 20% | 33 | 17% | 41 | 16% | 91 | 21% | 107 | 33% | 82 | 22% | 36 | 16% |
| Master's studies | MOB | 8 | 7% | 29 | 15% | 43 | 23% | 44 | 18% | 38 | 9% | 43 | 13% | 55 | 15% | 57 | 26% |
| Doktora studijas | DIEN/DAY | 2 | 2% | 1 | 1% | 3 | 2% | | | 7 | 2% | 1 | | 1 | | 3 | |
| PhD studies | MOB | | | 5 | 3% | 2 | 1% | | | | | 2 | 1% | 5 | 1% | 1 | |
| **Kopā/Total** | | **120** | | **195** | | **190** | | **249** | | **441** | | **328** | | **368** | | **220** | |

The number of processed applications is much larger than the number of actually arrived students, for example, in academic year 2015/2016, applications of 626 potential candidates were processed, but the studies were started by 349 students; whereas, in academic year 2016/2017, 670 applications were received, but 445 students were admitted; in academic year 2017/2018, there were 1813 applications, but 632 students arrived; in academic year 2018/2019, there were 2627 applications, but 774 students arrived; in academic year 2019/2020, there were 3340 applications, but only 870 students arrived.

The mobility of incoming foreign students under the Erasmus+ exchange program during the reporting period is positive. The distribution of incoming students by European country is shown in the accompanying figure "Division of incoming students by country".

Information on the involvement of foreign academic staff is provided in Section 2.3.7 of the report.

## 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 report of the Accreditation Commission of the Study Field was submitted on May 12, 2012, which provides an overview of the 23 programs of the Study Field 18. Mechanics and Metalworking, Heat Power Engineering, Heat Engineering and Mechanical Engineering:

- Automotive Engineering (42525)
- Automotive Engineering (46525)
- Aviation Transport (41525)
- Aviation Transport (42525)
- Aviation Transport (46525)
- Engineering Technology, Mechanics and Mechanical Engineering (43521)
- Engineering Technology, Mechanics and Mechanical Engineering (45521)
- Engineering Technology, Mechanics and Mechanical Engineering (51521)
- Heat Power and Thermal Engineering (42522)
- Heat Power and Thermal Engineering (46522)
- Industrial Design (41521)
- Mechanical and Instrumental Engineering (42521)
- Mechatronics (42521)
- Medical Engineering and Medical Physics (42526)
- Medical Engineering and Medical Physics (46526)
- Nanoengineering (46526)
- Production Engineering (45521)
- Production Engineering (51521)
- Railway Engineering (42525)
- Railway Engineering (46525)
- Transport (51525)
- Transport Systems Engineering (42525)
- Transport Systems Engineering (46525)

In the expert report and expert table prepared - “in accordance with the study accreditation commission 10.05.2013. Annex to the Methodology for the Study of the Approved Study Areas of the Organizational Process for the Evaluation of Study Areas, which have been fully assessed within the framework of the European Social Fund project”.

The evaluation table included 4 categories: Quality, Resources, Sustainability, Cooperation.

In the Quality section, the rating was 'good', but the recommendations were as follows:

1. Practical training should be more in line with the study program.
2. Greater involvement of students in the organization of studies is needed.
3. B (bachelor) and M (master) students need to be more involved in science.

In the Sustainability section, the rating was 'good', but the recommendations were as follows.

1. It is necessary to plan the development of the academic staff more regularly.
2. A more in-depth analysis of future plans is needed.

In the Cooperation section, the evaluation was "good", but the recommendations indicated the following.

1. The international mobility of students must be developed.
2. More subjects in English could be organized, as English is good for academic staff.

In the Resources section, the rating was “3” - the library is far from the faculty; assessment was “2” - Insufficient financial resources to ensure the implementation of the study program - “Deficiencies can be eliminated within 2 years”

During the reporting period, the instructions mentioned in the accreditation report were reviewed regularly in accordance with 2.2. internal quality assessment activities. The number of foreign students has significantly increased, by conducting regular student surveys, feedback has been activated to improve the study process. Financial resources have increased slightly, but they are not enough to attract new doctoral students to the study process.

These assessments were applicable to all study programs.

An overview of the implementation of the recommendations is attached. See Annex.

### 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, the European Social Fund project “Strengthening the academic staff of the Technical University of Riga in areas of strategic specialization (To reduce the fragmentation of study programs and strengthen the sharing of resources (hereinafter - SAM 8.2.1.)”, under the study field , was developed and the newly established doctoral program “Mechanical Engineering and Mechanics” and the program of the professional bachelor and professional master “Railway Engineering” were newly created.

The Mechanical Engineering and Mechanics Program was licensed on 2 September 2020 and the recommendations given in the licensing report are listed below.

**Recommendation for the long-term development of the study program, to be implemented until the accreditation of the course of study:**

“More involvement in the development and development of the study program, promote more awareness of the doctoral support mechanisms available to both students and program teachers, which are provided for by the Riga Technical University doctoral school.”

RTU informs both students and lecturers about the available support mechanisms for doctoral students, which are provided by the Doctoral School of Riga Technical University, centrally, using several information channels: ORTUS, section on RTU website (https://www.rtu.lv/lv/studijas/doktora-limena-studijas/doktoranturas-skola), as well as using Twitter: twitter.com/DoctoralSchool un Facebook: facebook.com/RTUDoktorantura. All information channels are available to students, while regular viewing of ORTUS news by lecturers is a mandatory daily event in accordance with the Rector's order.

Both topicalities of the RTU Doctoral School are available to both students and lecturers. Additional on the MTAF website, in the news section (https://www.rtu.lv/lv/mtaf/par-mums-mtaf/mtaf-zinas) the latest news is posted.

In its turn, on the MTAF website, in the section “Information for students” there is a separate section “Doctoral studies”, where you can place all current events that apply to doctoral students (there will be a link, because there is still a section)

**A short-term recommendation which the institution of higher education is required to comply with before the beginning of the study program:**

“Assessing the ability to supplement the content of study courses with study courses on composite technology and 3D printing technology, as the coverage of these advanced technologies is essential for the doctoral program.”

3D printing technologies are included in the study program as part of additive technologies. Both composite materials technologies and additive technologies are included in several study courses of the program, ensuring their acquisition and suggesting interest in conducting scientific fundamental and applied research in the various applications of these technologies. For example, the study course “MMM779 Technological Process Design” included in Part B of the program has been supplemented with the topic “Use of Additive Technologies”. The specialization courses related to welding "MMM701 Welding and allied processes" and related technologies are also intended to quote "the development trends of welding and related processes, their use in additive production" are analysed in depth.

See changes in the descriptions of the respective study courses.

The study quality commission meeting on 27 July 2020 decided on the “Railway Engineering” program of the professional bachelor of Riga Technical University. Meeting of 19 August 2020: decision on the licensing of the “Railway Engineering” professional masters' program. The critical remarks given in the expert opinions are given below.

**Professional bachelor study program "Railway Engineering"**

The planning of annual events for raising the qualification of the academic staff and the participation of lecturers in the exchange of the academic staff with foreign universities and the development of a mechanism for evaluating the effectiveness of periodic events has been started. The academic staff participates in courses, seminars, etc. organized by RTU. in-service training measures. Applications for starting cooperation with a foreign university have been submitted to the RTU Department of International Relations.

The process of updating the professional standard “Railway Transport Engineer (2149 27)” was initiated and successfully completed. It was decided to exclude the qualification of "Railway Electrical Engineer" from the program, because in modern railway electrical systems are an integral part of railway transport, that is included in the professional standard of "Railway Transport Engineer".

Involvement of a wide range of companies operating in the wider industry has started in the process of program development / improvement, and employers have been invited to submit topics for the development of bachelor's theses.

A long-term forecast has been started on the content of the study program, the nomenclature of their specializations and the provision of internships and jobs, as well as the number of students required in the future. Changes have also been made to the program with the long-term forecasted result to ensure the compliance of the trained engineers with the development trends of railways and transport and to interest more young people in the study program.

Students are offered the opportunity to participate in the Erasmus+ program. In order to arrange the organization of study practice abroad, the process of concluding cooperation with Deutsche Bahn AG and Rail Baltica has been started.

Greater involvement of teachers in the Erasmus+ program has not yet started, and it is planned to start this process in 2022.

It is not possible yet to provide students with the opportunity to enter the classrooms without the mediation of the teaching staff, as it is related to RTU's centralized economic processes, renting out buildings and premises, managing them and resolving legal issues regarding material liability.

**To plan annual measures for raising the qualification of the academic staff and to evaluate the implementation of these plans and the effectiveness of the measures taken periodically (every year). Including activating the participation of lecturers in the exchange of academic staff with foreign universities.**

The planning of annual events for raising the qualification of the academic staff and the participation of lecturers in the exchange of the academic staff with foreign universities and the development of a mechanism for evaluating the effectiveness of periodic events has been started. The academic staff participates in courses, seminars, etc. organized by RTU. in-service training measures. Applications for starting cooperation with foreign universities have been submitted to the Department of International Relations of RTU.

**Initiate the renewal of the professional standards “Railway Transport Engineer (2149 27)” and “Railway Electrical Systems Engineer (2151 20)”.**

The process of updating the professional standard “Railway Transport Engineer (2149 27)” was initiated and successfully completed. It was decided to abandon the qualification of "Railway Electrical Engineer", as modern railway electrical systems are an integral part of railway transport and are included in the professional standard of "Railway Transport Engineer".

**Involve a wider range of companies in the industry in the program development / improvement process and ask employers to offer topics for developing bachelor's theses.** Involvement of a wide range of companies operating in the wider industry has started in the process of program development / improvement, and employers have been invited to submit topics for the development of bachelor's theses.

**To create a more detailed long-term forecast of the content of the study program, the number of students required in the future, the nomenclature of their specializations and the provision of internships and jobs.**

A long-term forecast has been started on the content of the study program, the nomenclature of their specializations and the provision of internships and jobs, as well as the number of students required in the future. Changes have also been made to the program with the long-term forecasted result to ensure the compliance of the trained engineers with the development trends of railways and transport and to interest more young people in the study program.

**To promote students' participation in the Erasmus + program, separately, to organize the completion of study practice abroad.**

Students are offered the opportunity to participate in the Erasmus + program. In order to arrange the organization of study practice abroad, the process of concluding cooperation with Deutsche Bahn AG and Rail Baltica has been started.

**To promote greater involvement of the teaching staff in the Erasmus + program, only one teaching staff was advertised during the visit, the potential of this program should be used and the experience gained from universities of other countries should be used**

**at RTU.** Greater involvement of teachers in the Erasmus + program has not yet started, and it is planned to start this process in 2022.

**It is necessary to provide students with the opportunity to enter the classrooms without the mediation of the teaching staff.**

It is not possible to provide students with the opportunity to enter the classrooms without the mediation of the teaching staff, as it is related to RTU's centralized economic processes, renting out buildings and premises, managing them and resolving legal issues regarding material liability.

**Professional master study program "Railway Engineering"**

It is planned to offer internships to foreign (English) students within the project of SIA “Eiropas Dzelzceļa līnijas”, “Rail Baltica”.

The program is supplemented with a pedagogy study course. The methodology of the scientific work is included in the development of the master's thesis.

The topic of the test papers (master's theses) has been expanded by receiving information from industry companies about their current problems and tasks for solving these problems within the framework of the master's thesis.

The standard of the professions of Railway Technology Engineer has been developed and approved, and due to that both significant changes and improvement of the content of the study program have been made in the program.

Involvement of a wide range of companies operating in the wider industry has started in the process of program development / improvement, and employers have been invited to submit topics for the development of bachelor's theses.

Representatives of the industry participated in the development of the professional standard and in accordance with the improvement of the study program, in cooperation with whom the forecast of specializations, as well as the planning of internship and job provision was started.

The study course in pedagogy also envisages the possibility of pedagogical practice, while the opportunity to undertake scientific practice is by doing a master's thesis in research and preparing a scientific publication about the researched problem and its solution.

Discussions have been started on the possibilities of forming a council of the licensed study program, in which all interested parties would participate (employers, students, lecturers).

The development of a teacher training system has been started.

The development of a plan for the use of the Erasmus+ program, both for teachers and students, has been started, in order to make better use of the exchange program, including the performance indicators to be achieved.

**To find a solution to the issues of organization of study practice for foreign (English) students, providing students with an offer of practice places (to be completed before the beginning of the study practice).**

The issue of organizing an internship for international students is being agreed with Siemens and Bombardier. and it is planned that the relevant agreements will be concluded before the start of the internship. It is planned to offer internships to foreign (English) students within SIA “Eiropas Dzelzceļa līnijas, and “Rail Baltica” project.

**Find opportunities to supplement the program with studies of pedagogy and research methodology.**

The program is supplemented with a pedagogy study course. The methodology of the scientific work is included in the development of the master's thesis.

**To expand the topic of the final examination thesis (master's thesis) by receiving information from the companies about their current problems and tasks for solving these problems within the framework of the master's thesis.**

The topic of the test papers (master's theses) has been expanded by receiving information from industry companies about their current problems and tasks for solving these problems within the framework of the master's thesis.

**Initiate the development of professional standards and harmonize it with the content of the study program.**

The standard of the professions of Railway Technology Engineer has been developed and approved, and due to that both significant changes and improvement of the content of the study program have been made in the program.

**Involve a wider range of companies in the industry in the program development / improvement process and ask employers to offer topics for developing master's theses.**Involvement of a wide range of companies operating in the wider industry has started in the process of program development / improvement, and employers have been invited to submit topics for the development of bachelor's theses.

**The range of potential railway-related employers is expanding, therefore a wider involvement of the industry is needed both for the improvement of the program and for forecasting the nomenclature of the number of students and specializations, as well as for planning the provision of internships and jobs.**

Representatives of the industry participated in the development of the professional standard and in accordance with the improvement of the study program, in cooperation with whom the forecast of specializations, as well as the planning of internship and job provision was started.

**Within the framework of the study program, as an optional subject, to offer students the opportunity to undertake pedagogical and scientific practice.**

The study course of pedagogy also envisages the possibility of pedagogical practice, while the opportunity to undertake scientific practice is by doing a master's thesis in research and preparing a scientific publication about the researched problem and its solution.

**RTU should evaluate the efficiency of the existing study field council, as well as evaluate the possibility to form a council of the licensed study program, in which all interested parties would participate (employers, students, lecturers).**

Within the competence of the study department. Discussions have been started on the possibilities of forming a council of the licensed study program, in which all interested parties would participate (employers, students, lecturers).

**To develop a system of in-service training for teachers.**

The development of a teacher training system has been started.

**Develop a plan for using the Erasmus + program for both teachers and students. Exchanges for better use of planned programs. Including achievable performance indicators.**

The development of a plan for the use of the Erasmus + program has started, both for teachers and students, for the better use of the exchange program, including the performance indicators to be achieved.

**Major(significant) changes following licensing in the Professional Master's degree program "Railway Engineering"**

**Changes in the duration, volume, conditions of admission and degree and qualification awarded**

Due to the need to update the “Railway Engineering” professional master's study program and its compliance with the newly developed standards of the Railway Technology Engineer professions, the following significant changes are being made and approved at the FMTA direction commission and RTU Senate meeting:

Prof. Master, Railway Engineering (MGH0):

1. The variant of the study program amounting to 60 credit points, for which the previous Professional Bachelor Degree in railway electrical systems and qualification of a railway electrical systems engineer or education comparable with it is required, has been excluded;
2. The variant of the study program amounting to 60 credit points [2], for which the previous professional Bachelor degree in Railway Electrical Systems and the qualification of a railway electrical systems engineer or education comparable with it is required, has been changed with regard to the following parameters:
    - Duration and volume: 2 years and 80 credit points;
    - Types and forms of studies: full-time intramural studies – 2 years, part-time extramural studies – 3 years, part-time intramural studies – 3 years;
    - the obtained degree / professional qualification: Professional Master Degree in railway transport / railway technology engineer (EQF -European Qualification Framework/LQF – Latvian Qualification Framework 7th level/PQL – Professional qualification level - 5th level);
    - Admission requirements: Professional Bachelor Degree in engineering or education comparable with it.
3. A new implementation version [1] with the following parameters is added:
    - Duration and volume: 1 year and 40 credit points;
    - Types and forms of studies: full-time intramural studies – 1 years, part-time extramural studies – 1 year and 6 months, part-time intramural studies – 1 year and 6 months;
    - the obtained degree / professional qualification: Professional Master Degree in railway transport / railway technology engineer (EQF -European Qualification Framework/LQF – Latvian Qualification Framework 7th level/PQL – Professional qualification level - 5th level);
    - Admission requirements: Professional Bachelor Degree in railway electrical systems or professional bachelor degree in railway transport, or comparable education;
    - All existing fields of specialization were removed from the list of the study courses within the study program. Some study courses were removed, some courses were replaced with newly created courses to ensure compliance with the profession standards.

Tables for the performance of recommendations provided by licensing experts are attached in the Annex.

# 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) | Dvelpoment plan for the study field _ENG.pdf | Studiju virziena attīstības plānsPZ.pdf |
| The management structure of the study field | RTU_Study_Direction_Management_Structure.pdf | RTU_studiju_virziena_parvaldibas_struktura.pdf |
| 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. | Agreements on continuinuing education.zip | Ligumi par izglitibas turpinasanu.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 līgumi.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 | Student_survey FMETA ENG.pdf | Aptaujas_studenti_MTAF LV.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 | Teaching_staff_Annex.xlsx | Macibspeki_Pielikums.xlsx |
| Biographies of the teaching staff members (Curriculum Vitae in Europass format) | Teaching_staff_EN.zip | Macibspeki_CV_LV.zip |
| A statement signed by the rector, director, head of the study programme or field that the knowledge of the state language of the teaching staff involved in the implementation of the study programmes within the study field complies with the regulations on the state language knowledge and state language proficiency test for professional and official duties. | 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. | MTAF_proj._LV_EN.xlsx | MTAF_proj._LV_EN.xlsx |
| List of the publications, patents, and artistic creations of the teaching staff over the reporting period. | MTAF_publik..xlsx | MTAF_publikācijas.xlsx |
| II - Description of the Study Field - 2.5. Cooperation and Internationalisation | | |
| List of cooperation agreements, including the agreements for providing internship | List of cooperaton agreements_EN.zip | Sadarbības līgumu saraksts_LV.zip |
| Statistical data on the teaching staff and the students from abroad | p.2.5 I EN statistics on foreign full-time students (4).docx | p.2.5 I LV statistikas dati par arvalstu studejosiem (1).docx |
| Statistical data on the incoming and outgoing mobility of students (by specifying the study programmes) | p.2.5 II EN Statistics on students mobility (2).docx | p.2.5 II LV Statistikas dati par studējošo izejošo un ienākošo mobilitāti (1).docx |
| Statistical data on the incoming and outgoing mobility of the teaching staff | p.2.5. III EN Staff mobility.docx | p.2.5. III LV Macibspeki.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. | Report of expert recomendation Annex3.pdf | Studiju virziena rekomend parskats pielikums 3.pdf |
| An application for the evaluation of the study field signed with a secure electronic signature | 01000-2.2.1-e_292.edoc | 01000-2.2.1-e_292.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 | MGH0_diploms_dipl_supple.zip | MCE0_diploms_dipl_pielik_dipl_supple.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) | MMR0_CHE_opinion.docx | |
| 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 | MGA0_stud_statist.pdf | MCE0_stud_statis_LV_EN.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 | MCX0_StEdSt_6_annex.pdf | REV-MBM0_VaIzSt_6_pielik.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 | | |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | REV-3.2.5 MBM0_CurricStPogr_9_annex_EN.pdf | REV-3.2.5 MBM0_StudProgrPL_9_pielik_LV.pdf |
| Descriptions of the study courses/ modules | MCH0_DescriptStud_cour.zip | RMDC0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | | MGF0_Prakse_Apr.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | Apliecinājums - AL 55. pants par prof. skaitu akadēmiskās programmās.edoc |

# Other annexes

| Name of document | Document |
|---|---|
| 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 |
| Pirmā kursa studentu aptauja/survey first study course students | Annex First_course stud survey 2020 MTAF.xlsx |
| Rekomendaciju izpilde_Fulfillment of recomendations.zip | Rekomendaciju izpilde_Fulfillment of recomendations.zip |
| Par minimālo studējošo skaitu studiju programmās | Par_minimālo_studējošo_skaitu_studiju_programmās.pdf |
| On minimal number of students in study programmes | On_minimal_number_of_students_in_study_programmes.pdf |
| Statistikas dati par kopējo mobilitāti_Statistics on total mobility.docx | Statistikas dati par kopējo mobilitāti_Statistics on total mobility.docx |
| Līgumi, kas apliecina, ka augstskola studējošiem nodrošinās iespēju turpināt izglītības ieguvi citā studiju programmā vai citā augstskolā | Līgumi par izglītības ieguves turpināšanu.zip |
| Līgumi, kas apliecina, ka augstskola studējošiem nodrošinās iespēju turpināt izglītības ieguvi citā studiju programmā vai citā augstskolā | Agreements on continuing education.zip |
| Finansējuma sadalījums starp izmaksu pozīcijām / Funding distribution between the cost items | Studiju_programmu_finansejuma_sadalijums.pdf |
| Ar drošu elektronisko parakstu parakstīts iesniegums studiju virziena novērtēšanai (18.02.2022.) | 01000-2.2.1-e_57.edoc |

# Mechatronics (42521)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Mechatronics* |
| Education classification code | *42521* |
| Type of the study programme | *Professional bachelor study programme* |
| Name of the study programme director | *Anita* |
| Surname of the study programme director | *Avišāne* |
| E-mail of the study programme director | *anita.avisane@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., docente* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study program is to provide practical, science-based education necessary for the field of mechatronics, providing the necessary knowledge, skills, and competence that enable the mechatronics engineer to adapt to the labour market and implement the acquired knowledge in the areas of mechanical engineering, energy, automation, and computer technology.* |
| Tasks of the study programme | *1. To learn the basics of fundamental sciences;<br>2. To acquire general education humanitarian, social and environmental study courses;<br>3. To acquire theoretical, technical, and economic study courses corresponding to the profile;<br>4. To obtain the necessary knowledge for solving practical tasks;<br>5. To develop skills to perform the scientific activity.* |

| | |
|---|---|
| Results of the study programme | *Knowledge:*<br>*Ability to demonstrate basic and specialised knowledge characteristic to the sector of sciences of machines and profession of mechatronics engineer, and critical application of this knowledge that is in line with the most advanced achievements of the respective branch of science and profession. Ability to demonstrate understanding of most crucial concepts and regularities of the science of machines or professional field.*<br>*Skills:*<br>*Ability to apply the mastered theoretical basis and skills of mechatronics engineer; to carry out professional, innovation or research activities; to define and analytically describe information, problems and solutions in the sector of sciences of machines and profession of mechatronics engineer and to explain and substantiate them to specialists and laymen; to structure and accomplish independent studies and professional perfection of himself/herself and subordinates; to demonstrate scientific approach to problem solving; to assume responsibility and take initiative when carrying out work individually or in team; to take decisions and find solutions in changing or problematic situations.*<br>*Competencies:*<br>*Ability to independently gather, select and analyse information on the science of machines and use it, to take decisions and solve problems in the science of machines and profession of mechatronics engineer, to demonstrate understanding of professional ethics, to assess the effect of his/her professional activity on the environment and society and participate in the development of the respective professional field.* |
| Final examination upon the completion of the study programme | *Bachelor's Thesis including Project* |

# 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 mechatronics* |
| Qualification to be obtained (in english) | *Mechatronics engineer* |

### 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 volume of the professional Bachelor’s program is 160 CP, which consists of study courses (128 CP), internship (20 CP), and a state examination (12 CP), a part of which is the elaboration and defense of a bachelor’s thesis. General secondary education or 4-year vocational secondary education is required to start studies. As a result of the successful acquisition of the study program, students are awarded a professional degree in mechatronics and the qualification of a mechatronics engineer. Type of implementation are full-time (4 years). The latest teaching methods are integrated into the study program, and it is supplemented with the most recent topics in the field. The new teaching staff is attracted to implement separate study courses if necessary.

To improve the quality of the study program, after hearing the opinion of students and graduates of the study program, the director of the study program proposed changes in the study program “Mechatronics” - in section A study courses DAI201 Electrical Measurements [3CP] and DAA201 Basics of Computer Graphics, Pattern Recognition and Image Processing [2CP] were excluded. Study courses - MAB339 Manufacturing Technology of Machines and Devices [3CP] and MAB267 Basis of the Automated Designing - SolidWorks [2CP] were included. Section B1 was supplemented with the study course MAB373 Devices for Feeding and Orientation of Details [3CP].

The RTU Vice-Rector for Studies has approved changes to the program. Order No. 02000-1.1 / 46 of May 20, 2014. Based on the decision of the Council of the Institute of Mechanical Engineering Technology on January 7, protocol No. 1/14.

To fulfill the Riga Technical University Sports Development Concept of 2017-2020. (approved by the decision of the Senate sitting of March 27, 2017, protocol No. 608 “On approval of RTU Sports concept and tasks in the reorganization of RTU sports structural units”) the study course Sport [0 CP] was excluded from the study program.

For the structure and content of the study programs to comply with the requirements of the State Standards of Higher Education of the Republic of Latvia, changes were made to the Mechatronics (MCE0) study program according to the “Riga Technical University Uniform Requirements for Academic and Professional Study Programs”

In Part A of the study program, the amount was changed from 112 CP to 116 CP. The study course IET103 Economics [2CP] was excluded. A new study course SDD700 Innovative Product Development and Entrepreneurship [6CP] was included.

The volume of Part B of the study program has been changed from 20 CP to 16 CP and the volume of the section on humanitarian and social study courses (B.2.) - from 2 CP to 4 CP, language (B.6.) section from 5 CP to 4 CP. The section on economics and management study courses (B.3) and the list of study courses in this section were excluded.

The RTU Vice-Rector has approved changes to the program for Studies Order No. 02000-1.1 / 50 of May 16, 2017. Based on the decision of the meeting of the commission of the study direction

“Mechanics and Metal Processing, Heat Power Engineering, Heat Technology and Mechanical Engineering” of April 20, protocol No.2.

The content of the study courses was reviewed and analyzed. In order to improve the quality and competitiveness of the study program, changes were made in the study program “Mechatronics”. The council of the Institute of Mechanics and Mechanical Engineering 08.09.21. No. 25500-2 / 4 decision on changes. As a result, the total amount of the study program has been changed from 180 to 160 CP. The volume of credit points has been reduced by 20 CP. The total amount has been changed to change the duration of studies from 4.5 years to 4 years.

The volume of Part A was changed from 116 CP to 90 CP, and Part B1 was changed from 9 CP to 24 CP. The implementation of the indicated changes was facilitated by considering various risks for the quality assurance of the study program and the development of the study program.

Part B2 humanities and social studies courses were clarified and improved.

The volume of Part D of the study program has been changed from 26 CP to 20 CP. The existing study courses were replaced by the study course MMM010 “Designer Practice” [20 CP].

Changes to the program have been submitted for approval to the Commission for the Study of Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering. The decision of the Study direction Commission at the meeting of September 9, 2021, protocol No.4.

**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 study program “Mechatronics” is the 6th level of European Qualifications Framework (EQF) and Latvian Qualifications Framework (LQF) study program. The graduates obtain a Professional Bachelor’s degree in Mechatronics and Qualification of Engineer in Mechatronics.

The study program aims to ensure that professional education is suitable for practical use, based on scientific bases and competencies, is necessary for the field of mechatronics. Thus - to prepare competitive, including internationally, mechatronics engineers following economic requirements, with the necessary knowledge, skills, and competencies, including the ability to adapt and enter the labor market and continue studies at a higher level.

In order to achieve the aim of the study program, the main tasks are as follows: in accordance with the title and goal of the program to provide education corresponding to the Bachelor’s level and mechatronics qualification, ensuring understanding of the most essential concepts and regularities of the mechatronics industry and relevant professional field; to ensure the development and improvement of the study process by using modern study methods and techniques (in lectures, practical classes, during internship and project development), thus ensuring the development of skills and competencies, using the acquired knowledge and understanding in solving practical tasks; to ensure understanding and skills in solving automation tasks, as well as in quality management in accordance with the requirements of the industry; to develop skills to perform research work, analytical thinking and other relevant skills and competencies that would allow, inter alia, to continue studies at a higher level, as well as to promote their use in practice; to develop an understanding of the need for continuous professional development as the industry and technology develop, developing and implementing innovative solutions, promoting interest in lifelong learning and international mobility.

According to the study program’s title, aim, and tasks, the study results are also coordinated, which are formulated as a set of all skills and competencies required for bachelor mechatronics engineers. It should be noted that the mentioned skills and competencies are fully harmonized with the requirements of the industry, formulated in the relevant professional standard (Standard for Mechatronics Engineer), which was developed and evaluated by representatives of the mechanical engineering, hardware and metalworking industry, leading specialists, mechanical engineering and mechanical engineering experts, and representatives of the Metalworking Industry Association (MASOC).

RTU is a long-term member of MASOC (The Accociation of the Mechanical Engineering and Metalworking Industries of Latvia), a representative of RTU FMETA (Faculty of Mechanical Engineering, Transport and Aeronautics) is included in the board of MASOC. MASOC is a member of ORGALIME, the European Association of Engineering Industries, and there is extensive cooperation with industry associations and other organizations around the world. In order to cooperate and participate in the activities of MASOC, the study programs are regularly evaluated in the FMETA Convection meetings. The study program also envisages an internship. The aim of the Bachelor’s thesis with the project part is to solve the actual tasks in the Mechanical and Instrumental Engineering industry in cooperation with companies. The defense of the Bachelor’s thesis with the project part takes place at the meeting of the State Examination Commission, which includes at least 50% of the leading specialists in the field. Thus, regular and uninterrupted connection with the industry and operative management of the study process is ensured, taking into account the actual tendencies in Mechanical Engineering.

Admission requirements are coordinated with the aim, tasks, and study results of the study program. The studies can be started if the applicant has a general secondary or professional secondary education and meets other RTU requirements formulated in RTU Admission Regulations for academic and professional undergraduate programs. The basic principles of admission are that admission is based on the results of centralized examinations (CE) in mathematics, Latvian and foreign languages (if in addition to the above CE is passed in physics, the results of these CEs are taken into account in the ranking) and annual marks in other subjects.

Thus, there is a transparent interconnection between the aim, tasks, study results and admission requirements of the study program, providing the economy with new specialists with one of the most demanded engineering qualifications and a bachelor’s degree, which ensures successful implementation and operation of mechatronic systems in various fields.

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

Students of the study program “Mechatronics” are in demand in the labor market not only when they have already finished their studies but also during their studies. Given that the capacity of the education system to train the specialists needed for the industry is several times lower than the actual demand for the relevant specialists. Most students are admitted to internships and start their work before graduation.

The mechanical engineering and metalworking sector employs about 23,000 people. The total turnover of the sector in 2020 was about 1.9 billion EUR, of which about 1.5 billion in export revenue.

The main problem that the industry has long faced is the availability of qualified professionals. MASOC's annual industry research shows that 70% of companies in the industry identify the lack of qualified professionals as a significant impediment to development.

The most considerable shortage as a percentage of the existing number of employees is in engineering personnel. The two most demanded specialties are mechanical engineers (incl. Designers, technologists) and mechatronics engineers.

According to the results of a recent MASOC industry study, the industry currently needs approximately 150-220 additional mechanics and 60-100 mechatronics engineers.

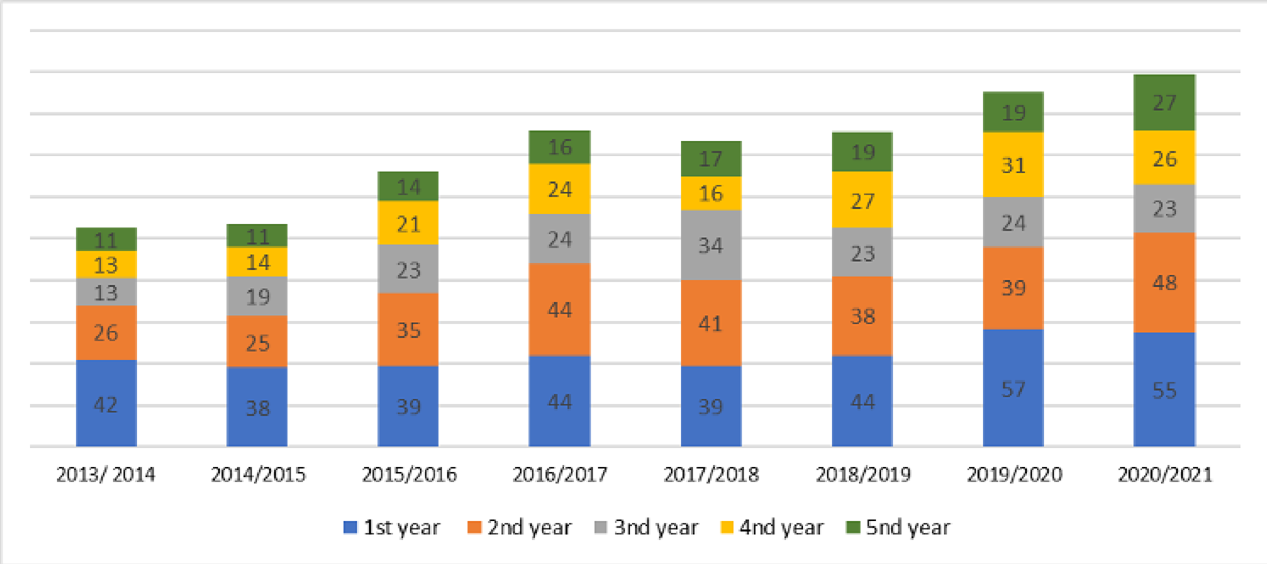
### 3.1.4. Statistical data on the students of the respective study programme, the dynamics of the number of the students, and the factors affecting the changes to the number of the students. The analysis shall be broken down into different study forms, types, and languages.

Analyzing the number of students in the period from 2013/2014. study year until 2019/2020, it can be concluded that the total number of students in this period is increasing every year. Appendix no.5 provides student dynamics tables and graphs.

The dynamics of the number of students is described taking into account that until 2021 the study program "Mechatronics" lasted 5 years (9 semesters).

| Number of students per study year | 2013./ 2014. | 2014./ 2015. | 2015./ 2016. | 2016./ 2017. | 2017./ 2018. | 2018./ 2019. | 2019./ 2020. | 2020./ 2021. |
|---|---|---|---|---|---|---|---|---|
| *Total number of students* | *105* | *107* | *132* | *152* | *147* | *151* | *170* | *179* |
| 1. course | 42 | 38 | 39 | 44 | 39 | 44 | 57 | 55 |
| 2. course | 26 | 25 | 35 | 44 | 41 | 38 | 39 | 48 |
| 3. course | 13 | 19 | 23 | 24 | 34 | 23 | 24 | 23 |
| 4. course | 13 | 14 | 21 | 24 | 16 | 27 | 31 | 26 |
| 5. course | 11 | 11 | 14 | 16 | 17 | 19 | 19 | 27 |
| On academic leave | 1 | 2 | 5 | 8 | 21 | 9 | 18 | 25 |
| Graduates | 11 | 8 | 12 | 13 | 14 | 15 | 14 | 11 |
| Studies for a fee | 4 | 7 | 3 | 2 | 3 | 3 | 4 | 3 |

Dynamics of the number of students by courses and study years




The number of students depends on the number of study places financed from the state budget. The study courses of the program are read in several places in Latvia (Riga, Liepaja, Daugavpils) and lecturers provide the profiling study courses from three faculties (Faculty of Mechanical Engineering, Transport and Aeronautics, Faculty of Computer Science and Information Technology, Faculty of Electrical and Environmental Engineering).

Analyzing the number of graduates, it must be concluded that it is not large compared to the admitted students. Students are admitted to defend the Bachelor's thesis when all their academic and financial obligations are fulfilled.

The proportion of students (around 30%) indicates that it is impossible to complete their studies due to the load at work. Almost all students are forced to work from the 2nd year due to their financial situation. A small part indicated that they could not complete their studies due to their own or their family's health problems and studying remotely at RTU counseling points.

As the drop-out rate shows over the years, the main reason is the failure in the first two courses, because we admit students with a low rating. However, there is also a part of students that leaves at the last year because it is not able to develop a Bachelor thesis in time (primarily due to workload). Another important reason is the lack of financial resources due to tuition fees and other outstanding liabilities. A small number of students study with private funding; some of the studies are paid for by the employer because the students themselves do not always have enough financial resources to pay for the studies. Due to the crisis in the country, some students and their guarantors are losing their solvency, and new sources of income are being sought; thus, study time is declining.

The study program is implemented in Latvian. However, every year a part of the study course is implemented in English by inviting guest lecturers. The study program is interdisciplinary, so students have to study various study courses related to the field of study so that the studies finally acquire the knowledge required by the professional standard. After graduation, the students can work in various companies - metalworking, woodworking, food production, etc.

**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 information included in the study courses: the results to be achieved; the set goals; the content of the permanent work meets both the aims of the study program and the results to be achieved, as well as the requirements of the professional standard – Standard for Mechatronics Engineer.

At the Faculty of Mechanical Engineering, Transport and Aeronautics, the content of study programs is regularly analyzed at the conventions, discussing them with the industry representatives. The program's content is also constantly analyzed by MASOC management and its representatives. The opinion of the industry representatives is that the study program is essentially relevant to the industry. The study program is comprehensive; the general study courses provide students with basic knowledge in STEM, humanitarian and social fields. In turn, in the specialized study courses of the field, students are introduced to the most up-to-date information and fundamental knowledge in mechanics, material processing technologies and automation, which is in line with the needs of the industry for employees with a general understanding of a wide range of issues. In general, the content of the study program covers all the necessary knowledge for a student to successfully start working in the relevant field. Proposals for the improvement of the program are regularly received from the representatives of the industry, which are also implemented as far as possible. Evaluating the content of the updated standard of the profession "Mechatronics Engineer" changes were introduced in the program, supplementing or changing the content of individual study courses and changing the study courses included in the program.

The content of the study course integrates the latest information related to the requirements of the Industry 4.0 concept regarding autonomous robots, simulations, 3D printing, and additive technologies.

The updating of study courses is carried out by the structural units responsible for the study courses. Those responsible and the academic staff are involved in implementing the study courses. Changes in basic sciences and general education courses with less variable content (mathematics, physics, chemistry, theoretical mechanics, etc.) are related to the entry of new technologies. The content of specialized courses in the field is changing rapidly; thus, part of the content of study courses is renewed every year.

The program improvement plan was discussed and approved in the structural units implementing the program and in the study field commission.

### 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).

Not 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.

Various methods are used to acquire and evaluate the courses and practical skills of the program - analysis of problem situations, seminars, group work, laboratory work, problem-oriented studies, use of information technology. RTU generally determines the organization of the study process, which is regularly updated based on the situation in the country. RTU has adopted and is bound by the “Regulations for the Evaluation of Study Results”.

In the implementation of the study program, the principles of student-centered education have been taken into account. In addition to the group tasks, individual tasks are set for students, taking into account the student’s interests and desire to specialize. The schedule of classes and the times of examinations are developed taking into account the possibilities of students as employed persons. Students are informed about the examination methods, criteria, and the procedure for appealing the assessment. Students are introduced to the expected results and report form of each course and test papers at the beginning of any study course. The content of the course, expected results, recommended literature and other important information are provided in the description of each course.

The results of the study process are analyzed in discussions with the director of the study program, as well as in the meetings of the Department of Mechanical Engineering and Mechatronics. The course of studies is analyzed in the following aspects: implementation of the study program and study plan by content and volume; the level of assessment of students’ knowledge, skills, and abilities and its compliance with the qualification requirements for specialists in professional programs; course acquisition results; and financial and economic compliance of the study process with the possibilities and requirements of the institute.

The study program includes various work and assessment methods: tests (oral / written), tests (written), exams (oral / written), course projects (written) with their defense (oral), which is concluded by a qualification paper with a diploma project evaluation.

A ten-point grading system is used to assess knowledge. Students’ work is mainly evaluated based on their success in the exam session.

The study results are determined and introduced to the student in each study course. So that as a result of the assessment, the student knows, understands his/ her competence and abilities, as well as receives recommendations for further improvement.

The student's knowledge of the study program is assessed after taking the study courses twice in the academic year - in winter and spring sessions. During this time, students take exams in study courses in accordance with the developed individual study plans. Exam questions are designed so that the students can prepare themselves to achieve the goal of the study course described in the description of each course. If necessary, students demonstrate the acquisition of the study subject on stands, use posters and models. Explanations shall be given orally. Exam questions are prepared on the basis of the course syllabus by the responsible lecturer, whose duties include teaching the respective study course.

The study program includes an internship in a company related to the Mechanical Engineering industry. The internship is in total 24 CP and forms a significant part of the student's acquisition of skills and competencies. For a detailed description of the internship, see 2.4. section.

**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).**

An essential component of the program is the internship, which until the enrollment in 2021 (inclusive) was in the amount of 26 CP, but starting from 2022, the internship will be in the amount of 20 CP. So far, the internship has been divided into four parts: Production training practice 4 CP; Practical Placement of Engineering 4 CP; Designer practice 4 CP; Practical Placement for Pre-Graduation Project 14 CP. The first three internships were implemented during the first, second, and third study years. The last internship was divided into two parts in the autumn and spring semesters of 6 CP and 8 CP in the fourth year. Each of the internships has tasks, which are indicated in the description of the study course:

- ability to understand and implement locksmith, machining, welding, and soldering work, as well as assembly and repair work;
- to recognize the technical production equipment, the latest technological processes in the company, to formulate the necessity of production mechanization, application of automation means and quality measures;
- to master the stages of mechanical designer documentation development, to perform construction analysis, development, design, and peculiarities of designing work in the company;
- ability to evaluate the existing technological processes and the need for their improvement, to solve the accuracy of the equipment operation, to develop proposals for the improvement of the technological process, to improve the structures of devices and mechanisms;
- to develop and strengthen the student's communication skills and the ability to defend one's

opinion in public and acquire independent work skills.

Starting from 2022/2023, the internship in the amount of 20 CP will be implemented in four parts (4 CP, 4 CP, and 12 CP). Each part will be implemented in one study year in the spring semester. The main results of the internship:

- the ability to draw medium-complex mechanical components;
- the ability to accurately set the required dimensions and tolerances in the assembly drawings, mark assembly units, design drawings in accordance with standards;
- the ability to use computer-aided design programs for 2D drawing and 3D model development;
- the ability to prepare material and component specifications;
- the ability to orientate in the production process.

The aim and tasks of the internship are closely related to the duties and tasks specified in the professional qualification requirements, which ensure the application of theoretical knowledge in practice. The internship supervisor at the internship provides feedback (fills in the feedback), in which the assessment of the internship's knowledge, theoretical training, communication skills, etc., is indicated. A constant close connection with the representatives of the industry is maintained, thus finding an opportunity to develop and improve the curriculum for the labor market requirements even better. For each of the internships, the student prepares an internship report, which is presented and defended in the internship defense commission of the department.

Internships outside RTU are an integral part of professional programs, which students must complete following the 2014 Cabinet of Ministers of the Republic of Latvia. August 26, Regulations No. 512. “Regulations on the second standard professional higher education state standard”, RTU Senate 2002 Decision of April 29, protocol No. 467 “On the structure of the second level professional study programs” and RTU Senate 2019 decision of January 28, Protocol No. 626 “On Approval of the Procedure for Organizing Internships at Riga Technical University in a New Edition”.

Before the internship, a meeting with the study program director or the internship coordinator from RTU is organized. The internship documentation, the internship course, and its defense are explained in the meeting.

According to the regulations, the place of internship may be a company or organization engaged in manufacturing. The internship aims to systematize, strengthen and expand theoretical knowledge and acquire practical skills and abilities. The tasks to be performed during the internship must be directly related to the “Mechatronics” study program and/or study direction in order to strengthen the theoretical knowledge acquired during the studies and develop the ability to perform the assigned tasks on the internship independently, research and analyze problems, and make economically sound decisions.

During the internship, the student:

- have to acquire the professional skills specified in the professional qualification requirements, which would promote professional competence and the ability to apply knowledge appropriate to the field;
- have to develop the ability to analytically formulate and solve current issues and/or problems in the industry;
- must acquire independent work and teamwork skills;
- must learn to orientate in the legislation related to the company, occupational safety and health, quality control, and environmental protection in the current legislation;
- has to learn and apply the basic principles of professional ethics and corporate social responsibility.

- 3-sided agreements are concluded with RTU, the company, and the student-trainee for the student internship. Students have the opportunity to choose from the internship places of previous years, the *Career Day company catalog*, the *MASOC company catalog*, where industry companies have offered internships, and choose another of their choice, provided that they meet the requirements of the industry and program.

According to the regulations on student internships, 3-sided agreements are concluded with RTU, the company, and the student-intern. It is possible to choose the internship place from the internship places of the previous years, as well as those offered by the companies of the industry as current as “MASOC” associations, and to choose others of their choice, provided they meet the requirements of the industry and the program.

### 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.

Students formulate and develop the content of their Bachelor’s thesis according to the acquired qualification. Mechatronics study program students develop equipment design solutions, choose mechanical and electrical drive elements, select the necessary sensitive elements (controllers), select equipment control elements (controllers) and develop electrical, pneumatic, and hydraulic circuits, if necessary.

Samples of Bachelor thesis topics:

- Seaming and pre-packing equipment for metal food-grade packaging.
- Design of an automated pallet dismantling unit.
- Designing of an automated metal sheet storage system.
- Skatuves gaismu izmēriem pielāgojama pakošanas iekārta / Adjustable stage light packing machine.
- Fish breading and frying machine.
- Veneer lay-up line LAC-B60 modernisation.
- Ravioli Production Machine.
- Development of plastic injection machine for individual production.
- IPackaging Wrapping and Palletizing Machine.
- Planed beam packer.
- Recycled textile fiber cross lapping and felting machine.
- Development of metal door packaging equipment.
- Semi-automatic forest tree tulbling planting device.
- Automated car turntable on lift.
- Beer reg turning and labeling line.
- Firewood packing machine.

The topics of students' Bachelor's theses are mostly related to the given task in the company where the student works or undergoes a Practical Placement for Pre-Graduation Project internship. The actuality of the topic is considered in the Bachelor's thesis, and the researched field is analyzed. Current industry trends focus on full or partial automation of production lines and equipment (see above for a list of bachelor thesis topics). The topics of the Bachelor's thesis projects are mostly related to solving real problems in a particular company, so the thesis topics are often developed into an actual, working equipment or production line, which allows the student to apply for the highest possible grade ascertain that the proposed engineering solution is correct.

The presentation and defense of the Bachelor's thesis are carried out at an open meeting of the State Examination Commission (VPK). The commission consists of both FMETA academic staff and company representatives. Thus, students' Bachelor's theses are evaluated from a theoretical point of view and with a great deal of practical orientation from the industry. Students must justify their work solutions from a functional, technological, and economic point of view.

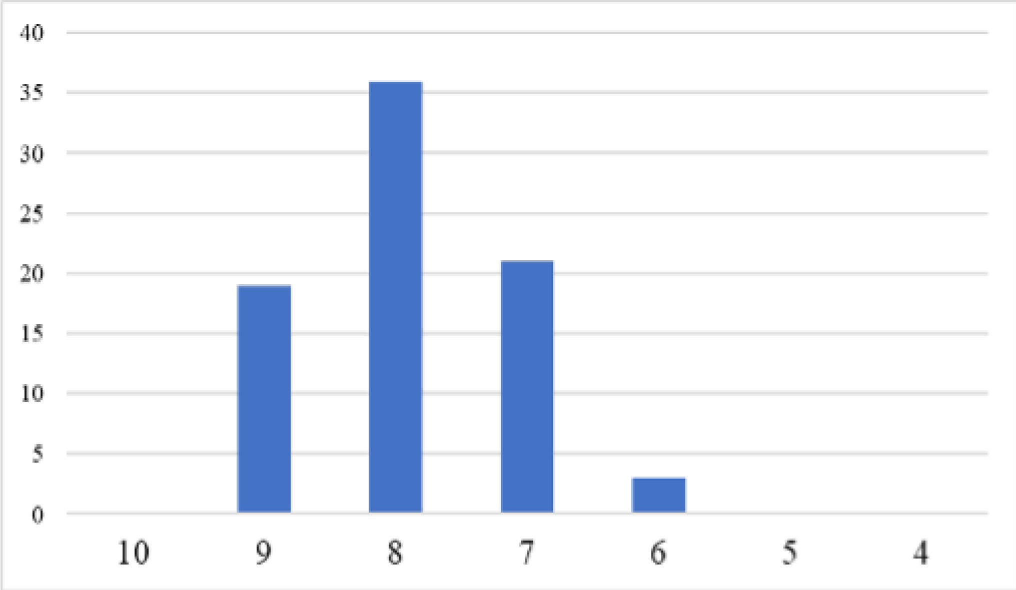
At the moment, there is a very significant shortage of engineers in the labor market. Due to this large deficit, representatives of production companies tend to participate in open meetings for the defense of Bachelor's theses. After defense, the company represenatives tend to address young engineers to offer work (for example, *Beer reg turning and labeling line*) or to develop proposed engineering solutions (for example, *Semi-automatic forest tree tulbling planting device*).

According to the data of the Central Statistical Bureau (CSB), in 2020 there was an increase of + 2.3% in turnover and 1.4% in exports in the mechanical engineering and metalworking sector. Therefore, it can be concluded that, given the economic situation in Europe and the world, the sector is still evolving and the need for a skilled workforce remains. This is also confirmed by the information published on the MASOC website that the most significant problem in the industry is the lack of qualified employees (approximately 70% of companies in the sector indicate this as the most significant problem).

Graduates of the study program Mechatronics work in such companies as SIA "Agility Sports", AS "Latvijas finieris", SIA "Hansamatrix innovation", SIA "Peruza", SIA "Dinex Latvia", SIA "Mass portal", SIA "Aerones", SIA "Lisna", SIA "Baltma", SIA "Valpro", SIA "Granīts", SIA "Plockmatic Riga", SIA "Naglis & ERR", SIA "Kalmet" and others.

Analyzing the last study years, it can be concluded that the highest percentage of graduates received a grade of 8 (very good) (46%). Grade 9 (excellent) was 24% of graduates, and grade 7 (good) was 27%. None of the graduates had a final thesis rating of 4 (almost average).

Final work evaluations since the academic year 2014/2015 (from 10-4 points)




Industry representatives with the required diplomas review student bachelor’s theses. Leading specialists of the companies like A/S “Latvijas finieris”, SIA “Duroc Machine Tool”, SIA “PLC Solutions”, SIA “WeMps”, SIA “Peruza”, and association MASOC, participate in the Bachelor’s thesis defense commissions. The state examination commission consists of 7 to 8 members, of which at least half are representatives of the industry and employees involved in the implementation of the study program.

After each defense of Bachelor’s theses, the state examination commissions report the student assessment. The final grade consists of the Bachelor’s thesis supervisor`s grade, the reviewer`s grade, and the grade obtained during the presentation and defense of the thesis. The revised final assessment is accepted as a result of a collegial decision of the state examination commission. During the defense of the Bachelor’s thesis, the Defense Protocol is filled in, reflecting the questions and the obtained evaluation.

During the elaboration of the Bachelor’s thesis, a progress report of the Bachelor’s thesis is organized at least twice, in which students present the progress of their research. Students’ performance is evaluated by a commission in which the program’s teaching staff is represented. If the commission finds in the last report of the Bachelor’s thesis that the student has not fulfilled the relevant requirements, then the student is not admitted to the defense of the Bachelor’s thesis. In this case, the student must improve his / her work and defend it in the following semester with the program director’s written approval.

## 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.

All material and technical support available at RTU is available to the students and teaching staff of the study program to implement it in the study courses. The academic program is mainly implemented in training laboratories, such as Metrology Training Laboratory, Automation Training Laboratory, Materials Technology Training Laboratory. Still, some classes also take place in scientific laboratories, such as Welding Scientific Laboratory, Metrology Scientific Laboratory, and Tribology Scientific Laboratory.

To implement study courses, where necessary, students work in computer classrooms, where such computer programs as MathCAD, MatLAB, AutoCAD, SolidWorks, ANSYS, etc., are available. Thanks to RTU HPC (High-Performance Center), students can download various computer programs, including AutoCAD and SolidWorks, on their private computers free of charge.

The range of literature available in the RTU library is regularly updated. Funds for the purchase of study or scientific literature are available for each study program. Each year, the teaching staff has the opportunity to submit a list of literature required for the implementation of the specific study program by filling in an order form, which is approved by both the program director and the dean of the faculty. The literature thus purchased is available to the library for all interested parties. The electronically available literature is becoming more available as well.

**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 study program is implemented at the expense of the state budget. Only 1% - 4% of students study the program for tuition fees. The number of students who pay for the studies themselves is consistently small due to the program’s relatively large number of budget places.

The Office of the Vice-Rector for Finance calculates the costs per student within the study program. Expenditures per student in the time frame of 2013-2020 averaged € 4,075.28. The state budget vacancies are allocated after negotiations with the Ministry of Education and Science. The amount of study funding is determined on the basis of the number of vacancies determined by the state at RTU, as well as the base costs of one vacancy determined by the state and the study cost coefficients of the thematic areas of education.

The study cost coefficients for Bachelor’s and professional study programs in the thematic areas of education are determined by the Regulations “Procedures for Financing Higher Education Institutions and Colleges from the State Budget” approved by the Cabinet of Ministers on December

12, 2006 (https://likumi.lv/ta/id/149900 ).

RTU funding from the state core budget for the provision of study places in the respective study year is distributed in accordance with the RTU Senate decision “On the Methodology for Distribution and Use of Basic Budget, Performance Financing and Paid Student Funds to RTU Structural Units”. The methodology is annually reviewed and approved in the new version, considering the necessary changes.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 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 lecturers from the Faculty of Mechanical Engineering, Transport and Aeronautics, other RTU Faculties, and from Study and Science Centers participate in the professional bachelor study program “Mechanical and Instrumental Engineering”. Guest lecturers and specialists from the industry are invited as guest lecturers to increase the quality of studies and inform students about the latest events in the specialty. When the teaching staff or inviting guest lecturers are chosen, the head of the responsible structural units of the study courses makes sure that lecturers have high qualifications. This ensures that they will be able to provide students with a high-quality education to achieve the results set by the program.

The fundamental theoretical courses and professional specialization study courses in the field of the study program are implemented by the teaching staff of the Department of Mechanical Engineering and Mechatronics (MMK), Daugavpils Study and Science Center (DSZC) and Liepāja Study and Science Center (LSZC).

**Anita Avišāne, Dr.Sc.Ing., RTU Assistant Professor, Engineering and Technology Expert of the Latvian Council of Science in Mechanical Engineering and Mechanics.** More than ten years of academic and scientific experience at Riga Technical University. More than ten years of professional work experience in production and service companies performing the duties of a constructor, production automation, technologist, and designer. Professional development is carried out by regularly participating in online courses and seminars. Member of the RTU Promotion Council P-16.

**Irīna Boiko, Dr.Sc.Ing., RTU Professor, Engineering and Technology Expert of the Latvian Council of Science in Mechanical Engineering and Mechanics.** Professional experience of more than seven years in the industry (hardware company), the experience of pedagogical work in RTU and vocational education institutions for more than 17 years. Carries out active scientific research work, participating in the implementation and management of LCS (Latvian Council of Science), ESF, ERDF, TOP (Market-oriented research project), and other projects; member of the International Program Committee for various conferences. Co-author for more than 40 scientific articles published during the last six years. Participation in more than 30 international scientific conferences. Co-author of 2 Latvian Republic patents and 1 Latvian Republic patent application. From 2012 works at the RTU Innovation and Technology Transfer Center as an intellectual property specialist, continuously practicing in intellectual property-related issues, as well as raising the qualification in specialized courses, which allows conducting the study courses “Basics of Patents” (bachelor and master studies) and “Fundamentals of Patents” (at PhD study level). Actively cooperates with the industry by participating in the Certification Scheme Committee of the Certification Authority of JSC Inspecta Latvia (currently Kiwa Inspecta), as well as by participating in the training of Latvian Association of Welding Specialists (LMSB), participating in the training of mechanical engineering specialists (welders, locksmiths, plumbers) and examination. Has participated in the international mobility for lecturers and researchers within the framework of ERASMUS+ exchanging experience and conducting lecture courses, including leading universities such as the Technical University of Vienna and the Chalmers University of Technology. Continuous professional development and research, mostly related to mechanical engineering technologies (including welding and related processes), allows conducting study courses - “Basics of Production Engineering”, “Computer Aided Engineering (CAE) Programmes for Mechanical Engineering”, “Materials Processing Technology and Theory” and “Welding Technologies and Equipment”.

**Guna Čivčiša, Dr.Sc.Ing., Leading Researcher.** Experience of academic and scientific work in a higher education institution for more than 15 years, administrative experience in quality management and project management for more than eight years. Professional interests are related to quality assurance, industrial measurement, and analytical directions. Academic knowledge is increased by gaining practical experience in industrial production, which is then integrated into the implemented study courses. Knowledge and competencies are regularly supplemented by participating in professional development training, exchange of academic experience, and scientific conferences.

**Ēriks Geriņš, Dr.Sc.Ing., Professor.** Long-term academic and scientific work experience in a higher education institution (more than 50 years). Professor since 2004. From 1988 until 2005 – Faculty (FMETA) deputy dean for education, while from 2005 - Dean of FMETA. Member of the Council of the Association of the Mechanical Engineering and Metalworking Industries of Latvia (MASOC) for many years. Expert for the Investment and Development Agency of Latvia (LIAA) since 1996. Since 1994. - Expert of the Latvian Chamber of Commerce and Industry. Professional interests and scientific activity are mainly related to mechanical engineering technologies, cutting theory, cutting tools, design and optimization of flow mechanics, and instrumental systems. This knowledge ensures a qualitative study process in appropriate study courses at different study levels. Actively involved in the promotion process as a member of the RTU Mechanical Engineering Promotion Council "RTU P-16" (since 2001) and a member of the RTU Transport and Traffic Promotion Council "RTU P-22" (since 2013). Supervisor of several doctoral theses. Continuous professional development, including participation in the implementation of scientific projects, scientific conferences, and professional development seminars, as well as the publication of research results in internationally recognized journals, allows for regular improvement of the content of study courses. Received several Letters of Recognition, and Acknowledgment by RTU, Ministry of Education and Science of the Republic of Latvia, MASOC, and the Cabinet of Ministers of the Republic of Latvia. State Award (2019): Cross of Recognition of the Three-Star Order for Special Merits for Latvia.

**Andrejs Grigorjevs Mg. Sc. Ing., Lecturer.** Professional experience in academic work for more than ten years. Ten years of experience in manufacturing and data protection. Additional education - the only Certified SolidWorks expert in Latvia with eight years of experience in production. Personal data protection specialist with three years of experience. He is currently pursuing a second-level professional higher education in teaching specialty. The acquired additional knowledge and expertise ensure the implementation of quality study courses.

**Ivans Griņevičs, Dr.Sc.Ing., Assistant Professor.** Professional experience in academic and scientific work at Riga Technical University for more than ten years. Currently works as director of RTU Daugavpils Study and Science Center. Professional knowledge is developed by attending conferences, participating in online courses and seminars, and regularly participating in Erasmus / Erasmus + experience exchange programs abroad (Germany, Bulgaria, Sweden, Lithuania), which promotes the acquisition of new methods and the development of academic knowledge. Industry-relevant scientific publications indexed in international databases (including Scopus). Main research areas - automation of assembly process for threaded connections.

**Viktors Gutakovskis, M.Sc.Ing., RTU Lecturer, Researcher**. More than ten years of work experience in the academic environment. Duties are related to supervising lectures, laboratory work, and Bachelor’s theses. Participates in conferences and seminars, as well as in the development of scientific articles for international scientific journals. Qualification is improved by attending several courses related to teaching methods, research methods, and CAD / CAM systems. Attend online qualification courses (in English). Within the framework of the Erasmus program, he has carried out teaching activities at Kaunas University of Applied Engineering Sciences (KTK). In addition, the acquired knowledge and experience gained while working in the metal processing companies SIA “Baltmet Holding” and SIA “MEKO un Ko” help ensure the implementation of quality study courses and the transfer of experience to students.

**Ernests Jansons, Mg.Sc.Ing., Assistant**. An applicant for a scientific degree in the FMETA PhD study program “Production Technology”. Since 2015 have participated in several local and international scientific research projects. Co-author of 10 scientific publications indexed in international databases (SCOPUS, Web of Science, etc.). Scientific quality improvements are ensured by participating in international scientific conferences and mobility trips abroad. The significant experience was gained working in the manufacturing industry. Combining theoretical knowledge with practical, he engages in such study subjects as “Fundamentals of Design”, “Apparatus Design”, “Industrial Product Design”, etc. He also works in the Metrology Scientific Laboratory, promoting cooperation with companies.

**Jānis Kaņeps, Mg.Sc.Ing., Assistant Professor (practical).** About 40 years of academic work experience at RTU. The main areas of professional activity are production automation, electro-pneumatic automation, mechatronics, and computer-aided design. He has written two books on this topic: Pneumatic Transport Devices (2007) and Technical Graphics. Computer-Aided Design in TurboCAD” (2001). Has advised entrepreneurs in the field of programmable equipment management and participated in the establishment of the FMETA Production Automation and Mechatronics Training Laboratory. In recent years, the most significant attention has been paid to the research of the possibilities of low-cost technical equipment used in mechatronics training and the development of primary lines of study methodology for teaching work with such equipment. One of the main principles of this methodology is the use of visual programming in the training of non-IT specialists. There are two scientific methodological publications in 2016 on these issues.

**Kalvis Kravalis, Dr.Sc.Ing.** Professional experience: 12 years of academic work experience in a higher education institution. Scientific research has been carried out for 16 years, specializing in the study of the properties of liquid metal systems and their components under the influence of magnetohydrodynamic effects, the behavior of electrically conductive media in magnetic fields, experimental liquid metal systems for high energy sources. Active participation in international conferences and publications. Participation in the Scientific Council of the Institute of Physics of the University of Latvia. Teaching students the principles of flow mechanics of liquids and gases. Theoretical knowledge is strengthened during practical work in the laboratory. Study materials and methods are regularly improved and renewed.

**Artis Kromanis, Dr.Sc.Ing., Associate Professor, Leading Researcher.** Eight years of academic work experience in a higher education institution. Scientific and research activities are related to mechanical engineering technology and LEAN production technologies. The research results are published in industry-relevant scientific publications, including the Scopus and ISI Web of Science databases. Academic experience is supplemented with practical experience in the private sector, in companies such as SIA "Metal3D", SIA "Blue Energy Global" and SIA "Pilnmeness tehnologijas", participating in their product and service development projects. Supervisor of several Bachelor's theses, master's theses, and also doctoral theses. In addition, he has obtained the qualification of European Patent Attorney, enabling him to provide competent assistance in intellectual property matters, in particular patents. Member of the Institute of the Professional Representatives before the European Patent Office (EPI) and its vocational training committee representative. Member of the International Association for the Protection of Intellectual Property (AIPPI) and the Licensing Executers Society (LES). Representing Latvia's interests in the European Commission's Coal and Steel Committee (COSCO) in accordance with its knowledge framework in production technologies. LCS (Latvian Council of Science) expert.

**Oskars Liniņš, PhD in Technology (1985), Dr.Sc.Ing. (1992), Professor (2008).** Academic and scientific work experience at RTU for 54 years. At the moment, the basic disciplines are "Fundamentals of Design" (MAB 370), "Apparatus Design" (MAB357, MAB375 Study Project – Apparatus Design), "Tribosystems Calculation" (MAB540), and a new subject "Wear Resistance and Calculation of Machine Parts" has been prepared for the new doctoral program. Also participates in the subjects related to metrology and electro pneumatics. Supervising student Internships in companies. Supervising bachelor and master theses. Prepare methodological materials and design requirements for students. Has published books on the following topics: Pneumatics, Production Automation, Sensitive Element Systems, Machining and Materials Used by Engineers. In the last period of scientific work, more than ten scientific publications have been written and submitted. Member of the scientific committee of "Production Technology" scientific conference. Secretary of the TMF (Faculty of Transport and Mechanical Engineering) and FMETA Council (2004-2018). Member of the Council of Professors of Mechanical Engineering (until 2018) and of the Promotion Council "RTU P-16". Has received several RTU Honorary Diploma.

**Jānis Lungevičs, Mg.Sc.Ing., Researcher, Lecturer**. RTU has been working as a researcher since 2016 and has been involved in several local and international research projects, mainly related to the study of surface friction and wear properties. Regularly participates in the production of high-level scientific articles. Elected lecturer of FMETA since 2018. Participation in the following academic courses: Construction of devices, General metrology, Latest directions of measurement technology, Calculations of tribosystems for local and international students. Provides video lecture filming and editing proceses. Supervisor of the Metrology Scientific Laboratory. The laboratory works closely with the Japanese company Mitutoyo, which provides regular training for the laboratory staff on the latest measuring equipment. The acquired knowledge is transferred to both students and representatives of the Latvian manufacturing industry, who regularly turn to the laboratory to consult or perform accurate measurements.

**Dmitrijs Ļitvinovs, Dr.Sc.Ing., FMETA Researcher, RTU Liepājas Study and Science Center (LSSC) Assistant Professor.** Academic work experience at RTU for more than eight years. Scientific activity and research have been carried out for more than 14 years, specializing in analyzing vibration signals of rotating equipment, which is confirmed by participation in scientific projects and participation in international scientific conferences and publications. Various research results are published in scientific papers. Attended RTU pedagogical qualification improvement courses. Since 2013, he has been lecturing on topics related to computer-aided design (AutoCAD and SolidWorks) and physics, as well as supervising bachelor's and master's theses for students of the FMETA Department of Mechanical Engineering and Mechatronics (LSSC).

**Natālija Mozga, Dr.sc.ing., RTU FMETA Associated Professor.** Professional work experience in a higher academic environment 25 years. In addition, scientific activities and research have been carried out for more than 25 years, specializing in the automation of production processes, as well as computer-aided design. Participate in scientific projects and international scientific conferences and publication preparation. She has extensive experience in managing RTU final theses and doctoral theses, developing study courses, as well as managing study courses. Author and co-author of 12 textbooks and brochures and two monographs. LCS expert in "Mechanical Engineering and Mechanics" sub-branches of the scientific branch "Mechanical Engineering Technology" and "Measuring Instruments and Metrology". Member of RTU Promotion Council "RTU P-16" for more than 15 years.

**Gatis Muižnieks, Dr.sc.ing. , RTU Assistant Professor.** Professional experience in the academic environment since 2007. Performing pedagogical work, working as an assistant professor, researcher, assistant, research assistant and laboratory assistant. Provides study courses - Material Science, Structures and Properties of Engineering Materials, Materials Science, Additional Chapters. In addition, he attends pedagogical training courses at Riga Technical University and The European Association of Distance Teaching Universities. Scientific consultant at SIA "Mašīnbūves kompetences centrs". Experience as a mechanical engineer at SIA "LUCO" adds practical knowledge and skills in developing production technologies, choosing materials, and processing them. Industry expert - evaluation of submitted projects. Scientific and research activities are related to studying physical, mechanical properties, structures, and other regularities of various materials.

**Jānis Ozoliņš, RTU Professor Emeritus., State Emeritus Scientist, Dr.Sc.Ing., Researcher.** More than 60 years of professional experience in academia and administrative experience in higher education institutions. Scientific activity for more than 50 years, specializing in materials science. Expertise and consultations for mechanical engineering companies are performed in cooperation with the MASOC. Author of the textbook 'Materials Science'. The results of the latest scientific research are used in the study process. In addition to his work at RTU, he has been a guest lecturer at the Latvian Maritime Academy for ten years. Participation in international scientific conferences on the history of technology and materials science research. Prepared video lecture materials for several academic courses.

**Guntis Pikurs, M.Sc.Ing., Assistant Professor (practical).** More than 15 years of academic work experience at Riga Technical University and more than 20 years of work experience in the Latvian Mechanical Engineering Industry. Regular participation in conferences and seminars related to production and repair technologies. G. Pikurs is the author and co-author of several scientific publications and has participated in scientific projects both in Latvia and internationally. Achieving full-fledged study results is ensured both by the acquired theoretical knowledge and significant practical work experience in the industry.

**Guntis Spriņģis, Mg.Sc.Ing., Lecturer.** Professional work experience in the academic and scientific environment at Riga Technical University for more than ten years, currently also the Deputy Director of RTU Daugavpils Study and Science Center. In addition, he obtained a bachelor's degree in English philology. Professional knowledge is developed by attending conferences, participating in online courses and seminars, as well as regularly participating in Erasmus / Erasmus+ experience exchange programs abroad, which promotes the acquisition of new methods and the development of academic knowledge. His industry-relevant scientific publications are indexed in international databases (including Scopus). Main research areas - research of friction and wear process of matched surfaces.

**Guntis Strautmanis, Dr.Sc.Ing., RTU Daugavpils Study and Science Center (DSSC) Associated Professor.** Professional experience: more than 40 years of academic and research experience in a higher education institution. Has a lathe operator diploma, which provides an excellent basis for academic work and helps to teach subjects in the technical field. More than 30 scientific publications in the field of rotor dynamics and more than 20 of them are published in internationally recognized journals or conferences with indexing in international databases (Scopus). Author and co-author of 5 patents and inventions. LCS expert.

**Valentīna Strautmane, Mg.sc.ing.,** Professional work experience in a higher education institution, academic and scientific environment for more than ten years. In addition to the obtained master's degree in economics, more than 20 years of work in the chief technologist's department at the Riga Wagon Building Factory and the provide an excellent basis for academic and research work in the fields of innovation and management. In cooperation with Daugavpils Railway Transport Technical School, she has written and published methodological literature. Participation in conferences and seminars in the fields of transport, educational methodologies, and others. Achieving full-fledged study results is ensured both by the acquired knowledge and extensive practical work experience, especially in the field of transport.

**Edgars Šīrons, Dr.Habil.Sc.Ing. (1993), Professor (1985).** Academic work experience at RTU is 63 years. At the moment, the basic discipline is "General Metrology", which contains 5 textbooks published in different years, as well as auxiliary literature "Tolerances and Sessions" Part I (1982). Several laboratory works have been developed and implemented. The course is digitized and contains ten video lectures. New supplemented methodological instructions for the elaboration of study work have been developed, which are inserted in e - studies. The work will be continued by digitizing the study work. Study assignments have been developed and summarized in an album. The second discipline, "Additional Departments of Metrology" is a written and published textbook (2011) for laboratory work, which is supplemented with theoretical knowledge and can therefore be used to acquire the course. The digitization of the lecture course is being worked on, and ten video lectures will be recorded. Part II (1985) of the Manual "Tolerances and Seats" has been published to be used as an aid to laboratory work. Several original laboratory works have been created and implemented. During 63 working years at RTU (the former RPI - Riga Polytechnical Institute) he worked in various levels of administrative work: for 11 years (December 1964 - September 1975) Head of the Department of Apparatus Construction; 21 years (December 1972 - March 1994) Dean of the Faculty of Apparatus Construction and Automation, organizer of teaching and scientific work. He has headed various scientific and methodological councils at RTU (RPI) and also at the State level at the Ministry of Higher and Secondary Technical Education, which was evaluated by the Government: N.b. University employee (1988): MK Honorary articles (1984 and 1987) IM Honorary articles (1973, 1974, 1986), etc. Practical work experience in the production of instruments has helped a lot in my academic work, working as a senior master in the instrumental workshop of the Riga Electrical Fittings Factory (June 1953 - September 1955).

**Antons Štekleins, Dr.Sc.Ing., Researcher.** Professional experience: production manager in a vacuum equipment manufacturing and vacuum technology application research company for more than eight years. Participation in several international vacuum equipment manufacturing projects. Many years of professional experience and qualification in a manufacturing company allow to achieve study results and supplement the theory with practical examples that significantly improve the learning process. More than two years of academic and scientific work experience. Research competence in working with students is ensured both by participation in scientific conferences and the development of publications in internationally recognized collections of articles indexed by SCOPUS and others. The doctoral degree provides an opportunity to conduct classes in academic study programs and increase competence and knowledge by constantly following the news in the field of production. He uses the gained professional and educational experience, knowledge, skills, and competence in pedagogical work, creating and improving the content of courses, choosing modern and appropriate teaching methods, and developing collaborative communication with students.

**Toms Torims, Dr.Sc.Ing., Professor.** Experience in academic and scientific work in a higher education institution for more than 14 years. RTU professor (since 2014), Latvian representative at the European Nuclear Research Agency (CERN), research associate at the European Nuclear Research Agency, Latvian representative at the European Nuclear Research Agency, Adviser to the Minister of Foreign Affairs of the Republic of Latvia, Adviser to the Rector of RTU. Active scientific activity (author of more than 50 scientific publications in internationally recognized journals), including CERN, allows implementing high-quality study courses closely related to scientific research topics: production and processing technologies, applications of particle accelerators in industry. Supervisor of several doctoral theses, author of teaching and methodological aids. 2021 By the decision of President E. Levits and the Chapter of the Order, Toms Torims has been appointed an officer of the Order of the Three Stars.

**Gunārs Upītis, Dr.Sc.Ing., Professor.** RTU lecturer since 1972. Provide study courses “Machine Elements”, “Lifting and Transport Machines”, “Mechanical Engineering Drawing”. As a visiting professor, he has conducted study courses “Computer Design of Machines” and “Methods of Statistical Data Analysis” at the Latvian Maritime Academy. Scientific qualification in the field of machine vibration analysis. As a certified specialist of the Latvian Union of Civil Engineers and an expert of the RTU Non-Destructive Testing Laboratory, he has long participated in solving technical problems of various Latvian companies, specializing in GEM analysis of Latvenergo AS hydroelectric power plants and combined heat and power plants (CHPP) large metal structures. Practical experience, calculation results, and theoretical findings are used to update and supplement the content of study courses and ORTUS e-learning materials “Machine Elements. Course aids”.

**Armands Leitāns, Mg.Sc.Ing., Lecturer, Researcher.** Academic work experience at RTU since 2014. Leading laboratory assistant in academic courses Electropneumatic Technique, Electro-, Pneumo-, Hydroautomatio, General metrology. Additional academic works include evaluating students’ study practice reports and supervision of Bachelor’s thesis. Scientific and research activities are related to the field of tribology, mainly testing of tribological properties of new materials, surface protective coatings, oils, and lubricants. Scientific and research activities are reflected in scientific publications cited in the international databases of scientific publications Scopus and the Web of Science. Academic experience is supplemented by working on projects in the National Education Content Center as an expert - school consultant, advising students on research, and participating in the competition evaluation commission. Qualification is improved by attending professional development courses and internships in companies.

### 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.

There have been changes in the academic staff during the reporting period. Five professors of the last academic team terminated their educational activities. The study courses of these lecturers have been taken over by other lecturers of the Department of Mechanical Engineering and Mechatronics. Department of Apparatus Construction and Department of Materials Processing Technology implementing the profiling study courses in the field of the study program were merged in the Department of Mechanical Engineering and Mechatronics in 2019, which significantly increased the workforce capacity management. As a result of the merger, the potential of the academic staff serving the Bachelor's professional study program "Mechatronics" increased. It should be noted that the average age of the academic staff decreased due to the defense of several scientific dissertations in the field. As a result, the number of new lecturers has increased, and as a result of re-election, assistant professors have moved to the category of associate professors.

| Academic staff | 2014/ 2015 | 2015/ 2016 | 2016/ 2017 | 2017/ 2018 | 2018/ 2019 | 2019/ 2020 | 2020/ 2021 |
|---|---|---|---|---|---|---|---|
| Professors | 5 | 5 | 7 | 7 | 6 | 6 | 4 |
| Associated professors | 5 | 5 | 4 | 5 | 3 | 4 | 5 |
| Assistant professors | 6 | 7 | 5 | 6 | 5 | 6 | 4 |
| Lecturers | 4 | 4 | 2 | 6 | 6 | 5 | 3 |

During the preparation of the self-assessment report, the team of academic lecturers of the Department of Mechanical Engineering and Mechatronics, involved in the implementation of the study program "Mechatronics", actively carried out research, teaching, published, participated in conferences, as well as improved their qualifications. In the European Social Fund project, the academic staff of the Department of Mechanical Engineering and Mechatronics had the opportunity to improve their English language skills and train in various companies in the field of the specific support objective of the Operational Program "Growth and Employment" During the reporting period, several lecturers of the Department of Mechanical Engineering and Mechatronics participated in the internship program. As well as within the framework of this project, the English language skills were improved by the academic staff of the Department of Mechanical Engineering and Mechatronics. Also this project, which focuses on three main goals: the improvement of the competence of the existing academic staff, the renewal of the academic staff, promoting the employment of doctoral students in academic work, allowed to attract three doctoral students, encouraging the renewal of the academic staff. The involved doctoral students will ensure the sustainability of the study process. Ernests Jansons, Didzis Avišāns, and Viktors Gutakovskis are involved in the study process using the specific support goal of this project.

Breakdown by academic qualification

| Qualification | Amount | % |
|---|---|---|
| Professors | 4 | 25 |
| Associate professors | 5 | 31 |
| Assistant Professors | 4 | 25 |
| Lecturers | 3 | 19 |
| **Total:** | **16** | **100** |

Percentage distribution of current academic staff by academic qualification in the academic year 2020/2021 indicates that the academic staff of the study program “Mechatronics” has the high scientific qualification and work experience. The largest share of the academic staff consists only of professors and assistant professors.

**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).**

In the implementation of the study program, it is important to ensure the cooperation of the teaching staff. One of such cooperation mechanisms is the implementation of study projects within the framework of several successively implemented study courses. Thus, the collaboration between teachers is promoted, and in parallel, students acquire skills and competencies for structured problem-solving.

Meetings of the structural units are organized at least once a week at the Institute of Mechanics and Mechanical Engineering and the Department of Mechanical Engineering and Mechatronics. Academic project meetings and seminars are held regularly. In addition, the university and the faculty have a system that provides regular academic conferences and professional development seminars to improve the teaching methodological competencies.

The teaching staff of the current study program additionally implements Bachelor’s level study courses in the study programs of other structural units for both the Latvian and international students.

On average, 45 to 55 lecturers are involved in the implementation of the study program, excluding guest lecturers. It should be noted that in some study courses, theoretical classes are given by one lecturer, but practical classes - by another lecturer. Students are divided into groups in separate study courses. A different teacher works with each group. The average ratio of the number of students and lecturers within the study program is one lecturer and 10 to 15 students. The given relationship and the content of the program provide an individualized approach to studies. Thus, it is possible to integrate a student-centered approach and promote the development and improvement of the above-mentioned professional competencies.

# 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 | MCE0_diploms_dipl_pielik_dipl_supple.zip | MCE0_diploms_dipl_pielik_dipl_supple.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) | | |
| 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 | MCE0_stud_statis_LV_EN.pdf | MCE0_stud_statis_LV_EN.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 | MCE0_StEdSt_6_annex (2).pdf | MCE0_ValzSt_6_pielik.pdf |
| 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) | MCE0__ProfSt_7_annex.pdf | MCE0__ProfSt_7_pielik.pdf |
| 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 | MCE0_kartejums_8_annex.xlsx | MCE0_kartejums_8_pielik.xlsx |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MCE0_CurricStProgr_9_annex.pdf | MCE0_StudProgrPL_9_pielik.pdf |
| Descriptions of the study courses/ modules | MCE0_Studkurs_Apr_DescriptStud_cour.zip | MCE0_Studkurs_Apr_DescriptStud_cour.zip |
| Description of the organisation of the internship of the students (if applicable) | Internship_Management_Procedure.pdf | Prakses_organizesanas_kartiba.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Heat Power and Thermal Engineering (42522)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Heat Power and Thermal Engineering* |
| Education classification code | *42522* |
| Type of the study programme | *Professional bachelor study programme* |
| Name of the study programme director | *Dmitrijs* |
| Surname of the study programme director | *Rusovs* |
| E-mail of the study programme director | *dmitrijs.rusovs@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., asociētais profesors* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study programme is to educate and train qualified specialists in the field of energy, heat supply, etc. competencies corresponding to the sectoral labour market, in accordance with the approved standard of the profession of the engineer in heat power and thermal engineering.* |
| Tasks of the study programme | *1. To develop students' skills to use theoretical knowledge, industry trends and requirements for formulating and solving specific tasks in work with existing and new technologies and their development;<br>2. To develop green and analytical thinking in the performance of practical tasks, preparing students for the labour market;<br>3. To develop the ability to work in a team and cooperate with specialists of different fields and levels;<br>4. To promote students' interest in further professional development, supplementation of knowledge and studies to obtain the Master's degree.* |

| | |
|---|---|
| Results of the study programme | *Graduates of the study programme:*<br>*1. Is able to obtain, select, compile and analyse information in the field of heat power and thermal engineering, as well as in other sectors and use it in the formulation of problems and solutions, decision-making and performance of professional tasks;*<br>*2. Is able to perform thermal, engineering and techno-economic calculations and develop economic substantiation of projects;*<br>*3. Is able to analyse and monitor the operation of district, local and individual heat supply systems and heating equipment, as well as technological processes of heat production and use;*<br>*4.. Is able to organize and perform the operation and technical inspections of heat engineering equipment, heat production and heat supply systems, as well as to plan the performance and organization of their assembly and construction works;*<br>*5 .Is able to develop the thermal engineering part of the project, performing environmental impact and energy efficiency assessment, as well as analysis of alternate solutions;*<br>*6. Is able to perform tasks in compliance with labour protection, environmental protection, civil protection, fire safety and electrical safety requirements and using regulatory enactments and standards binding on the industry;*<br>*7. Is able to responsibly plan, organize and monitor operational professional and business activities, performing tasks individually and in a team;*<br>*8. Is able to independently use information technologies in the performance of professional tasks, choosing more appropriate software, appropriate information resources and means;*<br>*9. Is able to use professional terminology in the official language and at least two foreign languages.* |
| Final examination upon the completion of the study programme | *Diploma project* |

# 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 heat power and thermal engineering* |
| Qualification to be obtained (in english) | *Engineer in heat power and thermal engineering* |

**Places of implementation**

| Place name | City | Address |
|---|---|---|

| | | |
|---|---|---|
| Riga Technical University | RĪGA | KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050 |

**Part time extramural studies - 5 years - latvian**

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *5* |
| 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 heat power and thermal engineering* |
| Qualification to be obtained (in english) | *Engineer in heat power and thermal engineering* |

**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.**

During the reporting period, the study courses and their structuring by sections were changed within the study programme in accordance with the changes in the regulatory enactments and industry requirements - for more details see Section 3.2.1.

**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 professional Bachelor study programme "Heat Power and Thermal Engineering" complies with Cabinet Regulation No. 512 of 26 August 2014 "Regulations on the State Standard of the Second Level Professional Higher Education" (see also Annex No 3.2.1.-1.) and RTU normative documents.

The study programme is implemented under the supervision of the Department of Thermal Power Systems of the Institute of Mechanics and Mechanical Engineering of the Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA) of RTU, with the premises physically located in RTU FMETA building. Changes to the study programme as well as the development and addition of new study courses to the study programme are coordinated with the management of the study field "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering", as well as the management of the FMETA and RTU, which, together with additional verification and expertise, allows ensuring and maintaining full compliance of the study programme indicators and content with the study field.

Given that the study programme is a professional one, its main indicators, aims, tasks and learning outcomes, as well as admission requirements, are based primarily on the specific features, needs and requirements of the sector, which are expressed in the occupational standard of engineer in heat power and thermal engineering, and secondly on the requirements of the regulatory enactments in the field of education. The set of requirements that form the basis of the study programme allows for a more complete interconnection of all indicators.

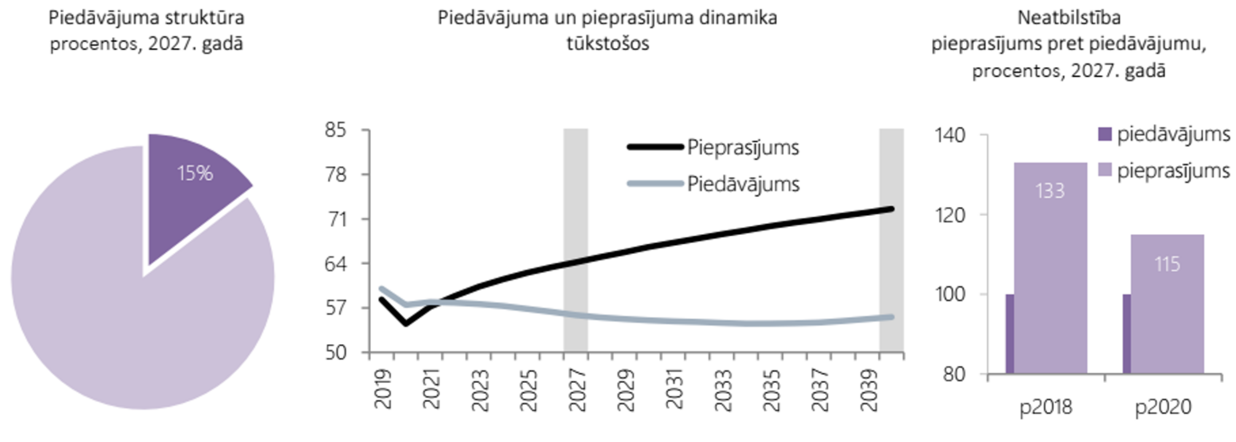
The trends in the sector, changing needs and technological developments, as well as the European Green Deal and the National Energy and Climate Plan guidelines and development areas, also determine the needs for adaptation and development of the higher vocational education programme and the need to implement modern changes to increase flexibility and remain relevant in line with changing market conditions, which also leads to the updating of the study programme and content. In addition, it is necessary to take into account the development plans of the education sector, including professional higher education, as well as the guidelines and directions of the Sustainable Development Strategy of Latvia for the development of society and the economy, where one of the important issues is also the planned contribution of RTU, FMETA and the study field, determining the integration of the basic principles of sustainability in the content of educational programmes, as well as in the development of employees in various infrastructure and organizational systems.

The full-time professional bachelor study programme "Heat Power and Thermal Engineering" is implemented 4 years and has the volume of 160 CP, which is in accordance with the requirements of Paragraphs 7 and 8 of Cabinet Regulation No. 512 of 26 August 2014. The graduates have opportunity to continue their studies at the Master programme in accordance with Paragraphs 18 and 26 of the above-mentioned Regulation. The degree and qualification to be awarded upon completion of the study programme shall meet the requirements of Paragraph 17 of the Regulation.

The part-time, extramural version of the study programme has the same volume of 160 CP, but it takes one year longer to acquire the degree and qualification.

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

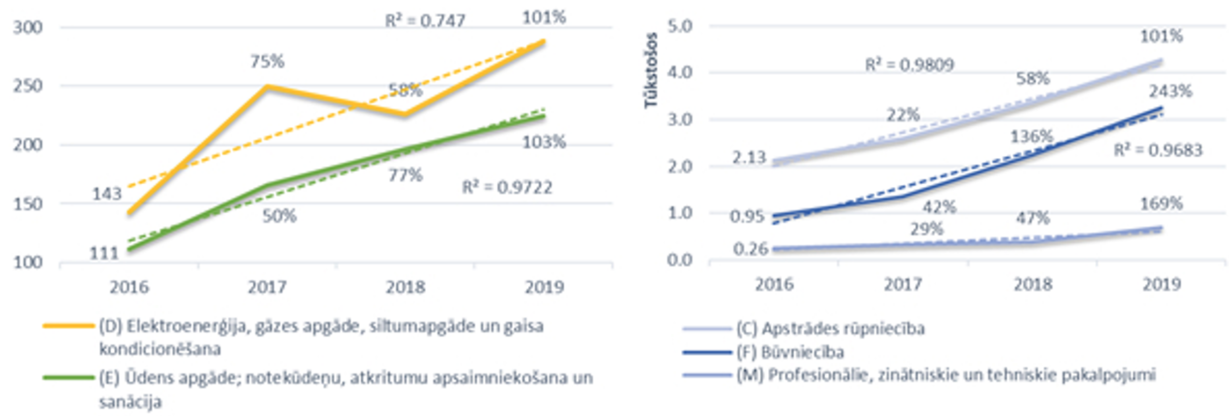
The professional Bachelor study programme "Heat Power and Thermal Engineering" is the only second-level professional higher education study programme in Latvia that educates and trains engineers in heat power and thermal engineering for the entire Latvian economy, providing the basis for the development of power engineering, manufacturing and other industries, as well as for the maintenance of engineering systems and infrastructure. For several years now, due to the demographic situation and migration in the country, as well as due to the rapid development of technology, the demand for qualified heat power and thermal engineers in the sector has significantly exceeded the supply, and labour market forecasts show that these trends will continue in the coming years.




Labour supply and demand forecasts with higher education in engineering, manufacturing and construction (Report on Medium and Long-Term Labour Market Forecasts for 2020 by the Ministry of

Economics) available at (in Latvian): https://www.em.gov.lv/lv/media/598/download; (in English report, 2018: https://www.em.gov.lv/en/informative-report-medium-and-long-term-labour-market-forecasts-0)

Special attention should also be paid to Cabinet Regulation No. 108 of 20 February 2018 "Specialties (Professions) in which a Significant Shortage of Workforce is Forecast and where Foreigners can be Invited to Work in the Republic of Latvia", which indicates, inter alia, a significant shortage of engineers in heat power and thermal engineering to cover various positions in the national economy (by job codes of the occupational classification), with the national government determining the permission to invite foreign specialists for them. For example, the following items in the Annex to the Regulation could be mentioned: 152, 153, 154, 158 as the title of the relevant profession and in addition: 105, 112, 118, 119, 138, 157, 160, 206, 210, 220 and 221, which are occupied, inter alia, by engineers in heat power and thermal engineering as directly relevant or related professions. The changes in the workforce in the power engineering and related sectors are shown in the figure below.




Dynamics of changes in labour demand in the energy, heat power and thermal engineering and related and allied sectors (data of the Central Statistical Bureau https://stat.gov.lv/lv)

One of the most popular job vacancy portals among Latvian jobseekers and employers, https://cv.lv/lv/, posts on average around 80 to 100 specialist vacancies in the energy sector each month, 350 to 380 vacancies mainly for persons with low levels of education in the manufacturing sector, and there are also vacancies for engineers and low- and middle-level management specialists, as well as 280 to 300 vacancies in the related construction sector, with a similar distribution, i.e., a smaller share of mid-level professionals.

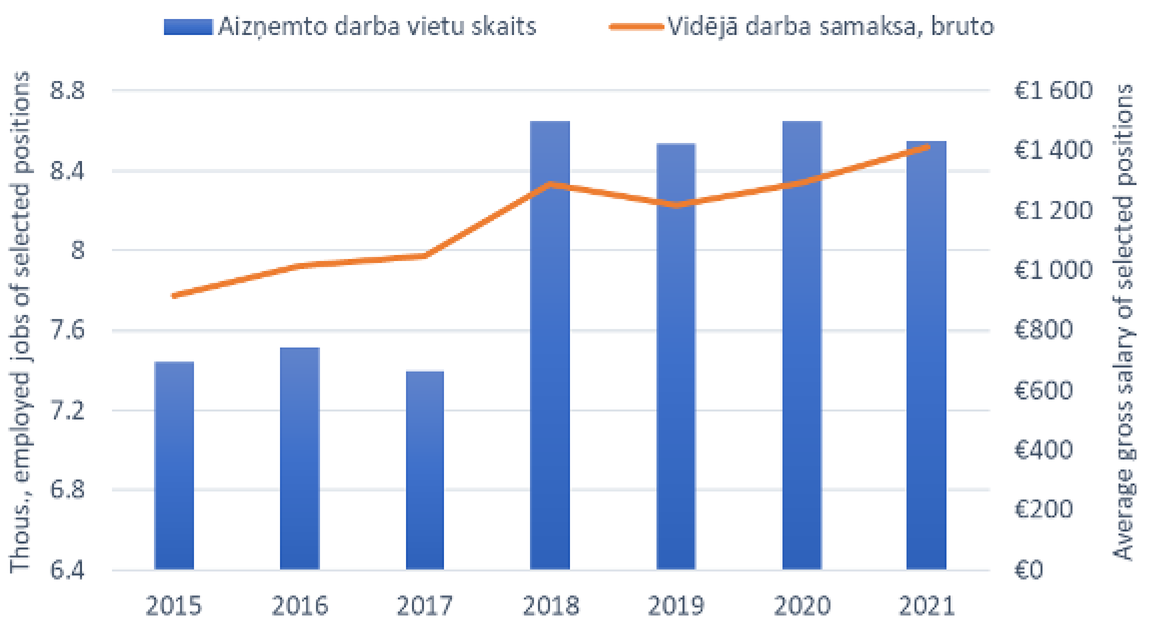
The heat power and thermal engineering sector is directly linked to the production of renewable energy, the improvement of the energy efficiency of heating systems and their equipment, and the related decarbonization objectives towards climate neutrality, all of which, together with specific and increasingly sophisticated technological developments, are a key part of the sustainable development of both the sector and the economy. The heat power and thermal engineering sector and, consequently, the professional study programme that ensures the training of young engineers play an important role in the achievement of the goals, guidelines and action plans set out in the Sustainable Development Strategy of Latvia until 2030, the National Development Plan of Latvia for 2021-2027, the National Energy and Climate Plan for 2021-2030, the European Green Deal, the Circular Economy Action Plan, the European Union (EU) 2050 Strategy, and other global objectives, including those set by the United Nations (UN).

Considering all the above, it can be concluded that the usefulness of the study programme is measurable not by its economic indicators, but also **by the economic effect it has on the sector**

**and the economy, along with its contribution to training the required young specialists** for the maintenance and development of energy security, thermal and industrial markets and infrastructure.

Graduates of the study programme, having acquired industry-specific professional competences, are 100% employed and find jobs in various areas of the national economy throughout Latvia, as well as in European and international companies such as Latvenergo JSC, Rīgas Siltums JSC, Liepājas Enerģija JSC, Latvijas Finieris JSC, Grindeks JSC, Adven Latvija Ltd, etc. A large part of the study programme students find a job in the industry already during their education, starting their professional activity in the 3rd or 4th year of study, many of them conclude permanent employment contracts also with companies where they undertook internship.

Graduates of the study programme work in the manufacturing industry, at energy and other enterprises engaged in the production or processing of products or materials, energy production, distribution, redistribution and network maintenance, in the trade of equipment and materials related to the field, at enterprises providing design, maintenance, operation, management services for heating supply systems and thermal engineering equipment and at other enterprises that use heat energy in their technological processes, not only in the industrial and commercial sectors, but also in the municipal and private sectors. Graduates of the study programme are employed in a wide range of positions, which include not only direct positions, but also other positions required by the industry, including positions in related and similar fields, according to the needs of specific employers. For example, the data on occupied positions are presented below for only 17 positions out of the total number of available and actually occupied positions, of which only two (occupation codes 2422 01 and 2142 36) are excluded from the list of items of Cabinet Regulation No 108 of 20 February 2018, thus summarizing the statistical data of the State Revenue Service (SRS) on occupied positions according to the occupational classification (in Latvian): https://www.vid.gov.lv/lv/informacija-par-darba-vietam-2021gada-atbilstosi-profesiju-klasifikatoram).




Changes in occupation and average remuneration of 21 selected positions for heat power and thermal engineering in 2015-2021 (SRS data for January of each year.

The number of occupied jobs in January 2021 compared to January 2015 increased by 15%. In 2018, there has been a sharp increase, which has taken place incl. at the expense of a significant increase in the number of occupied positions in the position “Project Manager”, which amounted to 18.4% compared to 2017 which indicates a significant demand in the labour market together with other positions in technical engineering. On the other hand, the increase in the average remuneration of the occupied positions in January 2021 compared to January 2015 was 54%, reaching an average level of EUR 1,412. A significant increase in the average salary level in the labour market of the industry and related fields indicates positive trends that could further motivate young people to study thermal power and engineering and obtain the qualification of engineer in heat power and thermal engineering, thus completing the only study programme in Latvia and reducing the shortage of industry specialists.

In the framework of the SWOT analysis of the study programme, apart from the analysis of its strengths and weaknesses, some opportunities and threats specific to the heat power and thermal engineering sector have been identified (see Section 3 below, as well as Section 2.1.2).

Opportunities:

- The EU Green Deal and related EU legislation create a number of opportunities for moving towards a climate-neutral Europe in 2050:
- rapid development of technologies and equipment in the heat and power, thermal engineering and refrigeration sectors, including the development and use of renewable energy and hydrogen technologies;
- the development of the local energy market and the expansion of specialized areas, including heating and refrigeration, which expands the possibilities for the academic staff of the Department of Thermal Power Systems to collaborate with companies in the sector in different areas;
- substantial EU funding is foreseen for the next programming period to directly support the objectives of the Green Deal through various support programs.
- The introduction of the competence approach in secondary education and the modularization of vocational secondary education contribute to the development of methodological approaches and delivery models also in higher education institutions.
- The expansion of the qualification structure in the energy sector in 2021-2022 with new professional qualifications and their specializations at the Bachelor level, including in the field of cold supply.
- The introduction of advanced courses in secondary education creates the opportunity to tighten the requirements for admission to engineering degree programmes.
- State support measures for adult education and the reduction of administrative burdens in the implementation of lifelong learning contribute to an increased interest on the part of employers and employees in various types of professional development programmes and the acquisition of new qualifications.

Threats:

- Adverse demographic situation in the country and migration, emigration to other countries to study, work and/or live.
- The spread of Covid-19 and its consequences, its impact on the quality of education at all levels and its impact on the examination results of secondary school graduates and their particularly increased drop-out rates in the first years of further studies.
- The shortage of specialists in the sector stimulates student employment, which is further fuelled by the scarcity of scholarships, which in general acts as a disincentive to in-depth study of the course content.
- The rapid and incompletely developed reform of secondary education contributes to a

situation where students from different schools and grades can graduate with a radically different knowledge base, which may not only lead to more frequent revision of admission requirements, but also to an additional burden on the provision of overly differentiated studies.

In order to improve the quality indicators of the study programme and to mitigate the potential impact of negative external factors, the following additional areas of action have been identified for the next reporting period, based on the strengths and opportunities of the study programme:

- To promote the only professional study programme in Latvia and strengthen the position of heat power and thermal engineers by using the support of companies, organizations and regional competence centres, as well as modern social networking technologies, etc.;
- To expand the study programme with additional sub-specialties along with the updating of the structure of qualifications in the sector, e.g., in the field of professional refrigeration equipment and systems, and to improve and develop work-based and adult-oriented studies, integrating modern models for the implementation of vocational education programmes;
- To extend closer cooperation with the industry in order to develop modern methods for the implementation of professional study programmes and to develop solutions for additional industry funding and support measures;
- To increase mobility of students and academic staff for exchange of experience and knowledge in line with the Green Deal and industry trends towards achieving RTU aims and the strategic objectives within the study field in terms of sustainable development.

### 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 dynamics of changes in the number of students enrolled during the reporting period (see Annex 3.1.4-1) reflects significant fluctuations significant fluctuations in the number of full-time students, what is closely linked to the nature of the sector itself. As of academic year, 2019/2020, there has been a significant decrease (56%) in the number of full-time students compared to that average in previous years, which was roughly at the same level over the last three years. This is mainly due to the overall demographic situation and migration in the country (see, for example, the 2019 report by the Central Statistical Bureau: https://www.csb.gov.lv/sites/default/files/publication/2019-10/Nr_05_Demografija_2019_%2819_00%29_LV_EN.pdf), and in 2020 and 2021 due to the spread of Covid-19 in several waves, which also had a significant impact on the education sector.

Restrictions introduced during the Covid-19 pandemic have also had a significant impact on the implementation of various admissions activities, with a number of regular events being cancelled, such as the annual exhibition “School” (“Skola”), etc., it was not possible to implement usual face-to-face events in schools and companies. Some of which were organized remotely in early 2021, but they could not fully replace the in-person events.

In 2021, with a relatively large investment, RTU additionally developed and carried out a fairly extensive enrolment campaign for the study programme, which, together with the active involvement of new study programme partners in the sector, helped keep the indicators from declining further (see RTU campaign results and additional information in the Annex 3.1.4.–2.). After summarizing the results of all activities carried out by RTU in 2021, it was concluded that the pandemic and remote events introduced their own significant adjustments and made it necessary to reconsider the planning of internal and centrally organized RTU activities and admission events - most of them were reached their target audience with a delay, in some cases only for an additional admission period, which was a less relevant period for Bachelor studies.

The average number of students enrolled in the study programme (see Annex 3.1.4.-1) in the reporting period is 23.9 students, reaching its maximum (37 students) in 2014/2015. study year and the second largest number (34 students) in 2018/2019, that can be rated as good indicator level. The analysis shows that on average 85.6% of the total number of enrolled students were admitted to full-time studies.

Admission to the part-time extramural study programme form is typically at a low level without significant fluctuations, which is closely related to both the specifics of the field itself and the lower interest in the part-time Bachelor study form. The digitalisation of studies in its broadest sense also expands the opportunities for attracting part-time students from the regions.

The highest number of graduates was in 2014, which, including part-time extramural graduates, reached 26 graduates. On average in the reporting period, the share of graduating full-time students represents 44.2% and that of graduating part-time students – 29%.

Two graduates of the study programme with a weighted average score of 8.3 were also included in RTU Golden Fund, which could be considered a stable positive achievement.

The total number of students in the reporting period and their share by type of the study programme and source of funding, as well as the share by study year are fluctuating values with a downward trend, following also the general national and engineering trends mentioned above.

A more detailed analysis of the number of students by study year shows that the student dropout rate is a variable phenomenon influenced by a number of factors. For example, an average of 15.7% of state-funded students, 31.6% of tuition fee-paying students and 12.6% of part-time students were on academic leave during the reporting period. During the pandemic, many students chose academic leave, incl. without withstanding the load of too variable conditions. The proportion of students who are exmatriculated directly due to academic failure is relatively high, which in the first two years of study is due to academic failure in general study courses, such as mathematics and physics. This problem affects virtually all engineering studies in the country, along with the poor knowledge of natural sciences and the education of pupils at the secondary school level. Several educational reforms have been launched in Latvia, including the reform of primary and secondary education, which foresees a transition of schools to a competence-based approach – including special advanced courses in the sciences – as from school year 2020/2021 (for more see Skola2030 resource, in Latvian: https://www.skola2030.lv/lv/skolotajiem/programmu-paraugi-videja-izglitiba). Reforms and alignment of the regulatory framework with higher education are still ongoing, so changes can be expected in the coming years on various related issues, such as the possible clarification of admission requirements for higher education study programmes.

The economic situation in the country, the students' desire for independence, as well as the high shortage of heat power and thermal engineers in the sector contribute to the situation when the majority of 3rd and 4th year students are already working part-time or full-time. Such a situation hinders the full mastering of the content of the study programme and affects both the overall drop-out rates and the amount of academic leave that students choose to postpone their studies.

In recent years, there has been a decline in general motivation and interest in personal development and higher education among young people, which is also leading to a decline in the choice of aspirations and professional activities. This is reflected both in the decrease in the number of enrolled students and in part in the drop-out rate in all forms of the study programme, where there are students who drop out, realizing that the chosen field is not suitable for them or they have not yet formulated their personal wishes.

In order to equalize the indicators, taking into account also the general tendencies and development plans in vocational and higher education, as well as the development plans of the direction, the following directions of solutions have been identified:

- more active involvement of companies in the sector in various types of events, incl. implementation of admission campaigns;
- modernization of the content of the study programme taking into account the general transformation of the heat power and thermal engineering sector in the direction of climate neutrality to achieve the goals of the EU Green Deal and the UN sustainable development, incl. the development of information technologies, will allow to increase the interest in the specialty among both young people and adults;
- introducing changes in the lecture planning for specialized professional courses of the programme and grouping them more efficiently with the external and general courses of the study field in the 2nd study year, which requires centralized solutions in the field and RTU;
- integrating work-based studies, taking into account the specificity and topicality of the sector and its professional education, which would allow students not only to combine the study process with the work in the sector, but also to increase both the efficiency of the study process and the quality of the acquired professional competences.

The implementation of such solutions would also allow other objectives to be met in order to achieve the sustainable development goals of vocational education, such as expanding opportunities for lifelong learning and adult vocational higher education. It would also increase the total number of students enrolled in the study programme, thus educating and training more thermal and heat power engineers that are in demand in the sector, leading the development of green thinking and the use of renewable energy technologies.

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

## 3.2. The Content of Studies and Implementation Thereof

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

**of the relevant industry, labour market, and science.**

The content of the professional study programme is developed and updated in accordance with Cabinet Regulation No. 512 of 26 August 2014 "Regulations on the State Standard of Second Level Professional Higher Education" and other normative acts, including the requirements of RTU normative documents, as well as the occupational standard. The examination of changes and updates of the content of several levels ensures its compliance with the main requirements.

Since 2013, the professional study programme has undergone a number of course changes. In accordance with the changes in the requirements of the regulatory enactments in the field of education, the study programme was supplemented in its compulsory part with the study course SDD700 "Innovative Product Development and Entrepreneurship". The compulsory part of the study programme was also reorganized in accordance with the new requirements, dividing the study courses into three parts: the general education part, the theoretical and information technology part and the professional specialization part. The courses in the humanities, social sciences and law were reorganized, rearranged and/or changed in line with changes in the requirements of the legislation and regulations, based on their status and the selection of courses more appropriate to the coverage and level of competences of the professional qualification. Sports activities have also been removed from the compulsory content of the study programme. RTU now has a single Sports Centre with a well-developed infrastructure and a wide choice of activities.

To develop and improve students' professional computer-aided design skills towards digitalization and to ensure their quality improvement, changes were made in the first half of 2021 in the content of the study programme by replacing the study course "Fundamentals of Design" with MAB266 "Basics of Automated Designing - AutoCAD", MAB267 "Basics of Automated Designing - SolidWorks" and MAB243 "Computer-Aided Engineering (CAE) Programs for Mechanical Engineering". The aforementioned study courses are delivered by professionals and professors in their field who are also authors of relevant literature in the field.

Thermal and heat power engineers work in a wide range of fields, so the professional Bachelor study programme includes relevant and necessary specialized courses. The rapid development of renewable energy technologies and the industry also involves the construction of new energy facilities. To ensure the competitiveness of future young heat power and thermal engineers, the compulsory elective part of the study programme was updated in the first half of 2021 to include a module on related qualifications and study programmes in the construction sector with the following courses:

- BMT251 "Building Materials (Basic Course)" provides an understanding of the range of materials used in construction, as well as basic skills in their selection;
- BBR453 "Building Technology" provides an understanding of the mechanization techniques, specialized tools, etc. used on the construction site, which will help young engineers to select appropriate technologies for a particular construction process;
- BĢE296 "Geodesy" provides in-depth knowledge and skills in topographic surveying and plan preparation;
- BTG711 "Building Information Modelling", along with the development and improvement of digital, computer-aided design and computer modelling skills, also provides an understanding and basic skills in the use of modern BIM technology, which is an effective tool not only in construction but also in the planning, management and implementation of other civil engineering projects.

The content, the learning outcomes, the set aims and tasks of the study courses comply with the learning outcomes, the set aims and tasks of the study programme. The interrelation of the study courses ensures that the planned learning outcomes are achieved at an appropriate quality level. The learning outcomes are also achieved by using methods appropriate to professional education, which are integrated into the content and ensure sufficient quality, e.g., regular study excursions are organized during which professional knowledge is acquired and strengthened. Guest speakers from the sector are invited to deliver individual classes, which helps ensure that the content is relevant to the needs of the sector and current trends.

The professional Bachelor study programme is the only one in Latvia that trains heat power and thermal engineers, so its emphasis is on meeting the needs of the industry in educating the required specialists, including content relevant to the industry and delivery methods and design. The last decade, and in particular the last five years, witnessed significant changes in the sector, with very rapid technological developments towards climate neutrality, as well as significant strengthening of specific requirements, leading also to changes in professional qualification requirements.

At the Tripartite Cooperation Sub-council of Vocational Education and Employment meeting on 11 August 2021, the updated version of the occupational standard of engineer in heat power and thermal engineering was approved. It is drastically different from the previous one due to the rapid development of technologies and significant changes in the sector not only in Latvia, but also in Europe and worldwide, that it is in fact a new occupational standard for the qualification of an engineer. Such changes also have a significant impact on the professional study programme, the content of which is based on the requirements of the occupational standard.

With the approval of the new occupational standard in autumn 2021, the process of modernization and updating of the study programme content was initiated: the aim, tasks and learning outcomes of the study programme were revised and changed in line with the new requirements of the occupational standard. The aims, tasks, learning outcomes and content of the study courses were also revised. For example, the content of the study course MSE279 "Fundamentals of Ecology" was substantially revised, while at the same time it was developed in such a way that its content would be relevant for other study programmes in order to achieve the objectives of optimizing RTU study courses.

The work done in 2021 is not considered to be complete: the analysis of the study programme content has shown that the existing structure of it, which was developed according to the requirements set in 2012 and earlier occupational standard of engineer in Heat Power and Thermal Engineering, has certain shortcomings in relation to the new 2021 occupational standard – a smoother alignment of knowledge coverage is needed, with more detailed revision of the content of individual professional courses and/or replacement of some of them with new ones. The process of structuring and developing the content will therefore continue in academic year 2021/2022. In the next reporting period, increased monitoring of content is planned, not only by analysing the changes introduced, but also by improving it in line with the expected reforms in the framework of the reform of higher vocational education, as well as by continuing to keep abreast of changes in the sector, including in the context of the introduction and implementation of the Green Deal for sustainable education in line with the needs of the sector.

Taking into account both the problems of the industry in the education and training of the required specialists, as well as the trends of general vocational education and the goals of RTU in the area of modular and lifelong learning programmes, the content of the professional Bachelor study programme "Heat Power and Thermal Engineering" is planned to be structured as modular as possible, paying attention to the division of study courses into their compulsory and elective parts, thus specifying the priorities of professional study courses/modules in accordance with the needs of the industry. The above trends, taken together with the results of the student analysis, also point to a possible need for increased flexibility in the design of courses and content in the next reporting period. In turn, the structuring and modernization of content should also take into account, where possible, the development plans of the study programme to add additional sub-programmes in the next reporting period, i.e., to provide, where possible, content that is also relevant for other related engineering professions. This would not only allow for a broader coverage of the needs of the sector, but also increase the quality of the study programme indicators and the effectiveness of its content in achieving the strategic objectives of RTU and the study field.

### 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).

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### 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.

In the professional Bachelor study programme "Heat Power and Thermal Engineering", the choice of the relevant methods for delivering study courses is based on:

- the aim, tasks and learning outcomes of the study programme;
- the aim, tasks and learning outcomes to be achieved for a specific study course;
- specifics of the content of the study courses, as well as the specifics of the technology and industry;
- the student's study opportunities, diverse needs;
- the study environment: available study facilities, information facilities, material and technical facilities;
- opportunities for the involvement of academic staff and industry in the implementation of studies.

The study programme is developed to educate and train the specialists in heat power and thermal engineering required by the industry. This provides the basis for the choice of methods aimed at the development and consolidation of professional skills and knowledge. The study content also focuses on the development of general professional skills, such as applied communication and cooperation with professionals at different levels, responsible and reasoned engineering decision-making in both the operation and design of equipment and systems, including in relation to the environment in the area of climate neutrality and human safety in the performance of work tasks. The study programme also focuses on general and sector-specific digitization, developing professional skills in smart and information technologies, together with the integration of relevant methods into the study content. Practical, independent and other tasks are designed to develop analytical thinking, learning, organizational and other personal skills necessary for the performance of professional duties.

The orientation of the professional study programme also determines the methods of assessment of the respective learning outcomes: the summative assessment method is used in the study courses, which includes examination methods and criteria corresponding to the specific study course and the occupational standard. The study programme offers the internship to consolidate and develop the acquired knowledge and skills in the industry. The evaluation of the learning outcomes is concluded with a state examination – the elaboration of a diploma project and its viva voce examination in front of the State Examination Committee.

In student-centred learning, academic staff use a diverse range of teaching methods, depending on the circumstances:

- traditional methods – lectures, practical classes, laboratory work, seminars;
- methods that promote analytical, critical, systemic and creative thinking, as well as communication skills – group work, discussions, debates, presentations, case studies and modelling, problem-solving, study tours and surveys of experts in the field, etc.;
- methods of encouraging students to work individually or in groups, to use information resources and to select and collect information – reports, projects, homework, study projects, graduation paper;
- meetings with invited experts – professionals in the field;
- students are motivated and encouraged to independently choose the topics of their study projects and graduation paper in accordance with the current trends in the field, which at the same time ensures the achievement of the learning outcomes.

Student-centred methods are used particularly successfully in the specialized courses of the programme, such as MSE424 "Compressors, Pumps and Ventilators", MSE384 "Equipment for Refrigeration Plants", MSE281 "Hydro- and Gas Dynamics (Study Project)". In the above examples, the study courses successfully integrate various methods, methodological techniques, principles of student-oriented education and forms of lecture organization, which allow providing the necessary professional knowledge and skills, at the same time effectively developing general professional competences, along with increasing students' motivation and interest both in the study process itself and in learning complex engineering material, which all together in some cases reach the level of synergy. The personalized learning approach is also widely used, supporting students' ideas, proposals and initiative in learning the content of their courses. The use of such approaches and methods promotes both the transfer of knowledge and competences (for example, especially in the fast-changing field of information technology, where an increasing number of new specialized and sector-specific software, tools and auxiliary instruments are emerging), the development of a mutually respectful and lasting relationship between student and instructor that continues beyond the completion of studies, and the full achievement of learning outcomes of a particular study course and study programme.

According to the survey data of the graduates of the study programme (see annex of point 2.2.4), the study programme has a high evaluation in the most part of points, which exceeds the average indicators of the study field, but in some positions the average indicators of RTU, where used methods and approaches are the one of the reasons.

The set of methods used for the implementation of the study programme and their evaluation show the development in the area of the competence approach, which can be assessed positively in terms of quality assurance and sustainable development of professional higher education.

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

Internship within the professional study programme "Heat Power and Thermal Engineering" is provided in accordance with Cabinet Regulation No. 512 of 26 August 2014 "Regulation on the State Standard of the Second Level Professional Higher Education" and RTU Internship Organization Procedure (RTU Senate Decision of 28 January 2019 (Minutes No. 626)).

The duration of the internship in the Bachelor study programme is 26 weeks with a volume of 26 CP, which is required for the award of the professional qualification "Heat Power and Thermal Engineer", which can be undertaken in the autumn, spring and/or summer semesters.

Students of the professional study programme "Heat Power and Thermal Engineering" have the possibility to find an internship site on their own, to use independent offers within the framework of concluded cooperation agreements, or to ask the internship coordinator and/or academic staff for support and guidance in searching and choosing an internship company (for the chosen internship, despite the wide choice of possible professional fields of activity. Additional assistance in the search and selection of internship company is provided by posting relevant information on RTU website, which also includes links to external information resources such as the https://www.prakse.lv/ portal, and throughout the academic year, especially towards the time of internship, various, mostly paid advertisements are posted on the Ortus bulletin/news board, and all news is also sent regularly to students by e-mail. Internship advertisements are also available on the FMETA website (in Latvian) (https://www.rtu.lv/lv/mtaf/studijas-mtaf/informacija-studentiem-1/prakse_un_darbs), as well as on the FMETA and Department notice boards in the Faculty premises, and in Department and common social networks and other information resources.

Active cooperation with large and small companies in the sector allows us to continuously offer internship opportunities to students, including paid internship in various fields of the sector, about which not only the internship coordinator, but also other instructors inform students.

Students of the study programme have opportunity to undertake paid internships at many companies throughout Latvia, including permanent and new partners of the Department of Thermal Power Systems:

Latvenergo JSC cooperates with RTU in a variety of ways, including in the provision of paid internship, which is also used by students of the study programme "Heat Power and Thermal Engineering". RTU ensures regular updating of the cooperation agreement to ensure the continuity of the cooperation.

During the reporting period, Rīgas Siltums JSC provides paid internships in accordance with the agreement, and regular study tours are also provided at the company and its facilities.

Since 2016, long-term cooperation has been established with EKO AIR Ltd, the only plate heat exchanger production plant in the Baltic States, located in Salaspils.

In 2021, two new cooperation agreements, including the internship provision, have been concluded with regional companies Adven Latvia Ltd (a branch/representative office of the Scandinavian energy company in Latvia) and Liepājas Enerģija Ltd.

During the internship, the internship diary is regularly filled in and after its completion, the internship report is drawn up, which the student presents in front of the commission. A summative evaluation is applied to the internship, which consists of the feedback of the internship supervisor at the organization, the evaluation of the internship report and its design, and public presentation. The experience gained during the internship and the information gathered can also be used in the development of the graduation paper.

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

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

At the end of the professional Bachelor study programme "Heat Power and Thermal Engineering", students develop a diploma project. Students choose the themes of the graduation paper in different ways: independently, choosing the theme of their interest; based on the information collected and analysed during the internship and the observed problems or opportunities for improvement, as well as receiving suggestions for the theme of the graduation paper from the internship supervisor at the company; or choosing current themes proposed by the companies or faculty members in the field.

Leading companies in the sector also offer scholarships for the development of graduation papers by organizing competitions (for example, the annual graduation paper competition by Latvenergo JSC for engineering students from various energy and information technology sectors), which additionally stimulates students both to choose a topical theme for the graduation paper that is more suitable for a particular company and to develop the high-quality paper in compliance with the competition regulations, thus enhancing and strengthening professional skills required in the labour market.

The wide range of possible professional fields of activity of heat power and thermal engineers is also reflected in the themes and technologies of the students' graduation papers, ranging from the design or modelling of thermal engineering and individual units of equipment or systems, including elements of applied research, to the design and analysis of energy facilities and urban heat energy sources and heating supply systems. A large part of the graduation papers is devoted to the improvement and modernization of systems and equipment, as well as to the improvement of their performance and other indicators. The themes of the graduation papers also reflect general trends in the sector and related areas, such as energy efficiency improvement, renovation of buildings and/or their systems, use of renewable, alternative and combined forms of energy.

Some examples of the themes of students' graduation papers in the period of 2013-2021:

- "The Design of Alternative Energy Heat Supply System for Country Estate"
- "Renovation of Typical Sand-Lime Bricks Apartment Building"
- "Influence of Wood Chips Quality on HP "Ziepniekkalns" Cogeneration Power Unit Boiler Performance"
- "Enhancement of an Electrical Oil Heater Using Computational Fluid Dynamics"
- "Energy Efficiency Improvement of Technological Equipment at JSC Laima"
- "Analysis of the Refrigeration System's Optimization Variants Using Brazed Plate Heat Exchangers"
- "The Heat Supply Reconstruction Project of Municipal Objects at Stabulnieki Village"
- "Low Potential Heat Recuperation at "AKG Thermotechnik Lettland" Ltd, Jelgava"
- "Modernization of Water Heating Plant "Imanta""
- "Biogas Production and Use in "Agrofirma Tērvete""
- "Improvement Possibilities of Preiļi City Heat Supply System"
- "Recovery of heat in ventilation system for pharmaceutical manufacturing facilities"

The quality of the graduation papers of the students of the study programme can be assessed by the grade obtained in viva voce examination. The average grade for graduation papers in the reporting period ranges from 6.9 to 8.1, with an overall median of 8 for all years and an average value of 7.5. The dynamics of graduation paper evaluation over the years is not stable and does not reflect clear downward or upward trends.

During the reporting period, 15% of students had a grade "6" for the graduation paper and only one had a grade below "6". Such ratings also reflect the objectivity of the evaluation of the quality of the graduation papers elaborated and show that there is room for improvement in these indicators through methodological approaches and organizational measures for the development of graduation papers.

In turn, 16.5% of students received a grade "9" and one had a grade "10". The trend is generally positive and indicates that about 70% of students received a grade in the range of average indicators, which is a relatively good indicator in the field of engineering.

## 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.

In 2013, the location of the professional study programme was in Riga, Ezermalas Street 6-k, i.e., in one of the remote districts of Riga with a relatively low intensity of public transport. In accordance with RTU Development Strategy, the construction and renovation of Ķīpsala Campus had already begun.

In 2015, within the framework of Ķīpsala Campus development project and the relevant ESF funding, a centralized procurement of laboratory equipment necessary for the implementation of the study programmes, including the study programme "Heat Power and Thermal Engineering", was carried out to provide equipment for the newly constructed Laboratory House.

The Department of Thermal Power Systems of the Institute of Mechanics and Mechanical Engineering has several premises in the Laboratory House, which in 2017 were already provided with a sufficient level of equipment for the implementation of studies and laboratory work. Starting from the autumn of 2017, they were also fully used in the study process. The premises of the Laboratory House are suitable for both laboratory work and lectures for groups of up to 20 students. The location in Ķīpsala, Paula Valdena Street 1, made it difficult to plan classes due to the additional time required for both students and academic staff to move between RTU buildings, which was resolved in 2019 with the full relocation of the FMETA to new premises at Ķīpsalas Street 6B.

In autumn of 2019, the implementation of the study programme "Heat Power and Thermal Engineering" was started in new and modern premises at Ķīpsala Campus, which were also equipped with new laboratory rooms in addition to those already existing in the Laboratory House. This ensures continuity of studies during the day, unlike the previous location at Ezermalas Street 6-k, which increased the time between classes of individual courses, especially in the first years of studies, which required travelling to other premises, including in Ķīpsala.

During the reporting period, a total of € 235 875 was invested in laboratory equipment, special instruments and various types of equipment, mostly in new premises, including ESF funds intended for the construction and development of Ķīpsala Campus. (see Annex 3.3.1).

Several multifunctional teaching laboratory stands have been received within the framework of European projects for the implementation of various study courses and for the acquisition and development of professional as well as scientific and research skills in the thematic areas of technical thermodynamics, hydro- and gas dynamics, heat transfer, thermal measurements, etc., providing a total of more than 40 different laboratory activities. The specialized equipment and instruments are designed for both study and professional use: training in the use of professional measuring instruments, e.g., pump station with integrated control, heat exchanger test bench WL110, etc. Technical equipment of other organizational units is also used for the implementation of the study programme, e.g., in one of the common computer rooms of the FMETA, the specialized study software KAN SET Pro + PLUGIN KAN SET for Revit and KAN HL Pro provided by an industry company within the framework of international cooperation was installed on 15 computers.

The pre-existing laboratory base was also renovated and modernized: laboratory equipment and apparatus were renewed together with some older teaching stands. Since the relocation of the study programme to Ķīpsala, the new premises are being upgraded and updated to meet current needs for efficient and high-quality studies.

In addition to the funded investment, the study programme also receives donations from leading companies in the field and from graduates in the form of laboratory equipment and specialized literature, as well as training and operational support in the use of the donated equipment. Industry also provides its own facilities for students during the internship period.

With the relocation of the study process to Ķīpsala Campus, students have also gained more convenient access to the Scientific Library of RTU with available databases, including the LVS Standards Database, which is used as a source of information by many lecturers in specialized study courses for the acquisition of professional knowledge. The Scientific Library is now located in an adjacent building, making the study process much easier. Despite the proximity of RTU Scientific

Library, the library of the Department of Thermal Power Systems was retained for the implementation of the study programme. A separate room with desks and computers was allocated for the Department library, where a research assistant and a researcher helped the students use the library and its facilities. The academic staff are always helpful in finding the necessary books, providing recommendations for the use of additional available literature according to the student's needs. For the implementation of the study programme, the Department library has a wide range of specialized books and publications in various areas of the study courses:

- thermodynamics and heat transfer;
- hydro and gas dynamics;
- combustion processes and boiler equipment;
- electromechanical and energy equipment;
- heating supply;
- thermal measurements, etc.

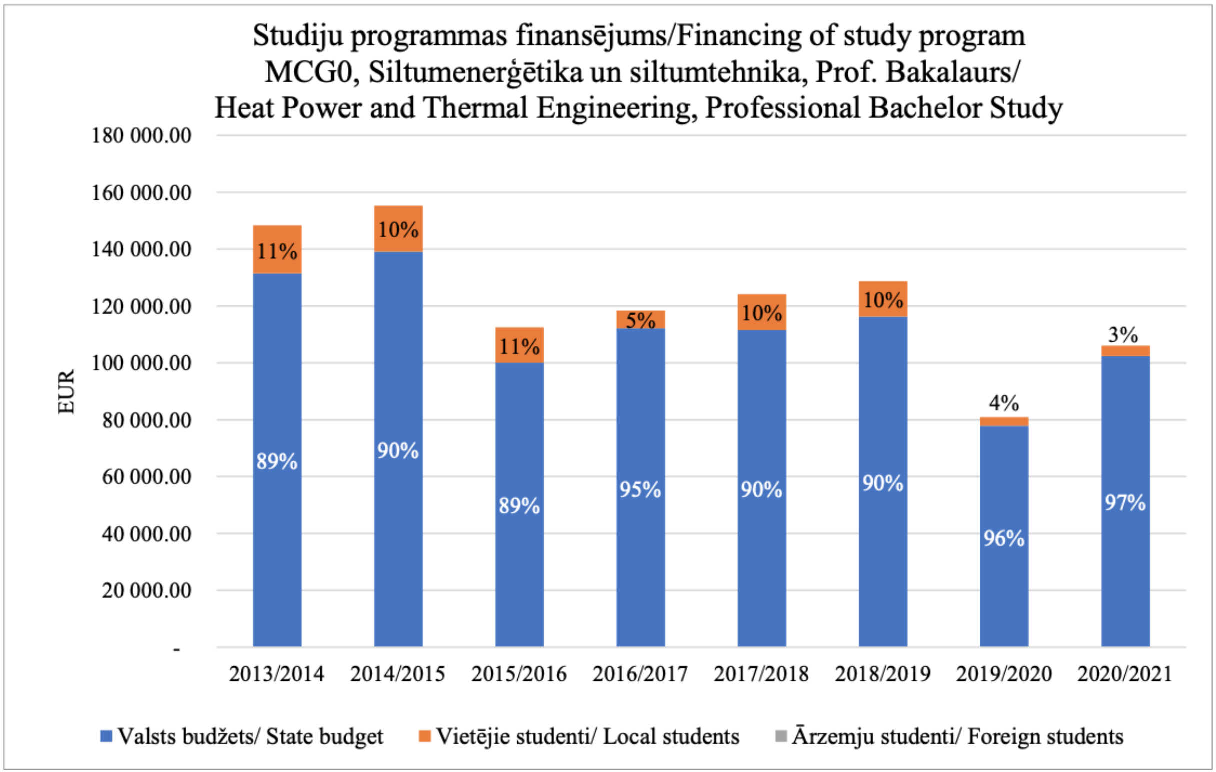
Methodological materials and instructions are regularly developed and updated for the implementation of the study programme, as well as RTU Scientific Library collections are enriched. In total, about 50 textbooks were ordered in the reporting period, including those supplemented with newer technologies, which are used in study courses as basic and/or supplementary literature, e.g.:

- Dinçer, İbrahim, Refrigeration systems and applications / İbrahim Dinçer, University of Ontario, Ontario, Canada.  3rd edition. Chichester, West Sussex, UK: John Wiley & Sons, Inc., 2017. xix, 727 lpp. ISBN 9781119230755
- Steane, Andrew M. Thermodynamics: a complete undergraduate / Andrew Steane. Oxford: Oxford University Press, 2017. xiii, 436 p. ISBN 9780198788560
- Marc A. Rosen, Seama Koohi-Fayegh, Geothermal energy: sustainable heating and cooling using the ground, 2016, ISBN 978-1-119-18101-9
- Roger C. Baker Flow Measurement Handbook. Industrial Designs, Operating Principles, Performance, and Applications. August 2015, CRC Press, ISBN 9781107045866
- Swapan Basu, Ajay Debnath. Power Plant Instrumentation and Control Handbook. Academic Press; 1 edition (2014), 942 p. ISBN-13: 978-0128009406
- Ganapathy. Steam Generators and Waste Heat Boilers: For Process and Plant Engineers (Mechanical Engineering) Springer; 2013 edition (December 14, 2014) 539 p. ISBN-10: 1482247127 ISBN-13: 978-1482247121
- Faith A. Morrison. Introduction to Fluid Mechanics. Cambridge University Press, 31-May-2012 ISBN-13: 9781107003538
- S. Lee Thermal Design: Heat Sinks, Thermoelectrics, Heat Pipes, Compact Heat Exchangers, and Solar Cells. December 2010, Wiley. ISBN 978-0-470-49662-6, etc.

The study programme is implemented using recommended sources of literature on fundamental knowledge and skills acquired over the years, as well as new publications and resources subscribed to by RTU Scientific Library, which have become particularly relevant in the period of distance learning.

### 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 total funding of the professional Bachelor study programme consists of state-funded subsidies and tuition fees, which include both full-time intramural and part-time extramural student fees, as well as various types of additional student fees (e.g., for re-examination), which have a significant impact on the stability and volumes of the indicators.

The state funding allocated to the study programme fluctuates from year to year as a result of the influence of several factors. To a large extent, the fluctuations in the total funding are related to the fluctuations in the number and distribution of students, as well as the diversity of students' study course choice combinations in the reporting period.

The cost of implementing the programme increased from €3866 to €4462 per student during the reporting period (see point No. 2.3.1. and its annex). The increase of 15.4% in costs is below the national average increase in salaries over the same period.

The analysis of the funding of the study programme for the reporting period shows that one of the challenges for the next reporting period would be to achieve a steadier increase in funding, together with a better stabilization and alignment of indicators. Taking into account the general trends in vocational education, higher education and the sector, the following areas for the development of the study programme can be identified, including in terms of attracting, distributing and reallocating funding:

- the new version of the occupational standard has led to a modernization of the structure and content of the curriculum, which also makes it necessary to develop new professional specialization courses of sufficient scope, which will also redirect the distribution of funding;
- continuous and broader cooperation with the industry and feedback from the industry will allow for an increase in the students enrolled and, consequently, in the number of students, both young and adult, forming the sustainable basis for the development of the study programme;
- integration of new work-based studies and other modern forms of studies into the study programme, together with the increase of overall efficiency indicators, would allow reducing the burden of direct expenses, taking into account that entrepreneurs also receive direct state-funded support for participation in such programmes, as well as increasing indirect and/or direct income;
- development of new study sub-fields and/or additional forms of implementation opens wide opportunities not only for the development of the study programme in the context of industry needs and trends, but also for attracting additional funding of various types, while ensuring improvement of the study field and RTU strategic indicators.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

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

The qualifications of the academic staff involved in the implementation of the study programme comply with the conditions for the implementation of the study programme, as well as with the requirements of national and RTU normative documents.

Associate professors, assistant professors, lecturers, assistants and researchers elected by RTU are involved in the implementation of the professional study programme, as well as practical and guest lecturers, three experts in the heat power and thermal engineering sub-sector approved by the Latvian Council of Science. This ensures the transfer of multifaceted high-value knowledge.

The academic staff involved in the implementation of the study programme are active in research. Research activities in relevant thematic areas, together with the University's professional development and industry events, including courses and seminars, enable the academic staff to maintain and improve their professional competences in line with the content of the study programme.

Particular emphasis should be placed on the changes in requirements and implementation methods of studies brought about by the spread of Covid-19, with virtually all classes moving to remote mode during the pandemic and the first emergency situation. This pandemic really changed the world and many lecturers, along with students, at RTU, in the country and all over the world, had to learn additional previously unused and new specially developed information technology tools and instruments, as well as to use unusual methodological techniques of conducting remote studies, all of which together make the study process significantly more difficult. However, there is also a positive part - RTU students were also involved in various training, advisory and assisting activities for academic staff, thus creating closer mutual cooperation and greater involvement not only in the teaching material, but also in the organization of the study process itself, which is definitely positive, including from the point of view of mutual transfer of knowledge and skills. In addition, it should be noted that RTU regularly organizes various additional training courses and seminars, with a particular focus on the development of knowledge and skills required by academic staff in new and unprecedented conditions, which is still ongoing. This set of additional training activities and the relatively wide choice of topics and participation times allow academic staff to develop their professional competences without being distracted from the study process, all of which ensures that the quality of studies is maintained even under such difficult conditions.

As mentioned above, practical assistant professors and lecturers are also involved in the implementation of the study programme, and renowned experts in the field are invited to deliver guest lectures and conduct practical classes. Some classes are also regularly held on field trips, which were unfortunately excluded during the pandemic, but alternative solutions were explored with the industry. Industry and practical faculty members work at well-known companies in the industry and actively participate in the resolution of heat power and thermal engineering issues, including within the energy sector, representing the views of associations or their members and industry experts (e.g., Association of Technical Experts, Latvian Association of Heating Companies). Professional development takes place in the industry, in the work environment, through participation in various industry, business and applied projects by fulfilling direct duties. This approach allows ensuring the appropriate quality of professional study results.

### 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 study programme is implemented by both academic staff members and highly qualified professionals. In recent years, more and more companies and other industry professionals have been brought in to provide students with a better understanding of the industry and to engage in the analysis and resolution of current industry issues, thus broadening their professional knowledge and skills.

During the reporting period, there was also a change in the generation of academic staff in the study programme - some of the retired assistant professors and associate professors were replaced by younger academic staff members. New PhD students and researchers are also involved in the study process by delivering certain specialized study courses and / or classes. Thus, while maintaining a similar proportion of academic positions and scientific degrees of the academic staff, the average age has been significantly reduced since 2013, at the same time ensuring the continuity of the academic staff implementing the study programme.

**Changes in the academic personnel**

| Position | 2013/ 2014 | 2014/ 2015 | 2015/ 2016 | 2016/ 2017 | 2017/ 2018 | 2018/ 2019 | 2019/ 2020 | 2020/ 2021 | 2021/ 2022 |
|---|---|---|---|---|---|---|---|---|---|
| Associate professors | 4 | 4 | 4 | 3 | 3 | 3 | 3 | 4 | 4 |
| Assistant professors | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 2 |
| Lecturers | 3 | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 3 |
| Assistants, incl.: | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| Research assistants | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Researchers | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| Total | 12 | 13 | 12 | 11 | 11 | 11 | 12 | 11 | 11 |

At the moment of drawing up the self-assessment report, the share of responsible instructors holding a scientific degree is 66.7% at the Department of Thermal Power Systems and associate professors account for 50%. It should be taken into account that in the coming years a new generation of academic staff is expected and the composition of the academic staff also includes practical assistant professors and lecturers, who are essential for ensuring the quality and compliance of the professional study programme with the requirements of the industry and the occupational standard.

The academic staff of other RTU and FMETA organizational units are also involved in the implementation of the study programme; thus, the total proportion of the academic staff holding a scientific degree exceeds the University average value of 67%.

Updating the composition of the academic staff allows ensuring modern methodological methods of studies and introducing various organizational, methodological and professional innovations in the course syllabi, by actively following modern industry trends, which in turn ensures the relevance of studies to the current needs of the industry and increases students' interest in the learning process that certainly serves as a positive factor in ensuring and improving the quality of studies and their learning outcomes. In the next reporting period, it is planned to expand cooperation with the industry, including the recruitment of academic staff, which was also stipulated in the new cooperation agreements signed in 2021. This set of measures allows maintaining a high-quality level of professional studies that meet the requirements of the sector and ensure the sustainable development of professional higher education.

### 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).**

Cooperation between academic staff and organizational units is important for the implementation of the study programme and the interconnection of study courses. To foster cooperation among academic staff members at the FMETA and at RTU as a whole, a system has been established, which provides for regular academic conferences and professional development seminars to improve teaching methodological competences.

The Department of Thermal Power Systems and the Institute of Mechanics and Mechanical Engineering host meetings of the Department, face-to-face and remote FMETA meetings at various joint events, including seminars and conferences. This allows discussing topical issues and proposals for updating the content of study courses, promoting mutual cooperation for the implementation of the study programme.

At the professional Bachelor study programme, study courses of other FMETA departments as well as of other RTU faculties are delivered; on the other hand, the academic staff of the study programme "Heat Power and Thermal Engineering", including the practical ones, conduct classes within study programmes of other departments, but for some study courses they are also appointed as responsible instructors, which all in all strengthens both mutual cooperation of academic staff and exchange of working experience with regard to teaching methods and approaches used. Guest lecturers from the field are also invited to deliver some of the practical study courses. It also facilitates the exchange of practical experience and ensures better interconnection and timeliness of content.

In turn, when considering the study courses that are implemented by different departments from the point of view of workload and taking into account that there are also joint classes for students of different programmes, the student-to-academic staff ratio should be considered in the context of the study field and the faculties. In this case, the average ratio of 10 students to 1 faculty member is indicative at the Bachelor study programme, as it does not take into account the timing of classes and possible fluctuations both within the semester and the academic year, as well as the possible participation of guest lecturers from the field invited for a particular class.

# 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 | MCG0_diplom_dipl.annex_sample_EN.zip | MCG0_diplom_dipl.pielik_paraug_LV.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) | | |
| 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 | MCG0_stud_statist_EN.xlsx | MCG0_stud_statist_LV.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 | MCG0_StEdSt_6_annex.docx | MCG0_ValzSt_6_pielik.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) | MCG0_ProfSt_7_annex.pdf | MCG0_ProfSt_7_pielik.pdf |
| 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 | MCG0_CoursMapp_8_annex.xlsx | MCG0_KursKart_8_pielik.xlsx |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MCG0_StudProgrPL_9_pielik_LV_EN.xlsx | MCG0_StudProgrPL_9_pielik_LV_EN.xlsx |
| Descriptions of the study courses/ modules | MCG0_DescriptStud_cour.zip | MCG0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | MCG0_Descr_org_internsh.pdf | MCG0_Prakse_Apr.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Aerospace systems engineering (45525)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Aerospace systems engineering* |
| Education classification code | *45525* |
| Type of the study programme | *Academic master study programme* |
| Name of the study programme director | *Ilmārs* |
| Surname of the study programme director | *Blumbergs* |
| E-mail of the study programme director | *ilmars.blumbergs@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., asociētais profesors* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study programme is to ensure the training of highly specialized aerospace systems specialists with in-depth knowledge of the field, which has systemic and analytical thinking and independent work skills, as well as to prepare students for further doctoral studies.* |
| Tasks of the study programme | *1. To provide competitive education, which corresponds to the level of Master studies and international standards, by training high class specialists in the field of aerospace and transport systems;<br>2. To provide students with comprehensive knowledge, develop skills and competences complying to the requirements formulated by the labor market for a transport (inc. aerospace) systems engineer as well as to prepare students for practical work;<br>3. To provide the development of study program curriculum, study process and scientific research activity as well as to introduce changes corresponding to changes in international normative acts related to transport institutions;<br>4. To promote students' interest in further professional development, improvement of academic knowledge, studies for a PhD degree; to develop scientific research skills and foster their application;<br>5. To stimulate students' interest in the social processes, create a personality able to act and make decisions independently;<br>6. To develop students' ability to carry out scientific research and to promote their participation in international exchange projects.* |

| | |
|---|---|
| Results of the study programme | *Knowledge (knowledge and understanding):*<br>*In-depth acquisition of theoretical and practical knowledge, scientific, professional and creative skills for creative and research activities in the field of transport systems engineering, which provides skills to create and apply new, exceptionally effective technologies, methodologies and systems, and provides the opportunity to successfully join knowledgeable and skillful professionals in international transport and logistics.*<br>*The content of the study course is continuously improved in order to provide students with the knowledge on the recent discoveries in the professional field of transport systems research.*<br>*The acquired advanced knowledge provides the basis for creative thinking and research activity in different fields (transport information technologies; transport machine design; transport system design and technologies; control, maintenance and repair technologies for special and mechanical equipment).*<br>*Skills (ability to use knowledge, communication, general skills):*<br>*- students can independently apply theory, methods and problem-solving skills to carry out research activity in the field of transport and logistics; they can propose new solutions, methodologies or technologies in the field of transport;*<br>*- students can reasonably explain and discuss with professionals and non-professionals the application of complex mathematical models for investigating problems in the field of transport and make calculations to optimize the design of transport technical facilities and special equipment;*<br>*- students can independently develop their competences and area of specialization, take on responsibility for the results of team work and analysis thereof;*<br>*- organize, manage and control the work on maintenance and repair of vehicles and equipment;*<br>*- introduce innovations in the field of transport systems and profession of a transport engineer;*<br>*- carry out research, design models of the system, apply research results and formulate proposals for normative documents;*<br>*- draw up reports and publications and present their results;*<br>*- students can learn in difficult and unpredictable conditions and, if necessary, change these conditions by applying new approaches.*<br>*Competence (analysis, synthesis and evaluation):*<br>*Students can independently formulate and critically analyze scientific and professional problems of transport systems engineering, substantiate decisions and, if necessary, carry out additional analysis.*<br>*Students can integrate knowledge from different fields to contribute to logistics and transport systems engineering:*<br>*- creation, improvement and management of an integrated, balanced multimodal and intermodal transport system;*<br>*- development of a cutting-edge transport technological system and technology, etc.*<br>*Students can contribute to the creation of new knowledge related to research methods development or professional activity in the field of transport systems.*<br>*Students can demonstrate understanding and ethical responsibility for the possible effect of scientific results or professional activity on the environment and society.*<br>*Academic Master education provides basic knowledge that creates a certain level of cultural intelligence providing the opportunity to start social activities and maintain relations with Latvian and foreign colleagues.*<br>*Students can apply knowledge and skills in a changeable situation; they have an ability to express attitude in compliance with professional ethics and an ability to act professionally and ethically.* |
| Final examination upon the completion of the study programme | *Master's Thesis* |

# Study programme forms

### Full time studies - 2 years - latvian

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *2* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *80* |
| Admission requirements (in English) | *Bachelor degree in mechanical engineering or a comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Master degree in mechanical 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 - 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) | *Professional Bachelor Degree in Mechanical 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 in mechanical 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.**

The main changes introduced to the program, with the regular accreditation, are the transition to the academic Master study program and the update/change of the name of the program.

The name of the program is to be changed from Transport Systems Engineering to Aerospace Systems Engineering.

Due to the transition to the academic study program, the qualification of Transport Systems Engineer will no longer be awarded. It is planned to implement the program only in one volume – 80 CP. Because of the transition from the professional master's program to the academic one, as well as in connection with the updating of the program, a number of changes have been made to the curriculum and courses.

Due to the death of Alexander Urbahs, the previous director of the program, Ilmārs Blumbergs has been the director of the program since 2020.

**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 academic master's study program “Aerospace Systems Engineering” corresponds to the 7th level of the EQF and the LQF, thus it is oriented towards graduates with a bachelor's degree in engineering in the field of transport and comparable education. Its title points to the goal of the study program to provide students with the opportunity to acquire in-depth theoretical knowledge in the field of transport with a specialization in aerospace, as well as to develop students' research skills and train analysts and industry specialists in transport systems and related processes. to solve various problems and make decisions in today's changing economic conditions. In order to achieve the goal of the program, the tasks of the study program are subordinated, which are set to achieve specific study results. The goal of the program will be achieved if the students will obtain the mentioned results in the study process. According to its content, the program is designed so that the goals and results of the study courses included in it are subject to and ensure the achievement of the overall goal and results of the program. The master's degree in mechanical engineering is awarded after mastering the theoretical study courses of the program and defending the master's thesis in the State Examination Commission. Analyzing the interrelation between the title of the study program, the degree to be obtained, the aim and tasks, the study results, as well as the admission requirements, it can be concluded that it has been observed.

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

Since the last accreditation, the content of the study program has been updated, its content is actual, mutually complementary, meets the objectives of the program and ensures the achievement of study results, as well as meets the needs of transport and the latest scientific trends and innovative practice solutions.

While elaborating RTU Development Strategy, recognizing the role of the university in the economic growth of the Baltic region and shaping the future of Latvia, the priorities of the European Union, as well as the guidelines of national and regional level education and innovation policy planning documents have been observed. Successful implementation of RTU Development Strategy is the basis for building a knowledge-based Latvian society and RTU is one of the most important partners in achieving strategic goal No 244 set in the National Development Plan of Latvia – education and knowledge for economic growth and technological excellence.

RTU mission is to provide the Latvian economy and society with internationally competitive high-quality scientific research, higher education, technology transfer and innovation.

The tasks of the academic Master study program “Aerospace Systems Engineering” correspond with the mission of RTU and focus on the education and training of new specialists.

The content and implementation of the study program focus on the development of such competencies as adaptability and responsiveness to changes in students, following and even getting ahead of the labor market demand. RTU is one of the cornerstones of Latvia’s development, which ensures the training of specialists necessary for the Latvian economy, as well as the creation of new products and services, serving as a basis for Latvia’s sustainable growth. RTU Strategy includes the most important guidelines for the development of RTU in the period up to 2020, as well as determines the tasks and delegates responsibilities for the completion of these tasks.

Graduates of the study program easily find a job in their specialty. In fact, upon admission to the study program many students already work in the respective field or find a job during their studies. AERTI on its part develops a schedule that is as suitable as possible to be combined with work.

The Latvian Aviation Association and Latvian Aerospace Industry Association confirm the necessity of the program and the demand for its graduates. Employability of the program graduates is promoted by the fact that Latvia has joined the European Space Agency and aerospace industry is developing in Latvia. As the transport sector continues to grow rapidly, the importance of proper maintenance of the transport system and smart, science-based management of transport operations increases. Given the situation in the world, it is difficult to predict the potential demand for students, but it is clearly growing over time and at least 20 new specialists per year would be necessary to satisfy the needs of the Latvian economy.

### 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 students of the study program “Aerospace Systems Engineering” are provided in Annex**.** As the graph shows, the number of students at the program is not large, which actually allows for individual training. Despite the demand from employers and the labor market for transport specialists, the number of people willing to study and consequently the number of students is not increasing. However, in this case one of the reasons is that already in the junior courses, the students of the Bachelor program tend to find well-paid jobs in the aviation industry and many lose motivation to continue studies to aim for even higher career development. In the last 10 years the number of similar study programs in Lavia has also grown, which has had adverse impact on the number of enrolled students. The passivity of the previous head of the study program must be acknowledged as well. Since the spring of 2020, the head of the program has been replaced and a lot of work has been put into developing scenarios for the development of the program. As a result, in the course of continuous discussion with the employers and academic staff, it has been decided to make the transition to an academic Master program, it has also been decided to develop a new field of specialization - aerospace transport. As a result, the study program will take a unique niche in Latvia, which will be in demand in future.

One positive trend may be mentioned - in the recent years, it has been possible to retain the number of alumni at the roughly the same level despite the overall reduction in the number of students. Some students who were on academic leave have resumed and completed their studies and some students have re-enrolled, which to a certain extent indicates a positive attitude towards the new program head and his actions.

Until now, the program was available only in Latvian, but with the approval of the new changes, the program will be also offered in English, which will increase the number of students admitted.

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

## 3.2. The Content of Studies and Implementation Thereof

### 3.2.1. Analysis of the content of the study programme. Assessment of the interrelation between the information included in the study courses/ modules, the intended learning outcomes, the set aims and other indicators with the aims of the study course/ module

**and the aims and intended outcomes of the study programme. Assessment of the relevance of the content of the study courses/ modules and compliance with the needs of the relevant industry, labour market and with the trends in science on how and whether the content of the study courses/ modules is updated in line with the development trends of the relevant industry, labour market, and science.**

The study program “Aerospace Systems Engineering” has been developed considering suggestions from employers regarding the demand of the labor market. In cooperation with the European Space Agency and local representatives of the space industry, it was decided to adjust the program to the needs of the aerospace industry by including the current topics relating to space systems. Order stipulating the transition of the program status from professional to academic Master study program, was adopted considering the situation in the country concerning the formulation of occupational standards as well as the recommendations of employers. This transition will allow academic staff to educate and train students for a wider labor market demand. In Latvia, most companies are classified as micro or small companies; occupational standards are not formulated for specialists working in such companies, because their number is too small. Nor are professional standards formulated for future professions, such as those in the space industry. However, to ensure the training of specialists necessary for the Latvian economy, the study program was adjusted in cooperation with employers to comply with both the regulations of Cabinet Regulation on the State Standard of the Second Level Professional Higher Education and the interests of companies.

Typically graduates of the program are currently employed by transportation companies and warehouse service enterprises, and other.

Considering the forecasts of employers, 15-25 graduates should complete the program per year.

The study courses are designed in accordance with the aim of the study program and observing the principles included in the description of the study program implementation. See the descriptions of the study courses in Annex.

The study program is implemented on the module formation and comprehension principle, as described in the Law on Higher Education Institutions, which stipulates that a study module is part of a study program created by combining study courses or their parts, which have common aims and learning outcomes. Program modules are divided according to the aims, comprising the study courses that provide information on the latest theoretical and practical achievements in the field, while the second module comprises research, creative work, design and management study courses.

The topicality and compliance of the content of study courses and modules with the needs of the labor market are maintained as the head of the program consults with the companies of the field, as well as RTU organizes regular meetings with employers’ associations and other organizations. Employers participate in the commissions evaluating the public presentations of graduation papers, where they can ascertain that student are educated and trained well. After the public presentation, the representatives of employers can express their observations and recommendations. Scientific trends are considered by following the trends in the themes of projects, as well as by consulting with the instructors of the program (considering their competencies in a particular research field). The instructors of the program regularly participate in international conferences, which ensures their competence in the represented fields.

The compliance of the program with the needs of the labor market of the sector is confirmed by positive feedback on the program from the leading association of the sector - the Latvian Aviation Association, which includes the absolute majority of companies in the sector**.**

**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 information included in the study courses/modules, the results to be achieved, the set goals, etc. The evaluation of the interconnection of indicators, the connection of the objectives of the study courses / modules with the objectives of the study program and the results to be achieved is provided by the program director coordinating the content of the courses and the set objectives. The interconnection of the results to be achieved by the courses is reflected in a certain sequence of courses.

The teaching staff is involved in various scientific projects and regularly speaks at scientific conferences and publishes their articles, including those included in Scopus and other databases. The involvement of staff in current research, as well as the execution of contract work in the industry and the regular cooperation of the program director with the industry, is the basis for concluding that the degree to be awarded is based on the achievements of the scientific field.

The content of the study program reflects the development trends of the field and ensures the training of specialists in the changing socio-economic conditions. The content of the program encourages new professionals who know the demand for new, modern technology in companies and institutions.

The study program is being improved, taking into account the results of student surveys, as well as the recommendations of employers. Involvement of industry professionals in the study process promotes students' understanding of the principles of operation of various medical devices.

The award of the degree is based on the achievements and findings of the relevant field of science or artistic creativity, which is confirmed by the scientific projects, articles and patents carried out in the structural unit implementing the program, the topics of which are reflected in the study courses.

**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.**

RTU has adopted the Regulation on the Assessment of Learning Outcomes that is binding on all study programs.

Various methods are used to assess student's performance and ensure mastering the program courses and acquiring practical skills – case studies, group work, problem-oriented studies, use of information technology. RTU determines the organization of the study process by Order, which is regularly updated based on the situation in the country.

The principles of student-centered education have been taken into account in the implementation of the study program – student representatives have participated in the development of the program, its discussion and approval. The classes and the examinations are scheduled considering the possibilities of students as they combine studies with work. Students are informed about the examination methods, criteria and the procedure for appealing the assessment. Students are introduced to the expected learning outcomes of each course and the report form, as well as expected tests at the beginning of the study course. The content of the course, expected learning outcomes, recommended literature and other important information are provided in the description of each course**.**

The results of the study process are analyzed in discussions with the head of the study program, as well as during the meetings of the AERTI Council. The main issues addressed are the following:

- Execution of the study program and study plan in terms of content and volume;
- The level of students' knowledge, skills and abilities and its compliance with the requirements of a specialist qualification in professional programs;
- Performance of students in the course;
- Financial compliance of the study process with the possibilities and requirements of the Institute.

The quality of students' knowledge, abilities and skills is constantly monitored by:

- Operational accounting of records – the instructor performs operational evaluations of the progress and quality of the completion of study tasks during the semester;
- Credit test and exams – exams are written or supplemented by oral additions, explanations;
- Public presentation of the study project – the content of the project or research and the public presentation are evaluated;
- Internship evaluation – fulfilment of individual task, evaluation of internship log entries;
- Evaluation of the graduation paper – the Master Thesis – creative practical research and results.

Students' knowledge is assessed according to a 10-point grading scale. If the final form of assessment of a study course is a credit test, then, similarly to an exam, it is evaluated by a mark in a 10-point grading scale. Students' performance is mainly evaluated according to the results during the examination session and upon the completion of a course.

Learning outcomes are determined for each study course and lesson within the program – what the student knows, what skills and competences they have acquired, and what they are able to do after successful completion of the course. Learning outcomes of both the whole qualification, and each component separately – the course and the internship – are assessed.

Students' knowledge is assessed twice a year upon completion of courses during winter and spring examination sessions when students take exams in study courses in accordance with the developed individual study plans. Examination questions are designed to ensure that the student preparing for the exam achieves the aim of the study course described in the description of each course. If necessary, students demonstrate their knowledge of the study course on stands, using posters and mock-ups. Explanations shall be given orally. Examination questions, based on the course program, are developed by the instructor, who is responsible for the respective study course.

The viva voce examination of the Bachelor and Master Theses takes place orally, demonstrating presentation materials. Internship places in the respective field are provided in collaboration with the technical staff of internship companies.

### 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 at RTU is organized in accordance with the “Procedure for Organizing the Internship at the Riga Technical University” approved by the RTU Senate**.**

Internships undertaken at companies are organized by dividing the total volume of internship by semesters. The head of the study program, a representative of the internship company and the intern sign an internship agreement. To ensure successful execution and management of the internship, a description of the internship has been developed, comprising the aim and tasks of the internship, the content of the internship and a report. Internships are intended to be undertaken at the companies, which have signed a cooperation agreement. The forecasted number of interns at each company is usually 1-2 students per year.

Internship tasks are related to achieving the following learning outcomes:

- skills in route planning, freight management, ability to understand logistics chains, assess environmental issues related to transportation;
- btaining skills in diagnostics, testing, repair and control of equipment, ability to perform preventive and regulated work.

Depending on the previously completed program, the volume of the internship was 6 CP or 32 CP. The volume of the internship for the graduates of the AERTI Bachelor study program “Transport Systems Engineering” was 6 CP, while the volume of the internship for the graduates of other professional Bachelor study programs was 32 CP. The volume of the internship in the academic Master study program will be 4 CP.

To support the student during the internship, the AERTI provides an internship supervisor-consultant, who coordinates the internship, advises the student and solves internship-related issues with the respective company.

Number of cooperating companies with which traineeship agreements are concluded are attached in Annex.

### 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.**

Usually, students choose the theme of the Master Theses from the list of themes provided by the AERTI during the second semester of the 1st year. After choosing a theme, students specify the chosen theme with a potential scientific adviser. Students may choose a theme which is not included in the list if the potential scientific adviser of the Master Thesis has approved it. The AERTI compiles the list of themes together with employers, including the managers of companies providing internship places, in accordance with the latest trends in the industry and the labor market and current topics of the European Aviation Safety Agency, as well as based on the current research trends.

The following Master Theses were publicly presented in 2020:

| |
|---|
| • Research into the possibilities of increasing the quality and efficiency of diesel train maintenance. |
| • Analysis and selection of evaluation criteria for ballast water management systems. |
| • Research into the use of alternative fuel in an international freight shipping company. |
| • Optimizing the logistics systems of a Latvian electrical goods wholesaler. |
| • Sustainability analysis of introducing Airbus 220-300 aircraft at AirBaltic. |
| • Optimization and improvement of a transport process using freight traffic statistical modelling methods. |
| • Optimizing a pharmacy chain by using modern trading technologies. |
| • Assessment of carbon dioxide emissions created by Latvian vehicle fleet and possibilities of reducing them. |
| • Research into air pollution caused by sea transport engines and possible improvements. |
| • Development opportunities for ACE Logistics company as a result of Rail Baltica project implementation. |
| • Comparison of Machine Learning methods for warehouse stock demand forecasting. |
| • Application of Remotely Piloted Aircraft for Ensuring Logistics Processes in Riga City. |
| • Assessing the efficiency of introducing Energy Management Certification (ISO 50001) to a transport company. |

As can be seen from the list of themes chosen for the Master Theses in 2020, they cover a range of themes related to ecological issues, logistics, logistic chain optimization, and engineering modernization issues, all modes of transport have been reviewed. The selected themes reflect the issues that are topical for companies operating in the industry, as well as themes that are interesting in terms of research.

## 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.

RTU Ķīpsala Campus currently has 54 study rooms, 187 laboratories, 19 special training rooms, 10 computer classrooms, 12 workshops and several research centers of national importance. There is also a student dormitory with 950 beds and a special block designed for people with special needs to ensure enjoyable and comfortable living.

All university equipment is available for the implementation of the program, but for the implementation of the study program at the Institute of Aeronautics of Riga Technical University at Ķīpsalas Street 6B and Lauvas Street 8 in Riga, 23 study rooms and specialized study rooms, training laboratories, workshops and simulation facilities are equipped with computers, projectors, webcams, audio systems, and other technical aids. The average number of work stations in the study rooms is 18. Lecturers have their own work rooms in each of the buildings, which are equipped with computers with Internet connection and printers.

The Institute has 2 computer classrooms with total of 60 work stations. RTU centralized computer classrooms, laboratories and library are also available for the implementation of the program. RTU HPC Centre provides high-performance computer resources and software for the study process and research. RTU organizational units may use software free of charge. The following software packages are available:

| No | Software | For research | For use in class | To be installed on student PCs |
|---|---|---|---|---|
| 1. | Adams | √ | | |
| 2. | *Altium Designer* | √ | √ | √ |
| 3. | *Ansys* | √ | √ | √ |
| 4. | *ArcGIS* | √ | √ | √ |
| 5. | AutoCAD (Autodesk) | √ | √ | √ |
| 6. | *COMSOL* | √ | √ | √ |
| 7. | *BM SPSS Statistics* | √ | | |
| 8. | *Intel Parallel Studio* | √ | | |
| 9. | *Mathcad* | | √ | |
| 10. | *Mathworks MATLAB* | √ | √ | |
| 11. | *OriginPro* | √ | | |
| 12. | *RETScreen* | √ | √ | √ |
| 13. | *SolidWorks* | √ | √ | √ |

In addition to the centrally purchased scientific software, the AERTI has purchased the following computer programs to improve research activities: ANSYS Academic Research (1 task) - TEC Technical Support, ANSYS Academic Research (1 task) - TEC Technical Support period.

The computer programs required for planning the curriculum, accounting, record keeping, personnel management and executing other administrative functions are provided centrally and are interconnected in a unified RTU system.

Database subscription agreements are signed both directly with the supplier and through the state agency Cultural Information Systems Centre, which is the national representative of Latvia in the international non-profit organization EIFL (Electronic information for Libraries, http://www.eifl.net/). The EIFL licensing program offers national libraries a subscription to internationally recognized databases at a significantly reduced subscription fee than is offered to individual subscribers, reducing the Library's expenditures. RTU Scientific Library has subscription to the following databases (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazeseresursi/abonetas-datubazes):

- ProQuest Ebook Central, Academic Search Complete EBSCOhost, Applied Science & Technology Source EBSCOhost, Business Source Ultimate EBSCOhost, EBSCOhost eBook Academic Collection, Wiley Online Library, SpringerLink, The International Monetary Fund;
- Subscriptions funded by the Ministry of Education and Science (ScienceDirect, SCOPUS (Elsevier), Web of Science);
- Latvian databases LETA, Letonika, Latvian Standards Database (available only on-site in the library).

The intensity of database use in RTU Scientific Library has been growing since 2016. The issuance of electronic resources has increased from 75,391 to 525,194 units. The new premises of the Library have allowed expanding the range of services for users. Since the opening of the new premises, the number of visits to the Library increased from 103,825 to 235,600 in 2018. RTU Scientific Library is available to anyone interested. It is open to users from Monday to Saturday. There is a 24-hour reading room. In summer, the Library is open every weekday and works part-time. (https://www.rtu.lv/lv/studijas/biblioteka/pakalpojumi-3) Information sources of the Library are organized in an open access collection.

A librarian helps navigate the collection. Bibliographers (information specialists) provide more detailed information and advice. A field-specific librarian service has been established in the Library (https://www.rtu.lv/lv/studijas/biblioteka/nozaru-informacija). Library resources can be found using the search tool Primo Discovery (https://www.rtu.lv/lv/studijas/biblioteka/vienota-informacijas-meklesana). It gives an opportunity to search for information in the library catalogue (https://kopkatalogs.lv/F/?func=find-b-0&local_base=rtu01), in the subscribed databases, as well as in the databases created by RTU Scientific Library (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazeseresursi/bibliotekas-veidotas-datubazes) within one interface. By searching for information in the electronic joint catalogue (https://kopkatalogs.lv/F), you can simultaneously obtain information about the available resources in 12 Latvian libraries. Both the electronic catalogue and RTU portal ORTUS have an option to reserve library resources remotely, remote access to databases is also provided. Since the introduction of RFID technology, users have been able to use five self-service book machines to take out books and return them at any time of the day. The Library provides students, academic staff and other interested parties with various levels of individual consultations and group training sessions on information literacy (https://www.rtu.lv/lv/studijas/biblioteka/lietotajuapmacibas).

Within the framework of the study program, students have an opportunity to use, strengthen and improve their knowledge, skills and competencies in practical, specialized study rooms, laboratories, workshops or simulation cabins and aircraft:

| No. | Name |
|---|---|
| 1. | Computer Simulation Aeronautics Laboratory |
| 2. | Metalworking Workshop with CNC Milling Cutters and CNC Laser Cutters and Other Equipment |
| 3. | Experimental Materials Laboratory |
| 4. | Module Manufacturing Laboratory/Workshop |
| 5. | Aircraft Navigation and Instrumentation System Laboratory |
| 6. | Fundamentals of Electronics and Electrical Engineering Training Laboratory |
| 7. | Aircraft Maintenance and Repair Training Laboratory |
| 8. | Aircraft Systems Training Laboratory |
| 9. | Propeller Training Laboratory |
| 10. | Aerodynamics Laboratory |
| 11. | Digital and Electronic Equipment Laboratory |
| 12. | JAK-42 Simulation Cabin |
| 13. | A-24 Simulation Cabin |
| 14. | AN-2 Simulation Cabin |
| 15. | Non-Destructive Testing Laboratory |
| 16. | Trainer Plane Socata Rallye |
| 17. | Trainer Plane VEF I-16 |
| 18. | Trainer Helicopter Mi-2 |
| 19. | Aircraft Engine Training Laboratory |
| 20. | Composite Material Manufacturing Workshop |
| 21. | Nanocoating Laboratory |

Every year, in addition to the centrally procured books, the AERTI purchases study literature corresponding to the study programs worth more than 1,000 EUR; these resources are included in the collection of RTU Scientific Library (see https://kopkatalogs.lv/F).

Provided resources are sufficient for the successful implementation of the study program.

**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).**

RTU funding from the state basic budget consists of study base funding, which corresponds to the list of study programs and the number of students. This funding comprises finances for utility payments, taxes, infrastructure maintenance (including providing data for the Register of Students and Alumni), purchase of inventory and equipment and staff salaries, as well as funding for research. The number of study positions is allocated after negotiations with the Ministry of Education and Science.  Study base funding from the state budget is intended to be used for full-time studies. It is calculated based on the number of study positions determined by the state at RTU, as well as the costs of the study position determined by the state and the study cost coefficients in the thematic spheres of education. RTU funding from the state basic budget for the study positions in the respective academic year is distributed in accordance with RTU Senate decision “On the Methodology for Distribution and Use of Basic Budget, Performance Financing and Student Tuition Fees between RTU Organizational Units” from the respective academic year. This Methodology is annually reviewed and approved considering the necessary changes. RTU has a decentralized budget and a separate budget is planned for each organizational unit. A budget essentially is a plan of revenue and expenditure for a specific period, work, event, or function. RTU revenues and expenditures are managed according to the principles approved by the Senate or determined by an authorized Vice-Rector for Finance.

According to the Methodology, funding for organizational units is allocated either according to the financial or budget year or immediately upon receipt of funding. The financial or budget year of RTU organizational units is from October to September of the following year, for this period the funding is calculated and distributed: the subsidies or the basic budget funding (education and training of state-funded students) is allocated in a form of a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month; financing for students, who pay tuition fees (education and training of students who pay tuition fees, including debtors’ finances) is distributed twice a year (in October and April) as a monthly limit – each organizational unit receives 1/6 of the calculated funding for the semester per month; performance funding (research support funding) is allocated as a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month; research base funding (research support funding) is allocated as a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month. Analysis of the general procedure for financing study programs at RTU reveals that the basic budget and tuition fee funding from local students who pay tuition fees are determined following the basic principles set by the state. In the process of determining the amount of funding, the study cost coefficients of the thematic spheres and the values of the study cost coefficients according to the level of the study program, as well as the number of students at the study program and the corresponding study courses are considered. As mentioned above, by using the study cost coefficients of the thematic spheres of education, it is possible to determine the amount of funding required for the implementation of a specific study program and study course. RTU Senate has decided that in the future the study cost coefficients of the thematic spheres of education will be applied individually to each study course included in the study program, thus ensuring even more appropriate funding for the implementation of the study courses. To implement this system, an expert commission was established by the order of the Vice-Rector for Academic Affairs, which determined the thematic area of each study course.

Financial resources of the study program are sufficient for successful implementation of the study program and their use is regularly controlled by the administration as well as RTU Office of Vice-Rector for Finance.

The financial indicators of the study program are listed in Annex.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

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

The teaching staff involved in the implementation of the study program is highly qualified and competent in order to ensure the acquisition of the necessary research skills, theoretical knowledge, skills and competencies. The qualification of the teaching staff complies with the criteria specified in Sections 28, 30, 32, 36, 37 and 40 of the Law on Higher Education Institutions.

Employees involved in the implementation of the study program, working in various scientific projects and conferences, transfer the knowledge gained to the study program by improving the content of the study courses. Also, experience of the work in industry and cooperation with industry allows to enrich the study content with up-to-date information, examples and real work environment tasks.

### 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.

| Academic year | Professors | Associate professors | Assistant professors | Lecturers | Assistants | Guest professors | Guest assist. prof. | Guest lecturers | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| 2013/2014 | 10 | 0 | 9 | 2 | 8 | 4 | 0 | 3 | **36** |
| 2014/2015 | 9 | 0 | 9 | 1 | 3 | 2 | 0 | 2 | **27** |
| 2015/2016 | 9 | 3 | 8 | 2 | 3 | 2 | 2 | 0 | **29** |
| 2016/2017 | 10 | 2 | 8 | 2 | 3 | 0 | 0 | 0 | **25** |
| 2017/2018 | 9 | 3 | 7 | 3 | 2 | 2 | 0 | 0 | **26** |
| 2018/2019 | 9 | 2 | 8 | 3 | 2 | 0 | 1 | 0 | **25** |
| 2019/2020 | 7 | 3 | 9 | 3 | 2 | 1 | 2 | 2 | **29** |
| 2020/2021 | 6 | 3 | 11 | 3 | 1 | 1 | 1 | 1 | **27** |
| 2021/2022 | 6 | 3 | 13 | 3 | 1 | 1 | 1 | 1 | **29** |

The study process in academic year 2013/2014 was carried out by 36 members of academic staff, including 10 professors, 4 guest professor, 9 assistant professors, 2 lecturers, 3 guest lecturers and 8 assistants. Based on the results of the analysis, it can be concluded that during the reporting period, in accordance with the strategic aims of the study field and study program development, the qualitative value of academic staff has increased, with particular emphasis on the increase in the number of assistant and associate professors. As a result, in academic year 2021/2022 the study process is mainly provided by 6 professors, 1 guest professor, 3 associate professors, 13 assistant professors and 1 guest assistant professors. Consequently, it can be concluded that the quality of academic staff has increased.

**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).

Academic staff members representing both professional and academic backgrounds participate in the implementation of the study programs, ensuring a balanced environment in which the staff help achieve the set aim and learning outcomes of the study program.

Members of academic staff communicate and cooperate with each other during the meetings of methodological commissions, individual conversations with the heads of study programs, conversations among academic staff members, as well as in meetings of AERTI academic staff, discussing various topical issues of the AERTI, higher education and professional fields. The academic staff of the study program cooperate in the implementation and updating of the content of the study courses, coordinating the topics to avoid repetition of the same content. The academic staff also cooperate within the research groups, offer ideas for sample themes of qualification papers and suggestions for improvement of study programs. Simultaneously, academic staff participate in the development of extracurricular activities for students, for example, to organize student study trips to employer’s companies or to invite guest lecturers.

In accordance with the internal normative documents regulating the study process at RTU, the Methodological Committee (hereinafter – the Committee) operates within the study program (hereinafter – the program) and acts as one of the elements for ensuring the quality of the program implementation.

The main operation areas of the Committee are the following:

1. Evaluation of study course descriptions for the approval at a meeting of the appropriate department and approval by RTU Study Department.
2. Review and approval of study and methodological materials.
3. Organization of class attendance and analysis of results.
4. Organization of methodological seminars on current issues.
5. Providing suggestions for the development and improvement of new study courses.
6. Coordination of Master Thesis themes.
7. Discussion of novelties in the use of information technologies in the study process and providing recommendations to the management of the Institute/Faculty.

The ratio of the number of students and teaching staff within the study program is on average one student per two lecturers. Such a small number of students per lecturer can be explained by the interdisciplinarity of the program and the specifics of the study courses. This means that there are a relatively large number of teachers in the program who teach one or two courses. Unfortunately, the number of students in the program has also fallen in recent years, which of course has affected this proportion. Taking into account the prepared changes in the program, as well as the plan to offer the program in English, the number of students in the program must increase. The existing teaching staff is able to qualitatively ensure the preparation of a larger number of students.

# 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 | MGL0_diploms_dipl_supl.zip | MGL0_diploms_dipl_pielik.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) | MGL0_CHE_opinion.pdf | MGL0_AIP_atzin.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 | MGL0_stud_statist.pdf | MGL0_stud_statist.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 | MGL0_StEdSt_6_annex.pdf | MGL0_VaIzSt_6_pielik.pdf |
| 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 | MGL0_CoursMapp_8_annex.pdf | MGL0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MGL0_CurricStPogr_9_annex.docx | MGL0_StudProgrPL_9_pielik.docx |
| Descriptions of the study courses/ modules | MGL0_DescriptStu_cour.zip | MGL0_Studkurs_apr.zip |
| Description of the organisation of the internship of the students (if applicable) | Internship_Management_Procedure.pdf | Prakses_organizesanas_kartiba.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | Confirmation - on compliance of the academic staff.edoc | Apliecinājums - AL 55. pants par prof. skaitu akadēmiskās programmās.edoc |

# Medical Engineering and Medical Physics (47526)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Medical Engineering and Medical Physics* |
| Education classification code | *47526* |
| Type of the study programme | *Professional master study programme* |
| Name of the study programme director | *Jurijs* |
| Surname of the study programme director | *Dehtjars* |
| E-mail of the study programme director | *jurijs.dehtjars@rtu.lv* |
| Title of the study programme director | *profesors, Dr.habil.phys.* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study programme is to:<br>1. to prepare socially responsible and qualified high-level specialists with systemic thinking and understanding, whose knowledge, leadership skills and competences would allow them to work in medical institutions, representations of medical equipment manufacturers and elsewhere;<br>2. to provide students with a set of knowledge, skills and competences in accordance with the knowledge, skills and competence specified in the 7th level of the framework and the professional standard specified in the Latvian classification of education in the field of medical physics.* |

| | |
|---|---|
| Tasks of the study programme | *1. To ensure comprehensive, continuous higher engineering education and in-depth knowledge and skills in the field of medical engineering and medical physics;<br>2. To develop ability to carry out research work, to promote interaction between students and academic staff in the development of scientific papers and to demonstrate best practices for practical implementation of the obtained results in enterprises of the sector, as well as to publish the obtained scientific results<br>3. To develop criticism, analytical and systematic thinking abilities, ability to perform analysis of work results;<br>4. To provide students with in-depth and expanded knowledge, to raise awareness of medical physics and nanoengineering, medical engineering-related research, equipment<br>5. To provide students with in-depth and expanded knowledge in one of the specialisation directions, to raise awareness of research opportunities, equipment and technologies to be used;<br>6. To develop the ability to apply theoretical knowledge in solving problems related to medical engineering and nanotechnologies;<br>7. To promote students' interest in further development of professional skills and academic knowledge;<br>8. To stimulate students' and graduates' interest in higher level study programmes, lifelong learning, as well as academic and scientific excellence.* |
| Results of the study programme | *Graduate of the study programme:<br>1. Is able to demonstrate comprehensive theoretical knowledge in the fields of medicine and nanoengineering, specialized knowledge and understanding of various fundamental issues, discoveries and development trends;<br>2. Is familiar with the methods and equipment of planning, implementation, processing, analysis and interpretation of scientific research, as well as methods and equipment for programming, modelling of physical processes, understanding their nature and fields of application;<br>3. Is able to apply knowledge of the issues to be studied, the most current discoveries and development trends in practice and theoretically;<br>4. Is able to collect, compare and, at the level of their competence, to discuss the research results obtained in scientific work, reports, reports and present these results both to specialists in the field and to the general public;<br>5. Is able to contribute to the creation of new knowledge, the development of research or methods of practical operation.* |
| Final examination upon the completion of the study programme | *Master Thesis* |

# Study programme forms

### Full time studies - 1 years - latvian

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *1* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *40* |
| Admission requirements (in English) | *Professional bachelor degree in medical physics and professional qualification of medical physical technology engineer or second level professional higher education in the fields of mechanical engineering, electrical science, computer control or computer science, or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in medical physics* |
| Qualification to be obtained (in english) | *Medical physicist* |

### Places of implementation

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

### Full time studies - 1 years - english

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *1* |
| Duration in month | *0* |
| Language | *english* |
| Amount (CP) | *40* |
| Admission requirements (in English) | *Professional bachelor degree in medical physics and professional qualification of medical physical technology engineer or second level professional higher education in the fields of mechanical engineering, electrical science, computer control or computer science, 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) | *Professional master degree in medical physics* |
| Qualification to be obtained (in english) | *Medical physicist* |

### Places of implementation

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

### 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 physics, chemistry or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in medical physics* |
| Qualification to be obtained (in english) | *Medical physicist* |

### 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 physics, chemistry 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) | *Professional master degree in medical physics* |
| Qualification to be obtained (in english) | *Medical physicist* |

### 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.

In accordance with the decision No. 653 of RTU Senate of 27 September 2021 "On Changes in the Professional Master Study Programme "Medical Engineering and Physics", some changes were made in the programme – graduates of the professional Master study programme "Medical Engineering and Physics" would be awarded the professional qualification "***Medical Physicist***"; the level of the professional qualification to be granted is in accordance with Level 5 of the Latvian Professional Qualifications, which corresponds to Level 7 of the Latvian Qualifications Framework.

The following structural changes were also made in the study programme:

- the volume of the study programme was reduced from 42 CP to 40 CP;
- the distribution of the study programme parts was changed as follows:
    1. Compulsory study courses 7 CP;
    2. Compulsory elective study courses 7 CP;
    3. Internship 6 CP;
    4. Final examination 20 CP.

The following changes were made to the **Compulsory Part A** of the study programme:

its volume was changed from 14 CP to 7 CP – the study course "Contemporary Physics in Engineering" 2CP (MMK216) was removed from the study programme, the study course "Contemporary Engineering Technologies in Medicine" was reduced from 5 CP to 3 CP, while the study course "Medical Technology Project Management" (MEE516) was moved from Compulsory Part A to Compulsory Elective Part B.

The following changes were made in the **Compulsory Elective Part B:**

Its volume was changed from 2 CP to 7 CP – the compulsory elective study courses in the field of humanities "Pedagogy", "Psychology" and "Communication Psychology" were excluded. Instead, 2 study fields were created: Medical Physics and Medical Nanoengineering, each providing study courses in the volume of 7 CP. Each study field includes a project management course (3 CP) ("Project Management for Micro- and Nanotechnologies" and "Medical Technology Project Management") and an advanced specialisation course of (4 CP) ("Radiation Physics" and "Nanobiomimetics").

For applicants with a degree in physics, chemistry (or equivalent), a 2-year study programme is foreseen, in which additional study courses that are required for the qualification of medical physicist are defined:

| | | |
|---|---|---|
| MEE410 | Anatomy and Physiology | 2 CP |
| MEE332 | Medical Physics | 3 CP |
| MEE226 | Radiation and Environmental Safety in Medicine | 3 CP |
| MEE413 | Physical Fundamentals of Medical Imaging | 4 CP |
| MEE509 | Medical Instrumentation | 3 CP |
| MEE508 | Radiation Therapy Technologies | 3 CP |
| RRI311 | Electronics in Medicine | 2 CP |
| MEE710 | Internship | 20 CP |

In accordance with the Law on Higher Education Institutions, studies are also offered to foreigners who are required to acquire the study course "Latvian for Foreign Students".

**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 professional Master study programme "Medical Engineering and Physics" has been developed in accordance with the Regulation of Cabinet of Ministers of the Republic of Latvia of 26 August 2014 No.512 "Regulations on the State Standard of the Second Level Professional Higher Education" https://likumi.lv/doc.php?id=268761, taking into account the occupational standard of Engineer in Medical Physical Technology, as well as the requirements of RTU internal normative documents. The study programme admits students with a professional Bachelor degree in Medical Physics and a qualification of Engineer in Medical Physical Technology or a 2nd level professional higher education based on mechanical engineering, electrical engineering, computer management and computer science, obtained after at least four years of studies, or equivalent education. Most of the Master students are graduates of the same professional Bachelor study programme. However, each year about 2 students are matriculated with a Bachelor degree in physics or equivalent. Upon graduation, students obtain the professional Master degree in Medical Physics and the qualification of Engineer in Medical Physical Technology, which corresponds to Level 7 of the European Qualifications Framework (EQF) and the Latvian Qualifications Framework (LQF). The study programme educates and trains qualified specialists for professional activities in the fields of medical engineering and medical physics with professional knowledge of the structure of medical equipment, apparatus and instruments, their physical and technical principles of operation, manufacturing technology, conditions of use and safety; develops students' practical skills for working with medical equipment – its acquisition, installation, use, adjustment and quality management, as well as improves skills for planning and monitoring the radiation technologies, patient and personnel dosimetry. The study programme also prepares the students for experimental research activities. The duration of the study programme is 1 year or 2 semesters with 40 credit points. For applicants with a Bachelor degree in Physics, Chemistry (or equivalent), the duration is 2 years or 4 semesters with 80 credit points. Graduates of the study programme possessing special knowledge and competences in the field of medical technology are in demand in the labour market; they work at medical institutions – hospitals, centres providing various medical services, as well as work at representative offices of medical device manufacturers, state administration institutions (accreditation, controlling bodies).

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

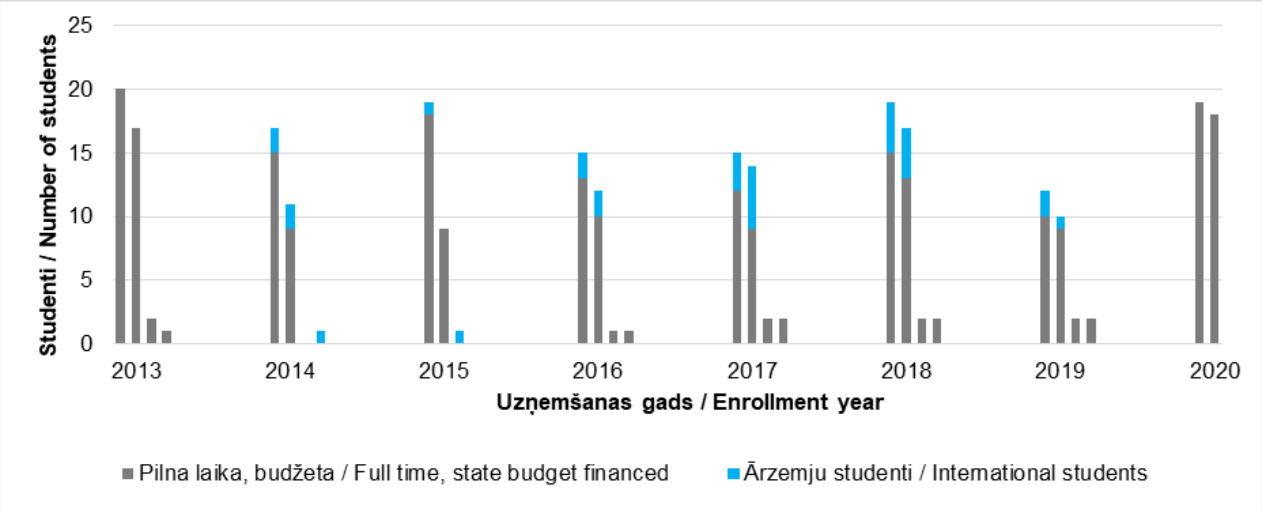
In accordance with the Law on Radiation Safety and the subordinated regulations, there are approximately 500 medical institutions in Latvia that use medical devices with ionizing radiation sources, over the years about half of the medical institutions are provided with these devices, and the graduates of the study program also work in the representative offices of medical device manufacturers (Siemens, Philips, GE), laboratories and other companies whose work is related to medical equipment. Such specialists are also required by state administrative, controlling and accreditation institutions.

### 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.

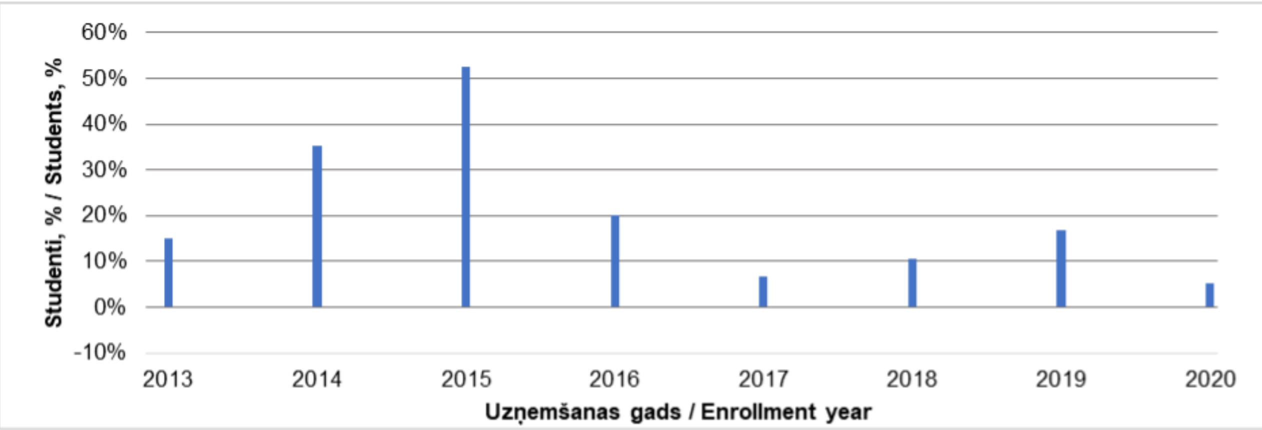
In total, the number of students planned for the master's study programme "Medical Engineering and Physics" is unchanged at 15 students. However, the number of students actually enrolled varies by year( see table below). The competition for one study place financed by the state budget is small, although it depends on the year of study, when there are more students. There have been years of study when the number of budget places was increased at the expense of other programmes, which had insufficient number of students to study. Not all graduates of the bachelor's study programme "Medical Engineering and Physics" immediately enter the master's degree. There are students who choose to study, improve their knowledge and skills in another field, such as management, programming and computer science, health and management etc.c. Others – take a respite for a year and enter in a year's time. Mostly in this study programme, those students whose professional activities are related to medical engineering and physics, who work in clinics, medical centers, representations of medical equipment manufacturers continue their studies. Approximately 10% of the master's students of the study programme have a bachelor's degree in physics, optometry, or similar education (3-year studies). These students were equated with previous education subjects related to the bachelor's degree in medical physics, which is acquired in the bachelor's professional study programme "Medical Engineering and Physics". The statistics by year are as follows:

| No. | Year of study | Number of students enrolled | | Academic leave | Number of graduates |
|---|---|---|---|---|---|
| | | One-year study programme | Two-year study programme | | |
| 1. | 2013./2014. | 23 | 2 | 2 | 11 |
| 2. | 2014./2015. | 16 | 1 | 1 | 12 |
| 3. | 2015./2016. | 18 | 1 | | 6 |
| 4. | 2016./2017. | 15 | 0 | 4 | 5 |
| 5. | 2017./2018 | 13 | 1 | 2 | 8 (1) |
| 6. | 2019./2020. | 15 | 2 | 1 | 11 (1) |
| 7. | 2020./2021. | 14 | 2 | | 4 |
| 8. | 2021./2022. | 13 | 2 | | 11 |

Most students study in places financed by the state budget. The number of foreign graduates is indicated in parentheses. The above is shown in the following graph.

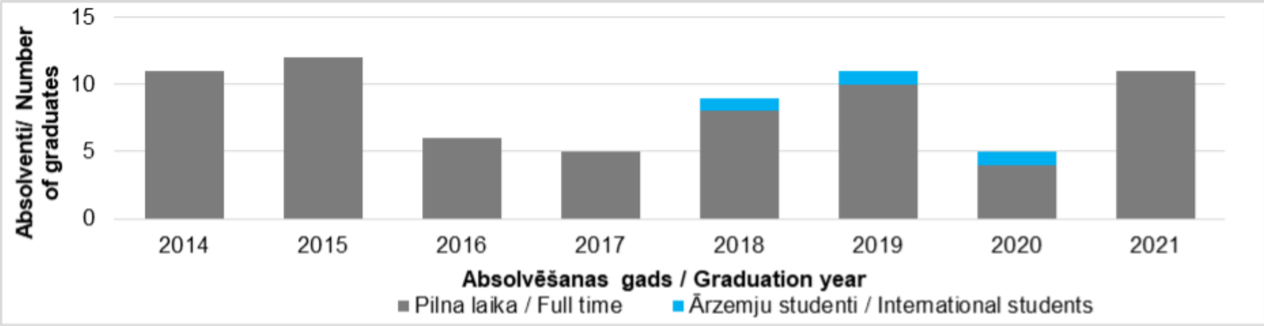



About 5% of students leave their studies, citing the fact that they are busy at work, cannot combine work with studies. Although the trend in the number of students deducted varies by year (see picture below).




Deducted per semester from the original count.

The graph below shows the number of graduates by year.




RTU graduates are also included in the Golden Fund as the most outstanding RTU graduates, assessing both academic achievements and social activities. Each year, at least one graduate from each study programme graduated by more than five graduates in the respective semester and with a weighted average grade of at least 7 (well) is included. Thanks to the one-year-old master's study programme "Medical Engineering and Physics", enough suddens with honours have graduated from this study programme. [1]

In accordance with the Law on Higher Education and Education, studies are also offered to foreigners in order to study requires a documented and recognized previous education in Latvia. During this period, 8 foreign students were admitted, of whom only 3 students have successfully graduated from this study programme - Karthikeyan Priya, Chrouda Abir, Vadhiraj Vijay Vyas. A big problem is poor knowledge previously acquired by students. For this reason, foreign students must pass a minimum knowledge test before entering the study programme. International students study for a fee. At the moment, no foreign students are studying in the study programme.

[1] "RTU Gold Fund Charter” https://www.rtu.lv/writable/public_files/RTU_rtu_zelta_fonda_nolikums_2018.pdf

**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 academic staff of the Institute of Biomedical Engineering and Nanotechnology collaborates with professional organizations in Latvia, such as Latvian Medical Engineering and Physics Society (LMIFB), the Association of Mechanical Engineering and Metalworking Industries of Latvia (MASOC), etc., as well as international professional organizations (associations) such as the International Federation of Medical and Biological Engineering (IFMBE), European Association of Nuclear Medicine (EANM), the International Organisation for Medical Physics (IOMP), etc. The objectives and tasks of the study program are designed considering recommendations from these organizations concerning the requirements of the profession worldwide and in Europe. The future vision of the professional Bachelor study program is implemented considering the professional opinion of students, graduates, and employers and in accordance with the mission and vision, aims and tasks of RTU. When a new study course is developed, the academic staff presents its content, learning outcomes to the methodological meeting of BENI, the content and volume of each study course corresponds with the specified content for acquiring the relevant skills and knowledge. The content and requirements of each study course are defined in the study course descriptions. Each study course plays an important role in achieving the goals of the whole program. Mapping of the study courses has been developed, which is necessary to ensure that the learning outcomes of the study courses would correspond to the learning outcomes of the study program, as a result, students would be provided with the necessary knowledge, skills and competences that are specified in the professional standard of medical physical technology engineer.

The study program is structured to ensure logical and sequential acquisition of knowledge, skills and competences, starting from mastering the general study courses and continuing with field specific study courses that focus on creating new products.

The program includes study courses that allow developing and educating highly qualified and socially responsible specialists in the field of medical engineering and physics, who possess relevant knowledge, skills and competences for professional work with medical devices, equipment and instruments used in medicine and understanding of their construction, physical and technical principles of operation, production technology, conditions and safety of use; with practical work skills for using medical devices - their purchase, use, adjustment and quality management, as well as skills for performing technology planning and management, dosimetry of patients and personnel.

Medical physicists and medical physical technology engineers must have an idea, general knowledge of the structure of the human being, its peculiarities, physiology. An important role is played by the acquisition of medical study courses provided by the partner institution of the study programme Rīga Stradiņš University and its lecturers.

The academic staff constantly carries out the identification of new trends in the field and follow the trends of the labor market development. Academic staff with sufficient experience in the field of medical engineering and physics is involved in the realization of the study program. Regularly invited guest lecturers have a significant impact on the changes in the study course curriculum. These are the experts in the field and company representatives whose work is related to medical technologies and innovations. Guest professors from other countries are also invited. All of the above-mentioned activities ensure integration of the topical experience and specific knowledge into the study process, the relevance of the study course curriculum and compliance with industry development trends are maintained.

The members of the Master Thesis Examination Committee provide an opinion of the students' knowledge and the conformity of students' works to the newest trends in the relevant field after the presentation of the papers.

The Master Thesis is a scientific and practical work that shows the Master student's theoretical knowledge in medical engineering and medical physics, the analyzed literature sources and statistical data, assessment of the efficiency of realization variants and offered alternative solutions. Students demonstrate strengthened ability to publicly present and defend their research and solutions. In order to ensure the conformity of the study program to the newest scientific achievements, students actively participate in scientific research, take part in RTU students' scientific conference where they present their research results.

Since the last accreditation, the curriculum of the study program has been updated in order to make study content topical, complementary, conforming with the program aims and ensuring the achievement of learning outcomes, as well as conforming with the requirements of the profession of a medical physical technology engineer and the newest scientific trends. Work was carried out to improve the curriculum of the study program in accordance with modern requirements and requirements of profession standards, the decision made by RTU Senate on March 23, 2015 "On the unified requirements for Riga Technical University programs", in collaboration with employer representatives and program advisers, improvements of the program structure were made by adding new study courses, as well as making curriculum related changes in the study courses in order to ensure that they meet the requirements of the current market and profession standards. The curriculum of the study program was improved in collaboration with the industry representatives so that students gain comprehensive knowledge in the professional field and will be able to use it in practice, and would be competent to independently analyze information, make decisions and demonstrate that they understand professional ethics.

Riga Technical University is a state-founded derived public person with self-governing rights. Its development strategy states the role of the university as a higher education institution in society, its mission, vision, aims and tasks. In the course of development of the RTU development strategy, awareness of the university's role in the growth of the Baltic Sea region and shaping the future of Latvia, European Union priorities as well as the guidelines of the national and regional level education and innovation policy planning documents have been considered. The study program meets the main premises of Riga Technical University Strategy and Development Program.

In order to realize RTU vision to become the leading science and innovation university in the Baltics, the strategy defines three aims of the university - high quality study process, excellent research, as well as sustainable innovation and commercialization activities. The mission of RTU is to provide the national economy of Latvian and society with internationally competitive high-quality scientific research, higher education, technology transfer, and innovation. The aim of high-quality study process is internationally competitive and creative specialists possessing analytical abilities that are trained in prestigious, internationally recognized high-quality studies, and who ensure the development of the economy of Latvia and who have the ability to study throughout their lives. The aim of excellent research is high-quality scientific research that meets the needs of the Latvian and international economies, implies wide involvement in international, state and field research programs, which is integrated in the study process. The aim of sustainable valorization is development of an effective environment for technology transfer and innovation development, which contributes to the creation of new technological companies and product creation.

The study process is organized so that the study and research work topics for students would include relevant issues in the field. The topics of the students' graduate papers, ideas for their realization come from the companies working in the field - medical institutions, medical equipment service centers. Guest lecturers from different Latvian companies regularly participate in the realization of different courses at the study program, guest lecturers from foreign countries are also invited. In collaboration with foreign higher education institutions, summer schools are organized on the most important topics in the field. This way for several years in a row BENI academic staff took part in organizing the summer schools – RTU and University of Trieste organized a summer school for any student from the European Union, who is interested in innovation in the field of medical engineering and physics "Nonlinear life”.

### 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 master's professional study programme (including bachelor's degree) "Medical Engineering and Physics" is currently the only one in Latvia and there are only a small number of similar programmes in the international education space. The competitiveness of the programme's graduates is very high. The content of the study programme reflects the development trends of the sector and ensures the training of specialists in changing socio-economic conditions. Constantly changing technical developments contribute to the demand of new specialists familiar with new, modern technologies in medicine, companies and institutions. Graduates of the study programme have highly developed research skills. The competitiveness of the study programme is confirmed by the fact that according to the SRS data available to RTU administration all graduates are employed, most of them working in the field of medical engineering and physics. The content of the study programme is updated according to the trends of the sector, labour market and research development. The study programme is improved taking into account the results of student surveys, as well as the recommendations of employers. The involvement of industry professionals in the study process contributes to the development of students' understanding of the principles of operation of various medical equipment.

Thanks to close cooperation with the Latvian Medical Engineering and Physics Society, its management and RTU teaching staff, industry professionals, a new professional standard was developed and approved. Consequently, the standards of the profession of both medical physical technology engineer (LQF 6) and medical physicist (7th LQF) have been approved, asthey ensure coherence and continuity of the requirements of both related professions. The study programme shall fully ensure the acquisition of the knowledge specified in the occupational standard. In accordance with the requirements of professional standards, the content of the program was updated.

### 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 professional Master study program is carried out in the form of lectures, practical classes, company visits, as well as independent studies, students master the basics of medical engineering and physics, their relevance to other related fields. All courses included in the study program are linked to the aims and tasks of the studies, as well as the learning outcomes. By mastering the study courses, students shall obtain knowledge, skills and competences specified by the profession standard.

Analyzing the connection between study program aims and learning outcomes with the information included in study courses, learning outcomes, aims and other indicators, and their compliance with Cabinet Regulations No. 512 "Regulations on the state standard of the second level professional higher education", approved on 26 August, 2014, it can be concluded that:

- The strategic goal of the study program has been developed to ensure professional studies based on the theoretical foundations of the research field and applicable in practice, appropriate for economic, cultural, state defense and safety, as well as public needs;
- The curriculum of the study program provides a body of knowledge, skills and competences in accordance with the knowledge, skills and competence specified in the framework of Level 7 of the Latvian educational classification. The main parts of the program are: study courses; internship outside the educational institution; state examination, which included the presentation of the Bachelor Paper and engineering project;
- The tasks of the study program are designed to educate students, ensuring Level 5 qualification, which corresponds to Level 6 EQF, facilitating their competitiveness in the changing social-economic conditions in the international labor market.

The tasks of the program are:

- to provide students with a broad, professional, practically oriented education that ensures easy adaptation to the labor market as well as the ability to carry out scientific research;
- to provide students with theoretical and practical training in accordance with Level 5 of professional qualification that provides the opportunity to obtain qualification as well as to continue their education at the PhD level studies;
- to ensure acquisition of modern general knowledge, develop economic and professional thinking, to facilitate the analytical abilities of students, to develop student skills for solving professional problems and tasks, project development that would allow graduates to be involved in solving business problems;
- to develop students’ ability to work in a team and cooperate with professionals from different fields.

The content and scope of the examinations comply with the curriculum specified in the course descriptions and requirements towards professional qualification skills and knowledge. All conditions for obtaining credits points are described in the description of each study course.

The study system is developed in accordance with the Education Law, Law on Higher Education Institutions, and Vocational Education Law in a way to maximally facilitate the achievement of aims set in the study programs and to facilitate the performance of tasks. The study system in a higher education institution is governed internally by the documents regulating the relations between the students and the university, the documents regulating the course and organization of studies.

The professional Master study program "Medical Engineering and Medical Physics" has been developed in accordance with Cabinet Regulation as of 26 August, 2014 No. 512 "Regulations on the state standard of the second level professional higher education" and the decision of RTU Senate of 23 March, 2015 "On the unified requirements for Riga Technical University programs". The volume of the study program and its structural distribution are in accordance with the state education standard. The volume of the study program and distribution of the study course into sections is in compliance with the requirements of the state education standard.

In order to ensure interaction between graduates' knowledge, competences and skills, during the realization of the study courses, special emphasis is made on:

- reflection of the current problem situations in the curricula of the study courses (at lecture, practical work level);
- the use of modern teaching methods (specialized computer software solutions, solution-focused methods, etc.);
- method development in collaboration with foreign experts.

Individual approach is provided to the students:

- study materials are provided for each of the courses, both handouts and electronic materials and presentations;
- each lecturer has a specific tutorial time, which students are informed about when starting the course or the student may apply for an individual tutorial in Ortus system.
- individual approach is considered when choosing the applied methods - individual topic for independent work, study project, as well as Master Thesis;
- regular communication with students via e-mail and Ortus environment.

During the realization of the study program, mutual feedback is regularly provided. Students receive regular feedback from the lecturers on submitted credit tests, courses, exams, study projects, reports, internship reports and presentations. In turn, academic staff at the end of the course may conduct a survey on the students' satisfaction with the course content, their desires as well as hears out proposals. Students can realize their participation in the improvement of the study process by expressing their opinion to the academic staff of a particular study course or the administration of the study program. The study courses included in the study program are student-centered as different previous knowledge, skills, and experience of the students are considered, thus applying individual learning methods to each student. The academic staff works with the students in small groups, which makes it possible to use the most appropriate pedagogical methods. The study process is organized in such a way that students acquire both theoretical knowledge and practical skills. Various forms of training are used during the study process: lectures, seminars and discussions, business games, individual and group works, presentations, guest lectures and seminars. Classes are interactive, students are invited to discuss different aspects of the topic of the lecture, take part in decision making and problem solving.

Evaluation of the study courses takes into account active participation of students during classes by working individually and in groups, taking part in discussions, completing independent work, their ability to present their research result. In accordance with the decisions made by RTU Senate, summative performance evaluation method is used for evaluating studies. Within all study courses, the evaluation structure consists of the student's work throughout the semester, their independent work and examination work component shall not exceed 50 % in the evaluation structure. When starting a new study course, students are introduced to the evaluation criteria and methods of the respective study course. The evaluation results are designed to achieve the learning outcomes of the study course, and students receive feedback.

The learning outcomes are evaluated in accordance with Paragraph 1 of Section 15 of the Law on Higher Education Institutions and RTU Regulation on the Assessment of Learning Outcomes. Evaluation is carried out according to the 10-point grading scale.

**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).**

Internship is an integral part of the study program; its goal is to develop student's professional skills and competences in a professional environment, as well as to strengthen the knowledge in accordance with the requirements included in the profession standard. Internship within the professional Master study program "Medical Engineering and Medical Physics" amounts to 6 CP. According to the Law on Higher Education Institutions, 1 CP is equal to 40 hours of workload. The internship is organized in accordance with RTU Senate decision of 28 January, 2019 on the new edition of the "Internship Management Procedure at Riga Technical University" and BENI institute General Internship Guidelines. As a result of the internship, the student should be able to develop and present the Master Thesis. For students with a Bachelor degree, the internship is intended to be 20 CP, during which the students have to develop at least 2 projects. As part of this internship, the students are required to undergo a *Clinical Internship***,** during which they acquire basic skills in working with diagnostic and therapeutic equipment and systems at the clinic. The aim, tasks and methodological guidance for this stage of internship are provided in the "Clinical Internship Guidelines". Place of internship: diagnostic departments of medical facilities, radiation therapy department of medical facilities.

The head of the BENI institute selects the internship coordinator at the institute. The place and time of the internship is determined by the internship coordinator, and it is confirmed by the head of the BENI institute. The student may also search and choose the place of practice independently, having agreed with the internship coordinator. The internship coordinator sends the necessary information for preparing the internship contract - the details and tasks of the place of internship to the head of the FMETA faculty training office. The internship coordinator also prepares the internship log, which the student fills out during the internship. The internship log is signed by the RTU internship coordinator, the student and the internship supervisor at the place of internship. The supervisor at the place of internship is an employee of the company, who has higher education in the specific field and/or work experience in the specific field. Students can get acquainted with the internship regulatory documents at the BENI institute website in section Training/Internship Guidelines (http://bini.rtu.lv/prakses-vadlinijas/). At the end of the internship, the student submits a filled out and signed internship log, as well as an internship report, which has been drawn up in accordance with the requirements specified in the methodological instructions to the internship coordinator. The internship is presented publicly, in accordance with the requirements specified in the methodological instructions of the internship stage and RTU Senate decision. The internship reports and logs are kept at the BENI institute until the exmatriculation of the student. The student may also undertake internship abroad, for example, during ERASMUS mobility. Possible internship places for BENI students:

- State LTD “Paul Stradins Clinical University Hospital”, Reg. No 40003457109, Radiation therapy, medical equipment service and maintenance at the hospital;
- LTD “Riga Eastern Clinical University Hospital”, Latvian Oncological Center, Reg. No 40003951628, Radiation therapy, medical equipment service and maintenance at the hospital;
- LTD "Daugavpils Regional Hospital", Reg. No 41503029600, Radiation therapy, medical

equipment service and maintenance at the hospital;

- LTD “Liepaja Regional Hospital”, Reg. No 42103041306, Radiation therapy, medical equipment service and maintenance at the hospital;
- State LTD “Children Clinical University Hospital”, Reg. No 40003457128, Radiation therapy, medical equipment service and maintenance at the hospital;
- LTD “Rēzekne Hospital”, Reg. No 40003223971, Medical equipment service and maintenance at the hospital;
- LTD "Medicīnas sabiedrība ARS", Reg. No 40103021886, Diagnostical radiological procedures, medical equipment service and maintenance at the medical establishment;
- LTD Stereotaktiskās radioķirurģijas centrs "SIGULDA", Reg. No 40103771667, Radiation therapy, radiosurgery;
- Riga Stradins University Medical Education Technology Centre (METC), Reg. No 90000013771, Medical simulation technologies;
- JSC "Latvijas Jūras medicīnas centrs", Reg. No 40003306807, Radiological diagnostics, doze monitoring in the radiological diagnostics labs;
- LTD "Medicīnas sabiedrība Gaiļezers", Reg. No 40103019330, Kidney disease curing technologies, kidney replacement technologies;
- LTD "VIA UNA", Reg. No 40003120404, Applications of the diagnostic ultrasonography equipment and X-ray equipment in the medical clinic, work of a clinical laboratory;
- LTD “INLAB”, Reg. No 40103522689, Dosing for the patients in X-ray diagnostics and computer tomography manipulations;
- LTD "Kodolmedicīnas klīnika", Reg. No 40103852116, Manufacturing of radiopharmaceuticals;
- Society "For Latvian Children with Disabilities", Reg. No 40008063822, Physiotherapy for the children with movement disabilities;
- JSC "Protezēšanas un ortopēdijas centrs", Reg. No 40003012251, Manufacturing technologies of orthoses and mechanical auxiliary means and their applications in therapy/rehabilitation;
- LTD “Medicīnas sabiedrība ARS”, Reg. No 40103021886, Technical maintenance and service of the medical equipment at the hospital, sterilization of the surgical tools;
- LTD “INLAB”, Reg. No 40103522689, Testing of the electric safety and functionalities of the medical equipment, its calibration, verification, testing of ionizing radiation sources;
- LTD "Baltic Scientific Instruments", Reg. No 40003176361, Design of radiation detectors;
- LTD “REHAD”, Reg. No 40103854615, Manufacturing technologies of orthoses and mechanical auxiliary means;
- LTD "Baltic3dEU", Reg. No 42103066210, 3D printing technologies;
- LTD “MASS PORTAL”, Reg. No 40103538800, 3D printing technologies, 3D printer manufacturing;
- LTD "Baltijas Dialīzes Serviss", Reg. No 40003651502, Sale, installation, maintenance and repair of haemodialysis equipment.

RTU FMETA, place of internship and the student enter into a tripartite internship agreement (the sample of the agreement is available in RTU Senate decision of 28 January, 2019 on the new edition of the "Internship Management Procedure at Riga Technical University ", where duties, rights and liability of all parties are specified. If the agreement is concluded with an internship place abroad, a tripartite agreement in English and in Latvian is concluded. Annex 1 of the agreement shows internship tasks. Internship tasks are developed for each student individually, considering the field of the internship place. The internship tasks are developed by the BENI internship coordinator in coordination with the student and the internship supervisor at the place of internship. The tasks of the internship are shall also be written in the internship log.

### 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.

Upon completion of the studies, the graduate of the professional Master higher education program must, using the theoretical basis and skills, be able to perform professional, innovative, and research activities, as well as be able to formulate and analytically describe information, problems and solutions. Upon completion of the program, student shall develop a Master Thesis devoted to a topical problem in the field, it must be innovative.

Students acquire research skills by regularly working with literature and internet resources in order to successfully develop various study papers. Thus, the scientific-research work of the students is also promoted i.e., the work with international scientific data bases that are available at RTU Library with electronic access from ORTUS environment.

Graduation papers - Master Theses - are developed in accordance with "Regulation on Final Examinations at Riga Technical University" of 26 April 2021 and detailed methodological guidelines developed by BENI. These documents are available at Ortus portal at the relevant study course page - "Master Thesis". The student is informed about these requirements when starting work on the Master Thesis. 1 year is devoted to the development of the Master Thesis. During the first half of the year, the student shall select a topic they are interested in, plan how much time is necessary for writing each chapter, experiment planning, etc. In order for the student to complete the Master Thesis, the student shall fill out two documents, one of which is the justification of the topic and tasks of the Master Thesis and a Master Thesis work task that is signed by the student, scientific adviser, consultants, and the head of the study program.

Master Theses are presented publicly, and a State Examination Committee appointed by the Rector of RTU is created, which includes professionals in the field of medical engineering and physics. The papers are evaluated by reviewers approved by the Dean of FMETA.

After each Master Thesis presentation, the SEC provides a report, joint evaluation of the developed Master Theses, their quality, topicality in the field and mean student assessment. The Presentation Minutes are filled out during the presentation of the Master Theses, in which the questions and the resulting assessment are reflected.

The topics of the graduation papers of the students are topical, meet the aims of the program, ensure the achievement of the learning outcomes and meet the needs of the field. The State Examination Committee notes the high quality and usefulness of works in the professional sphere. The information on the presented Master Thesis see in Annex.

## 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.

RTU funding from the state budget is formed according to the list of study programs and the number of students at the programs - base financing for studies, which consists of the funding for covering utility costs, taxes, infrastructure maintenance, purchase of inventory and equipment and staff salaries, as well as funding for scientific activities. The number of study seats is determined by the Ministry of Education and Science. Base financing from the state budget funding is allocated to full-time studies. The amount of base financing for studies is determined based on the state specified study seats at RTU, as well as state specified basic costs of a study seat and the study cost coefficients of the thematic fields of education.

RTU funding from the general state budget for study seat provision for the relevant study year is allocated according to RTU Senate decision "On the methodology of distribution and use of funds from the general budget, performance funding, and paying students for RTU departments" in the relevant academic year. This methodology is reviewed and approved annually in a new version, taking into account the necessary changes.

The study program is fully supported by material facilities located at RTU Biomedical Engineering and Nanotechnology Institute (BENI). Material facilities include textbooks, methodological materials, classrooms and laboratories equipped for lectures and practical classes.

Located at BENI:

- the only medicine diagnostics equipment laboratory in the West-North region of Europe equipped with the widest range of devices;
- material and nano-object characterizing laboratory, including threshold photoelectrons and exaelectron spectroscopy, infrared and FTIR spectroscopy, FTIR ATR spectroscopy for surface analysis; XPS, Oze, SIMS spectroscopy; AFM, STEM and optical microscopy; micro and nano indentation methods;
- radiation dosimetry devices;
- devices for assessing the quality and safety of medical diagnostic equipment;
- devices for measuring bioelectric signals for analysis;
- biochip laboratory;
- powder material laboratory;
- workbenches and 3D printing equipment for prototyping;
- electronic components and instruments for assembling and testing electronic devices;
- and others.

The equipment is being updated by acquiring grants from ERAF, International Atomic Energy Agency, as well as receiving donations from various medical companies and private individuals. For their internship and Master Thesis, students use the material facilities located at the site.

### 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).**

RTU funding from the state basic budget shall consist of the study base funding corresponding to the list of study programmes and the number of students, which consists of funds for utility payments, taxes, infrastructure maintenance (including  provision of data to the Student and Graduates Register), the purchase of equipment and equipment and staff salaries, as well as funding for scientific activities. The study base funding from the state budget funds shall be allocated for full-time studies. The amount of the basic funding for studies shall be determined on the basis of the number of study places determined by the state at RTU, as well as the basic costs of the study place determined by the State and the coefficients of the study costs in thematic fields of education. RTU funding from the state basic budget for ensuring study places in the relevant study year shall be distributed in accordance with the decision of the RTU Senate "On methodology for distribution and use of basic budget, performance funding and paid student funds at RTU bodies in the relevant academic year. This methodology is revised and re-approved annually in the light of the necessary changes. RTU has a decentralised budget and a separate budget is planned for each structural unit. For RTU structural units the financial or budget year is from October to September of the following year, for this period of time the calculation of funding is carried out and the investment is  made:

- grant or basic budget funding (training of state budget students) is divided as a monthly limit – 1/12 of the calculated annual funding is allocated to the structural unit per month;
- paid student funding (paid student training, including debtors' fee funds) is divided twice a year (in  October and April) as a monthly limit – per month 1/6 of the calculated semester funding is allocated to the structural unit;
- science support funding is divided as a monthly limit - 1/12 of the calculated annual funding is allocated to the unit per month.

In the process of determining the amount of funding, both the coefficients of study costs in thematic fields, the values of the study cost coefficients according to the level of the study programme, as well as the number of students in the study programme and,  accordingly, the number of study courses to be implemented therein are taken into account. It can determine the amount of funding necessary for the implementation of the particular study programme and study course by acquiring the coefficients of study costs in thematic fields of education. RTU  Senate confirmed that in future the coefficients of study costs in thematic fields of education are applied individually to each study course included in the study programme, thus ensuring an even more appropriate amount of funding included in the study programmes study courses.

| Together | Total grant for the study programme EUR | Paid student funding | Funding for science | 1 student funding |
|---|---|---|---|---|
| 341700 | 267000,00 | 48000 | 26700 | 2130.32 |

It can be seen from the table that approximately 78% of the total BINI funding is made up of state budget grant contributions, 14% of the total BINI funding is paid student contributions, which amount to fees of both foreign and local students, the majority of this funding is made up of foreign student fees, 7% of the total BINI funding is made up of Science funding. The cost per budget place in the bachelor's professional study programme is EUR 2130.32. The minimum number of places financed by the State budget to ensure the profitability of the study programme shall be 15 students.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

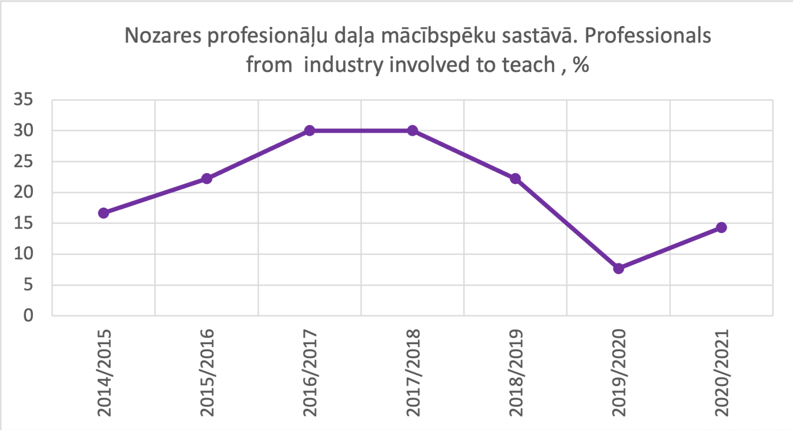
Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

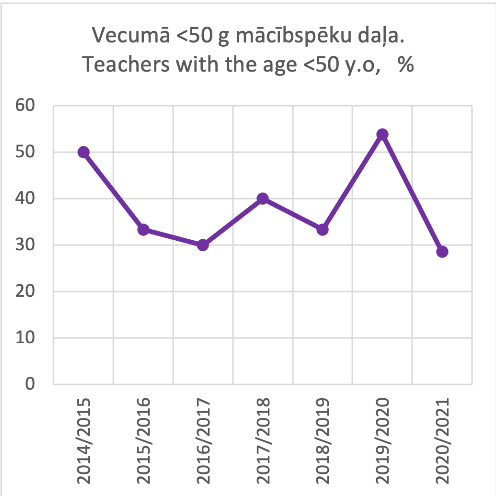
**3.4.1. Assessment of the compliance of the qualification of the teaching staff members (academic staff members, visiting professors, visiting associate professors, visiting docents, visiting lecturers, and visiting assistants) involved in the implementation of the study programme with the conditions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

The professional master study program is implemented by academic staff holding a degree of Doctor of Science and highly qualified professionals with appropriate work experience, whose characteristics are reflected in their CVs and resumes. The list of academic staff and their curriculum vitae and career development are included in the Annex. The academic staff shall meet the requirements for the implementation of the study subjects. This is evidenced by the indicators of their characteristics in their resumes and CVs, as well as the scientific and methodological developments of the teaching staff, their participation in international scientific and methodological conferences organized by RTU.

Professionals in the field ("the matched person") are invited to provide BINI master's programme aimed at the profession, the part of which in the 2018/19-2019/20 academic years is characterized by a negative trend (see image below).



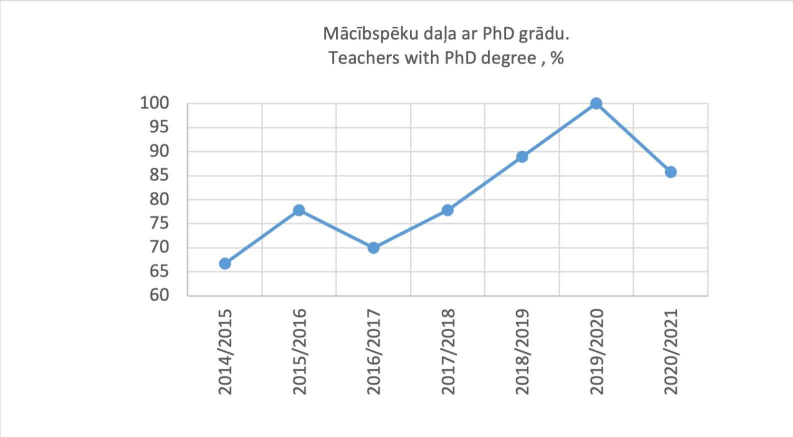

This is due to the fact that the professionals in the field, which are necessary for professional training for a Master, must have higher qualifications than the professionals involved in the bachelor's study programme. Therefore, industry professionals are better paid for master's training when working in the main job. BINI's salary fund is not large enough to adequately reward relevant teaching staff, taking into account the increase in the average salary in Latvia. With this, professionals in the field begin to abandon cooperation. However, as new scientific directions developed (e.g. biochips, smart textiles, nanocondesitors, and others), BINI increased the budget for research projects and disposed of part of the "grant" wage fund that was directed to reward professionals in the sector. As a result, the ratio of professionals in the sector increased in 2020/21. There will be no appropriate policy to address the problem by increasing the number of paid students, as a large proportion of applicants are not able to pay. Teaching staff aged <50 are characterized by stability:



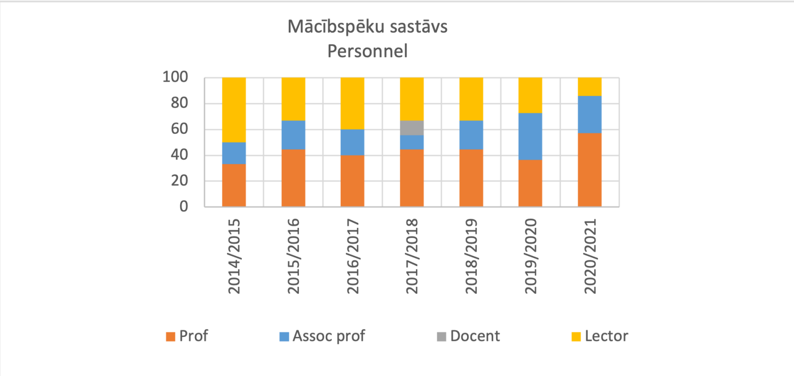

In the composition of the teaching staff, the number of teachers with an age < 50 years is stable . This shows a steady upward trend in the staff of the teaching staff, which ensures the sustainability of the programme.

### 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.

There is an improvement trend for the qualifications of teaching staff: the number of teaching staff with a PhD degree increased:




The proportion of professors (including associate professors) is also on an upward trend:




The proportion of professors and associate professors is increasing. This indicates a continuous improvement in the quality of teaching.

Around 42% of the academic staff are involved in research activities. Academic staff are engaged in ERDF, ESF, LCS and Horizon projects. They also participate in RTU "small" grants.

The results of each project are used for student training. For example:

- ERDF project MULTILAYER SILICON NANOCAPACITOR WITH IMPROVED DIELECTRIC LAYERS (2017-2020), 1.1.1.1/16/A/203, the achievements are used in the course MEE406 “Spectroscopic Methods in Medicine” (AFM and XPS measurements of multilayer nanostructures);
- The project SYNTHESIS OF TEXTILE SURFACE COATING MODIFIED IN NANO-LEVEL AND ENERGETICALLY INDEPENDENT MEASUREMENT SYSTEM INTEGRATION IN SMART CLOTHING WITH FUNCTIONS OF MEDICAL MONITORING (2017-2020), 1.1.1.1/16/A/020 involved students in the development of the graduation papers;
- In the HORIZON, ERA-NET project, BIODEGRADABLE AND NON-BIODEGRADABLE ORTHOPEDIC IMPLANTS WITH BACTERICIDAL COATINGS AND CONTROLLABLE DEGRADABILITY (2018-2021), students participated with graduation papers.

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

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

-

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

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

The interlinking of study courses and their logical, sequential acquisition are essential for achieving the results of the study programme. A system has been established to promote cooperation between teaching staff in the faculty and the university as a whole, which ensures regular academic conferences and professional development seminars for the improvement of methodological competences. An example is the academic conference "Integration of methodological and scientific work in the study process" of 27 April 2018. Such activities contribute to the improvement of teaching staff and provide an opportunity to cooperate more effectively in achieving results and improving study courses. The study programme implemented by the BINI Institute is interdisciplinary, lecturers of different structural units are involved in the implementation of study courses, and the most current things that are necessary for students to acquire in the relevant study course are discussed. The implementation of the study process involves professionals in the field, both in the lectures and in the management of practical work, for example, the study course "Physical Basics of Medical Display", "Radiation and Environmental Protection in Medicine", etc.c. The cooperation between teaching staff is also evidenced by the fact that before starting the semester, the teaching staff meet and agree on the content so that there is no duplication of study course content. Every year there is a hospitalisation of study courses. The sequence of study courses is followed in order to move from the simplest and mainstream to a more complex and professional level, which allows to ensure mutual connection and sequence of development. After each semester, the Department responsible for the implementation of the study programme shall evaluate the course of the study process and the results achieved at its meeting. Questionnaires on the quality of implementation of study courses are important in this process. Based on the analysis of the current situation, solutions are found together. For example, adjustments have been made to the structure of individual study courses in order to avoid partial duplication and improve the interlinkage of study courses, or changes in the content of the study programme are proposed.

The ratio of students to academic staff is as follows: 12 students, 20 academic staff. There are 1.33 students per teacher. However, it should be noted that in some study courses theoretical classes are conducted by one lecturer, but practical classes - by another lecturer, usually a practitioner related to the field, who is a lecturer at RTU in parallel.

The cooperation of the teaching staff takes place as follows:

- joint discussion of new and upgraded courses/modules in methodological sessions, BINI seminars;
- regular consultation of RTU-RSU programme department directors, at meetings of managers, inviting parties involved in the matter to be discussed, including RTU/RSU administration;
- hospitalation visits which take place according to a schedule;
- the results are discussed at BINI seminars and Council meetings.

# 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 | MGF0_diploms_dipl_supple.zip | MGF0_diploms_dipl_pielik.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) | | |
| 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 | MGF0_stud_statist_EN.docx | MGF0_stud_statist_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 | MGF0_StEdSt_6_annex.docx | MGF0_Valsts_St_6_pielik.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) | MGF0_ProfSt_7_annex.docx | MGF0_ProfSt_7_pielik_1.docx |
| 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 | MGF0_CoursMapp_8_annex.xlsx | MGF0_KursKart_8_pielik.xlsx |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MGF0_CurricStProgr_9_annex.docx | MGF0_StudProgrPl_9.pielik.docx |
| Descriptions of the study courses/ modules | MGF0_DescriptStud_cour.zip | MGF0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | MGF0_Descr_org_internsh.pdf | MGF0_Prakse_Apr.pdf |
| **III - Description of the Study Programme - 3.4. Teaching Staff** | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Production Engineering (45521)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Production Engineering* |
| Education classification code | *45521* |
| Type of the study programme | *Academic master study programme* |
| Name of the study programme director | *Anita* |
| Surname of the study programme director | *Avišāne* |
| E-mail of the study programme director | *anita.avisane@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., docente* |
| Phone of the study programme director | *29268113* |
| Goal of the study programme | *The aim of the study program is to provide in-depth theoretical knowledge, develop research skills and prepare high-level specialists in the field of engineering mechanical engineering, as well as prepare students for further doctoral studies.* |
| Tasks of the study programme | *1. To provide in-depth knowledge in fundamental subjects, as well as in specialized study courses corresponding to manufacturing technology and mechanical engineering;<br>2. To acquaint students with research skills and methods;<br>3. To teach students the ability to apply data processing and analysis methods;<br>4. To develop students' ability to substantiate, design, and defend research work.* |
| Results of the study programme | *The graduate of the study programme:<br>1. Is able to demonstrate deepened or extended knowledge and understanding, which is in line with the latest findings in the sector and which provide the basis for creative thinking or research, including work at the threshold of different fields.<br>2. Is able to independently use theory, methods, and problem-solving skills that have been mastered during the study process to perform research or highly qualified professional functions.<br>3. Is able to substantiate and discuss complicated aspects of engineering or professional field with field specialists.<br>4. Is able to formulate independently and critically analyse complex scientific and professional problems, substantiate decisions, and, where necessary, carry out additional analyses. Is able to integrate the knowledge of different fields, give input into creating new knowledge, develop research or professional activity methods, demonstrate understanding and ethical responsibility for a possible impact of the results of scientific or professional activities on the environment and society in general.* |
| Final examination upon the completion of the study programme | *Master's Thesis* |

## Study programme forms

### Full time studies - 2 years - latvian

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *2* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *80* |
| Admission requirements (in English) | *Bachelor degree in mechanical engineering, mechanics and metal processing, or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Master Degree of Engineering Science in Manufacturing Technology* |
| 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 mechanical engineering, mechanics and metal processing, 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 Science in Manufacturing Technology* |
| 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 academic Master study program "Production Engineering" is implemented and developed in accordance with the requirements set out in the state regulatory enactments and the decisions of RTU Senate. The study program is academic, and in the course of academic studies, students acquire theoretical knowledge and competences corresponding to Level 7 knowledge, skills and competences. Students holding a bachelor degree can be enrolled in the program. The Master Degree of Engineering Science in Mechanical Engineering can be acquired in two years, the volume of the study program is 80 CP.

To ensure that the structure and content of the study program comply with the requirements of the regulatory enactments of the Republic of Latvia regulating higher education, changes were made in the study program "Production Engineering" (MMR0) following the approval of the "Riga Technical University Unified Requirements for Study Programs in a New Wording" (Senate Decision Minutes No 638 of 30 March 2020).

The volume of Part A of the study program was changed from 42 CP to 24 CP. The study courses IDA700 Basics of Occupational Safety; MAI476 Processing of Parts with NC Tools; MAB408 Statistical Mechanics of Surfaces; MAB540 TriboSystems Calculations; MAB560 Technological Facilities of Apparatus Building (special course); MAI538 Cutting Theory, Physical and Thermal Processes was moved to B1 and MAI430 Fundamentals of Scientific Research; MAI423 Test Data Processing; MAI540 Basics of Patents were included in Part A.

The volume of Part B1 was changed from 10 to 26 CP and fields of specialization (Apparatus Design and Automated Production and Management) were abolished. Students could still choose several courses for their specialization.

The courses in humanities and social sciences in Part B were updated and improved.

The volume of the free elective courses (Part C) was changed from 4 CP to 6 CP.

The changes to the program have been submitted to the Study Field Committee of Mechanical and Metal Engineering, Thermal Engineering, Heat Engineering and Mechanical Engineering for approval, which was done by Decision of the Study Field Committee at its meeting of 7 October 2021, Minutes No 5.

### 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 study program "Production Engineering" is Level 7 academic higher education study program, the graduates will acquire a Master Degree of Engineering Science in Manufacturing Technology.

The aim of the study program is to provide scientific knowledge and competence-based education to the students necessary to work and conduct research in the field of production technology for both professional and academic use. Thus, the program aims to educate and train competitive, also internationally, production technologists in line with the economic and academic requirements. The graduates will acquire the required knowledge, skills and competences, including the ability to adapt and integrate into the labor market and academic environment, including the ability to continue studies at the PhD study programs.

The main tasks of the study program in view of the title and aims of the study program are to provide education in compliance with the requirements of the Master study program and the qualification in Production Engineering; to develop student understanding of the key concepts, acquisition of the appropriate skills and competences in the manufacturing sector and the relevant academic field; to ensure the development and improvement of the study process using modern education methods and techniques (at the lectures, practical classes and during the development of scientific research projects), thus ensuring the development of student skills and competences in applying the acquired knowledge and understanding in completion of both practical and research tasks. The program also aims to ensure students with a thorough understanding of production technologies and the skills to solve problems in a structured way not only in professional, but also in research areas, in accordance with the requirements of the sector. One of the main tasks is to develop student research skills, analytical thinking and other relevant skills and competences that will enable students continue education at the PhD programs and that may be applied in the real world situations in the management of production processes and/or production enterprises, as well as to build their awareness of the need to continuously improve one’s qualification, as the industry and technologies develop, by developing and implementing innovative, research-intensive solutions, and to promote student interest in research and innovation.

The learning outcomes, which are formulated as a body of skills and competences required for a Master in Production Engineering, are also aligned with the title, aim and objectives of the study program. It should be noted that these skills and competences are aligned not only with the requirements of the study field, but also with the requirements of the research field, which is also indicated by the changes made in the study courses - the study courses MAI430 Fundamentals of Scientific Research; MAI423 Test Data Processing; MAI540 Basics of Patents are included in Part A.

The Master Degree of Engineering Science in Manufacturing Technology can be obtained in two years. The volume of the study program is 80 CP, which is sufficient to acquire the skills and competences required and accepted by the manufacturing industry, as well as the skills and competences to continue studies at the PhD level. Most graduates are employed in the management positions in the manufacturing industry, as the skills to solve industrial problems in the structured way, which graduates acquired during their studies, allow them to use to their full benefit in their professional work.

The knowledge covered by the study program is also internationally recognized, as evidenced by the number of international students choosing to study at this program. In the first year, 3 international students enrolled in the program, while 13 international students already enrolled considering the feedback on the program in 2018, and 14 international students enrolled in 2019.

Internationalization of the program, as well as common delivery of some courses to the joint domestic and foreign student groups further enhances students' skills to cooperate and implement projects in an international environment.

The admission requirements are aligned with the aim, objectives and learning outcomes of the study program, as studies can be started if the applicant holds a Bachelor degree, as well as if the applicant meets other RTU requirements formulated in the RTU Admission Rules for Academic Study Programs.

Considering the above mentioned, there is a clear correlation between the aim, objectives, learning outcomes and admission requirements of the study program, thus it may provide the industry with specialists who have in-depth knowledge of production technologies, as well as educating and training young researchers who can continue their scientific research career at the PhD studies.

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

The Master study program “Production Engineering” is very important for the Latvian economy, as within this program, new managers of production workshops and companies, whose level of understanding of technological and economic aspects of production corresponds to the current level of world development, are educated and trained. In addition, this study program prepares students for further PhD studies.

Graduates of the study program are familiar with modern production, diagnostic and quality control equipment and methods, have mastered various production systems and the basics of business, they understand the process of planning and conducting scientific research, are competent in the properties of materials and know their application specifics. Integrating the acquired knowledge, graduates enter the labor market as highly demanded specialists, and often establish their own companies after graduation. Such companies as Ltd Exigum, Ltd Metal3d, Ltd Dilatech, Ltd Metal print founded by the recent graduates of the study program Production Engineering cab ne mentioned as examples.

Absolutely all graduates of the study program are employed in their field of specialization, and a large proportion of graduates hold leading positions at the companies, as it had been expected. The vast majority of students already work at the companies during their studies, so full-time lectures are planned not earlier than at 16.30 to allow student to combine work with studies.

Training of young researchers who continue their studies at the PhD level is a very important task of the study program, thus allowing to renew and complement the academic and research staff. There is a critical shortage of personnel exactly in these two categories in Latvia, and the average age of the academic staff is also very high, which is a vivid sign that it is important to train new specialists at the national level. If the Master study program “Production Engineering” did not exist, the higher education system in the field of mechanical engineering would be significantly endangered, as there would be a considerable shortage of qualified academic personnel. The capacity for conducting scientific research in mechanical engineering would also be limited, but it should be kept in mind that it is the largest industry in Latvia in terms of export volumes. Without the participation of young and knowledgeable researchers, the opportunity to develop high value-added products in Latvia would be significantly reduced, and exactly high value-added products are considered to be very important for the development of the national economy of Latvia.

According to the data of the Central Statistical Bureau (CSB), in 2020 there was an increase of +2.3% in turnover and 1.4% in exports in mechanical engineering and metalworking industry. It can therefore be concluded that, given the economic situation in Europe and the world, the sector is still evolving and the need for skilled workforce remains. This is also confirmed by the information published on the MASOC website that the lack of qualified employees is the most significant problem in the industry (approximately 70% of companies in the sector indicate this as the most significant problem).

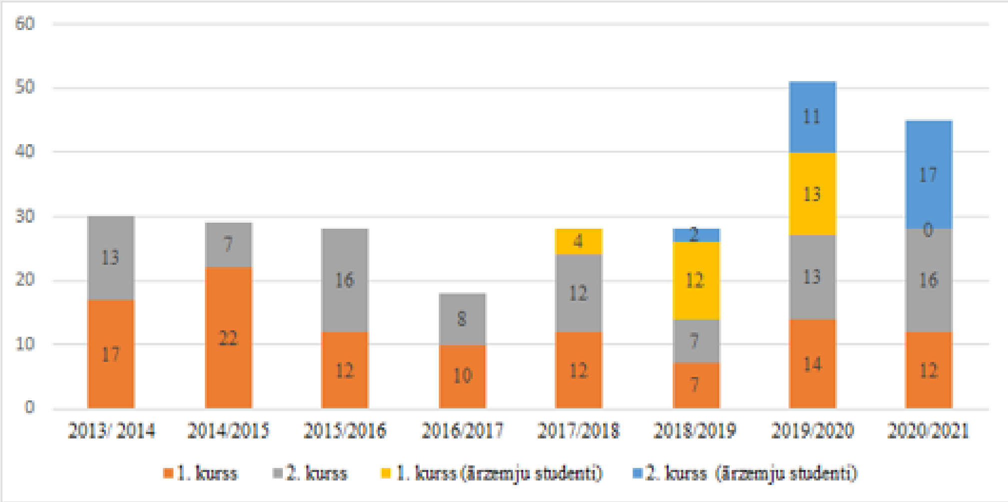
The graduates of the study program “Production Engineering” work at such enterprises Ltd “Agility Sports”, JSC “Latvijas finieris”, Ltd “Hansamatrix innovation”, Ltd “Peruza”, Ltd “Kompānija NA”, Ltd "Dinex Latvia", Ltd “Mass portal”, Ltd "Aerones", Ltd "Lisna", Ltd "Baltma", Ltd "Valpro", Ltd "Granīts", Ltd "Plockmatic Riga", Ltd "Naglis & ERR", Ltd "Kalmet", Ltd "Instro", Ltd "EHT Fabrik", Ltd "Ceram Optec", Ltd "Light Guide Optics" and other.

### 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 (total) number of full-time intramural students at the academic Master study program "Production Engineering" by year is given in the table below:

| **Number of students in the current academic year** | **2013/ 2014** | **2014/ 2015** | **2015/ 2016** | **2016/ 2017** | **2017/ 2018** | **2018/ 2019** | **2019/ 2020** | **2020/ 2021** |
|---|---|---|---|---|---|---|---|---|
| *Total number of students* | *30* | *29* | *28* | *18* | *28* | *28* | *51* | *45* |
| 1st year | 17 | 22 | 12 | 10 | 12 | 7 | 14 | 12 |
| 2nd year | 13 | 7 | 16 | 8 | 12 | 7 | 13 | 16 |
| 1st year (foreign students) | 0 | 0 | 0 | 0 | 4 | 12 | 13 | 0 |
| 2nd year (foreign students) | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 17 |
| On academic leave | 2 | 2 | 2 | 6 | 6 | 4 | 5 | 7 |
| Alumni | 9 | 8 | 9 | 6 | 1 | 5 | 1 | 15 |
| Tuition fee paying seats | 1 | 0 | 0 | 0 | 4 | 14 | 24 | 17 |

Student number dynamics by study year and academic year :




Analyzing the changes in the number of students in the period from academic year 2013/2014 until 2020/2021, it can be concluded that the total number of students in this period has changed significantly from 18 students in 2016/2017 up to 51 students in 2019/2020 per year.

The table shows the dynamics of the number of full-time domestic and foreign students. The number of students depends on the number of state budget funded study seats and the fact that in 2017/2018, foreign students stated to be admitted to the study program "Production Engineering" for a fee, which is also the main reason for the change in the number of students. The number of students at the program is also influenced by the number of graduates of Bachelor programs in this study field.

The changes in the number of students can be explained both by the demographic indicators and the decrease in the total number of students in the country, as well as by the fact that tuition fees have been increased, but the number of state budget study seats at the program has practically not changed during this period. Tuition fees for foreign students are increased every year, students choose a similar field of specialization, which is available at a lower tuition fee. The choice of the program by the student is also conditioned by the fact that it is possible to combine work in the chosen field with studies at the university.

Analyzing the number of graduates, it must be concluded that it is not large in comparison with the enrolled students, because only the students, who have settled their obligations, both academic and financial, are admitted to the viva voce examination of the Master Thesis.

Certain part of students, about 30%, indicate that it is not possible to complete their studies on time due to workload. All Master students also have to work due to settle for financial considerations. Some students indicated that they could not complete their studies due to their own or their family health problems.

As attested by the drop-out rates, one of the reasons for the drop out is that the study program in question admits graduates of various Bachelor study programs in different fields (agriculture, marine, medicine, humanities, etc.), but there is also certain part of students who leave during the last year because they are not able to develop their Master Thesis in time (mostly due to workload and long-term business trips outside the territory of Latvia). Due to the situation in the country, some students and their guarantors face financial problems and have to look for new sources of income, and thus the time they may dedicate to studies is decreasing. Students in the first place try not to lose their jobs, not to lose the sources of financial income, and the learning process remains in the second place.

The study program is implemented in Latvian and English. Foreign students often face problems in the study process related to comprehension of special technical terms. It is connected with the fact that English is not a native language either for the students (students are mainly from India) or course instructors. Foreign students entering the study program have different levels of preparedness and different educational background. The study program is interdisciplinary, so students have to take various study courses related to the field of study so that the students finally acquire knowledge and after graduation can perform scientific activities - conduct research experiments, processing and analysis of results, work in research institutions, and various companies - metalworking, wood processing, food processing, etc., where it is necessary to improve and automate equipment ensuring the running of technological processes.

**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 information included in the study courses, learning outcomes, course aims, and the content of the independent work correspond to both aims of the study program and the learning outcomes. As graduates of the program should be competitive in the global labor market in order to work in multinational companies, it is important to regularly improve the curriculum of the study program.

The study program aims at educating and training highly qualified specialists capable of conducting research in engineering, covering a wide range of professional knowledge.

The content of the study courses is updated in accordance with the development trends of the industry and respective field of science. Students can get acquainted with the latest technologies, for example, within the study course "New Trends in Surface Roughness Control", students work at the Metrology Research Laboratory.

The awarding of the academic degree at the program “Production Engineering” is done considering the knowledge, skills and competences the Master students acquired during their studies, as well as their ability to demonstrate their skills in developing a Master Thesis in the definite research field.

The results of research carried out in the course of development of the Master Theses are successfully presented at the annual RTU Student Scientific and Technical Conference.

In order to find out students' wishes for improving the curriculum of the study program, student surveys are conducted. Study plans and study course outlines are regularly reviewed at the meetings of the Department of Mechanical Engineering and Mechatronics.

**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).**

At the Master study program, students are introduced to the latest achievements in the research field, the knowledge of which they also demonstrate in their final theses, where the topicality of the theme is an important issue. When developing the graduation paper, students search for information about the latest achievements in the field where the chosen topic pertains in high-quality scientific journals, which are available in the electronic databases offered by RTU Scientific Library.

**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.**

Various methods are used in delivery and assessment of the curriculum of the study courses and research skills to be developed within the program - case studies, seminars, group work, laboratory works, problem-oriented studies, use of computer technologies. RTU provides general guidelines with regard to the organization of the study process, which are regularly updated based on the situation in the country. RTU has adopted “Regulations for the Assessment of Learning Outcomes”, which are binding for all study programs.

The principles of student-centered education have been taken into account in the implementation of the study program – in addition to the group tasks, individual tasks are set for students, taking into account student's interests and willingness to specialize. The schedule of lectures and examinations is developed taking into account that students are employed persons. Students are informed about examination methods, criteria and the procedure for appealing the assessment. Students are introduced to the expected results and report form of each course, as well as test papers, at the beginning of any study course. The curriculum of the course, learning outcomes, recommended literature and other important information are provided in the description of each course. Learning outcomes are defined within the study program as a whole, within each study course and during every class. Students are informed about the leaning outcomes and the methods of their assessment, so that receiving the assessment the students know and understand the scope of their competences and abilities, and can receive recommendations for further improvement, if necessary.

The results of the study process are analyzed in discussions with the head of the study program, as well as at the meetings of the Department of Mechanical Engineering and Mechatronics. The study process is analyzed considering the following aspects: implementation of the study program and study plan in terms of curriculum and volume; assessment of students' knowledge, skills and abilities and compliance of their level with the qualification requirements for the specialists at professional study programs; learning outcomes of the courses and their assessment; and the financial and economic compliance of the study process with the possibilities and requirements of the institute.

Various teaching and assessment methods are employed at the study program: credit tests (oral/written), tests (written), exams (oral/written), course projects (in writing) with their public presentation (orally), the program concludes with the development a Master Thesis and its assessment.

A 10-point grading system is used to assess student knowledge. Student performance is mainly evaluated on the basis of their success during the examination session.

The knowledge of the students within the study program is assessed after mastering the courses twice in the academic year – in winter and spring sessions. During this time, students pass exams in study courses in accordance with the individual study plans. Exam questions are designed so that the student can master them to achieve the learning outcomes of the study course specified in the description of each course. If necessary, students demonstrate the extent of mastering of the study curriculum on the stands, use posters and models. Explanations shall be provided orally. Exam questions are drawn up by the instructor responsible for the respective study course considering the course syllabus.

**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.**

Although the Master study program "Production Engineering" is an academic study program, the topics of students' Master Theses are mostly related to research in specific companies, where real problems of interest to the company are solved, or additional research is conducted that can make a valuable contribution to the company's development in the long term.

There is an increasing need for higher quality parts and assemblies in mechanical engineering and metalworking industries. Several studies (Analysis of the influence of cutting modes on the cutting tool using the finite element method, Technological support of surface roughness in mechanical machining of powder metallurgy parts, Influence of turning parameters on surface roughness of AISI 304 parts, Studies of tool wear resistance in composite materials machining) are devoted to this issue and the results obtained make a real contribution to both the improvement of the quality of spare parts and the economic performance of the company.

With in-depth knowledge and understanding of the latest findings in the industry, applied methods and data processing, graduates of the Master study program "Production Engineering" work in leading positions in such companies as JSC "Latvijas finieris", Ltd "Peruza", Ltd "Buschmann tools", Ltd "Dinex Latvia" and others. They also successfully manage and create jobs in companies such as SIA "Exigum", Ltd "Metal Print", Ltd "Metal3d", Ltd "Dilatech".

The Master study program "Production Engineering" is an essential step in the training and education of young researchers and highly qualified academic staff in the education system of mechanical engineering.

**Examples of Master's thesis:**

1. Mazgabarīta birstošā kurināmā noliktavas ar transportēšanas funkciju

Small scale bulk material container with feeder mechanism

2. PLA plastmasu virsmas kvalitātes ietekme uz galvanizācijas procesu.

PLA plastic surface quality effect on electroplating process

3. Ražošanai paredzētā karstā ūdens sildīšanas tehnoloģiskā procesa izpēte

Research on the technological process of heating water for manufacturing purposes

4. Griešanas režīmu ietekmes analīze uz griezējinstrumentu, izmantojot galīgo elementu metodi

Analysis of cutting regimes influence on cutting tool using finite element analysis

5. 3D drukātu polimēru materiālu mehānisko īpašību salīdzinājums

Comparison of mechanical properties of 3D printed polymers

6. Virsmas raupjuma tehnoloģiskais nodrošinājums pulvermetalurģijas detaļu mehāniskā apstrādē

Technological control of surface roughness for powder metallurgy parts in machining

7. 3D printējamo elektrovadāmo materiālu pielietošana iespēju izpēte rezistīvo sensoru izstrāde

Research of 3D printed conductive material appliance in flex sensor design

8. Pārstrādāta polipropilēna deformācijas pētījums 3D printēšanas procesā

Recycled polypropylene deformation research in 3D printing process

9. Mobilās iekārtas izstrāde kuģu dīzeļdzinēju kloķvārpstas gultņu virsmas atjaunošanai ar lāzera uzkausēšanu

Research on marine diesel engine crankshaft journals in-situ laser cladding refurbishment technology

10. Virpošanas parametru ietekme uz AISI 304 detaļu virsmas raupjumu

Turning parameters influence on surface raughness of parts from AISI 304

11. Saplākšņu presēšanas lentes ekspluatācijas un drošuma pētījumi

Maintenance and reliability research for plywood pressing belt

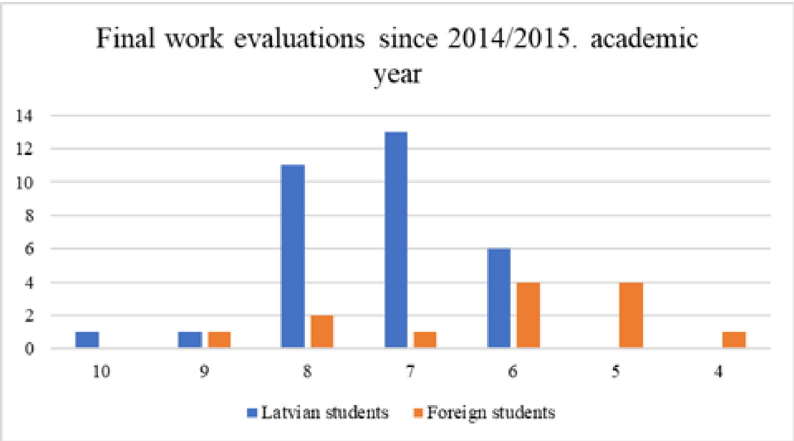
12. Cietķermeņu modelēšanas programmu vides salīdzinošā analīze

Comparative analysis of solid modelling programmes

13. Instrumentu nodilumizturības pētījumi kompozītmateriālu apstrādē

Research in tool wear resistance in composite material machining

Analyzing the indicators of the study program in the last study years, it can be concluded that proportionally a large part of graduates obtained grade 7 (good) (31%). 29% of graduates got grade 8 (very good) and 22% of graduates received grade 6 (almost good).




Analyzing the results of the Master thesis viva voce examinations, it can be concluded that Latvian students receive higher grades. Since academic year 2014/2015, the average grade received by the domestic students has been 7.3. The foreign students learning in English demonstrate lower grades. The first graduates graduated from the study program in academic year 2018/2019. The average grade received for the Master Theses is 6.1.

The Master Thesis is publicly presented in front of the State Final Examination Committee. The Committee shall operate in accordance with the Regulations approved by the Senate. The composition of the State Final Examination Committee shall be approved by the Dean of the Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA) on the recommendation of the Program Head.

After each public presentation of the Master Theses, the Committee submits a report on the students' average grade. The final grade is made up of the evaluation of the Scientific adviser, the reviewer and the assessment of the presentation of the Master Thesis. The final grade is the result of a collegial decision of the Committee. During the viva voce examination of the Master Theses, Viva Voce Examination Minutes are completed, which reflect the questions and the grades obtained.

## 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 technical, scientific and informational support available at the FMETA allows to fully ensure high-quality studies within the study program "Production Engineering". Cooperation of the FMETA with such equipment manufacturers as SMC Automation, Okuma and Mitutoyo has enabled it to supplement the available technical support in pneumatics, hydraulics, metalworking and dimensional metrology. Three new scientific laboratories were set up between 2019 and 2021:

1. RTU Mitutoyo Metrology Laboratory;
2. Tribology Scientific Laboratory;
3. Laboratory of Welding.

The equipment available in these and other laboratories is most directly used in student training, as well as for development of the experimental parts of the Master Theses and for collecting the measurement data. The equipment available at the laboratories includes rotational and linear motion tribometers, 2D and 3D profilometer, micro-hardness measuring equipment, digital and optical microscopes, a contourgraph, coordinate measuring machines, a roundness instrument, a measuring microscope, digital lathe, digital milling machine, sample grinding machine for micro slides, heat treatment furnaces, tensile machines, 3D printing machine, MIG, MMA, PAW, MAG, TIG welding machines, contact and non-contact thermometers, force sensors, analytical balances, etc. The machines most frequently used in experiments described in the students' Master Theses include Okuma CNC machines, Mitutoyo SJ500 2D roughness tester, Taylor Hobson Form Talysurf Intra 50 3D roughness tester, Mitutoyo HM210D micro-Vickers hardness tester, CSM Instruments TRB tribometer, Mitutoyo QI 2010 measuring microscope, Mitutoyo CV2100 contour gauge, Mitutoyo Crysta Apex S544 coordinate measuring machine.

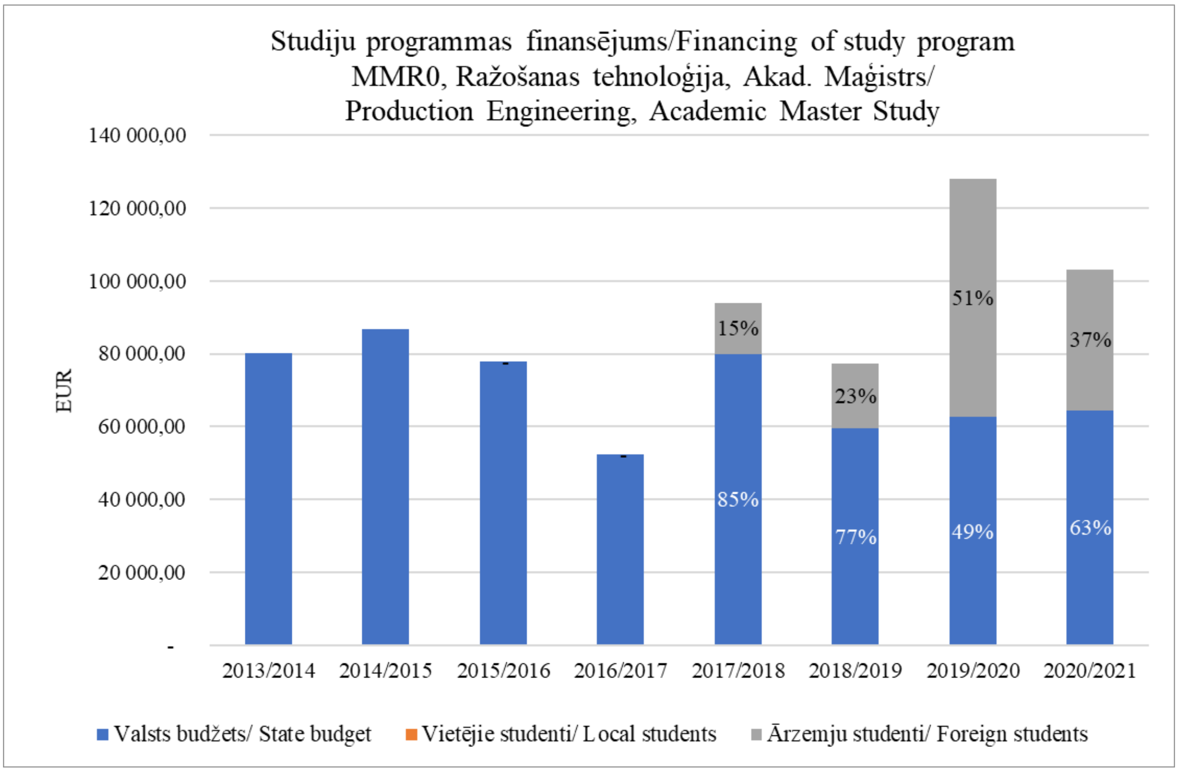
The organizational unit also works in close cooperation with other academic and scientific units, which also provide access to other scientific facilities when needed. Examples include cooperation with RTU Design Factory, where students have access to a digital milling machine and a laser as well as various 3D printers, RTU Institute of Biomedical Engineering and Nanotechnologies provides access to nanoindentation measurements, the Baltic Biomaterials Centre of Excellence provides SEM measurements, the Institute of Solid State Physics at the University of Latvia provides SEM and other microscopy equipment. In addition, cooperation with various manufacturing companies, such as Ltd "Instro", Ltd "Exigum", Ltd "SMC Automation", Ltd "Metal Print" and others. Cooperation with companies allows students to have access to equipment that is not available at RTU or other

Latvian universities, as well as to obtain information and comments from the industry.

In addition to the technical support, students have access to the latest educational literature, which can be found in the Scientific Library of RTU, as well as access to information databases such as Scopus, Web of Science, ScienceDirect, SpringerLink, EBSCO, ACM Digital Library, Wiley Online Library, IEEE Xplore Digital Library, etc., where they can find the most up-to-date information on various engineering topics, including the topics of their Master Theses. The lecturers regularly participate in various conferences, refresher courses and trainings, which allow them to improve their competences and update their knowledge on the current trends in the manufacturing industry.

**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 study program is funded from the state budget. There were no fees for local students during the reporting period, as budget funded seats were not always filled. Only foreign students study for a fee.

The cost per student is calculated by the Office of Vice-Rector for Finance. The average cost per student in 2013-2020 was EUR 6112.92. The number of study seats is allocated after negotiations with the Ministry of Education and Science. The amount of study funding is determined on the basis of the number of study seats determined by the state at RTU, as well as the base costs of the study seat determined by the state and the study cost coefficients of the thematic areas of education.

The coefficients of study costs for the professional Bachelor and Master study programs in thematic areas of education are set out in the Regulation approved by the Cabinet of Ministers on 12 December 2006 "Procedures for Financing Institutions of Higher Education and Colleges from the Funds of the State Budget" (https://likumi.lv/ta/id/149900).

RTU funding from the general state budget for the provision of study seats in a given academic year shall be distributed in accordance with the decision of RTU Senate "On the Methodology of Distribution and Use of the Basic Budget, Performance Funding and Student Fees to RTU Structural Units". The methodology shall be reviewed annually and approved in a new wording, taking into account the necessary changes.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

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

The implementation of the academic Master study program "Production Engineering" involves highly qualified academic staff from the Faculty of Mechanical Engineering, Transport and Aeronautics. Guest lecturers and specialists from the industry are attracted to increase the quality of studies and identify current events in the field. When choosing the academic staff or attracting guest lecturers, the heads of the responsible organizational units of the study courses included in the program do so with the aim to provide students with an opportunity to obtain high quality education and achieve the learning outcomes set by the program.

The basic theoretical study courses and study courses of professional specialization of the study program are implemented by the academic staff of the Department of Mechanical Engineering and Mechatronics.

**Anita Avišāne**, Assistant Professor, Dr.sc.ing., Leading Researcher. She has more than 10 years of academic and research experience at Riga Technical University. More than 10 years of professional work experience in production and service companies performing the duties of a designer, production automation specialist, technologist and designer. Professional development is carried out regularly by participating in online courses and seminars. Member of the Promotion Council “RTU P-16” and expert of Engineering and Technology of the Latvian Council of Science in the field of Mechanical Engineering and Mechanics.

**Irīna Boiko**, Dr.sc.ing., RTU professor, Leading Researcher, Engineering and Technology Expert of the Latvian Council of Science in the field of Mechanical Engineering and Mechanics. Professional experience of more than 7 years in the industry (in a machine-building company), academic experience at RTU and vocational education institutions of more than 17 years. Active in scientific research, participating in the implementation and management of LSC, ESF, ERDF, TOP and other projects; member of the international program committee of some conferences. In the last six years has published about 40 scientific articles, participated in about 30 international scientific conferences, co-authored 2 Latvian patents and 1 Latvian patent application. Since 2012, she has been working at RTU Innovation and Technology Transfer Centre as an intellectual property specialist, continuously practicing in IP-related issues, as well as in the specialized courses to increase her qualification, which allows her to qualitatively deliver the study course "Fundamentals of Patents" (at the Bachelor and Master study level) and "Patent Studies" (at the PhD study level). She actively cooperates with the industry by participating in the Certification Scheme Committee of JSC "Inspecta Latvia" (now Kiwa Inspecta) as a member, as well as in the Latvian Association of Welding Specialists by participating in the training and examination of mechanical engineering specialists (welders, locksmiths, plumbers). She has participated in several international mobility projects for teachers/researchers, including ERASMUS+, experience exchange and lecturing at such leading universities as Vienna Technical University and Chalmers Technical University. Continuous and targeted qualification advancement and research, mostly related to mechanical engineering technologies (including welding and related processes), allow for quality teaching of the relevant study courses - "Fundamentals of Production Engineering", "Computer-aided engineering (CAE) in Mechanical Engineering", "Materials Processing Technology and Theory" and "Welding Technology and Equipment".

**Artis Kromanis**, Dr.sc.ing., Associate Professor, Leading Researcher. 8 years of academic work experience at a higher education institution. Scientific and research activities are related to mechanical engineering technology and lean manufacturing technologies. Research results are published in scientific publications relevant to the field, including Scopus and ISI Web of Science databases. Academic experience is complemented by the practical experience in the private sector, at such companies as Ltd "Metal3D", Ltd "Blue Energy Global" and Ltd "Pilnmeness tehnologijas", participating in their product and service development projects. Scientific advisor to several Bachelor Papers, Master Theses and PhD theses. In addition, he has obtained the qualification of the European Patent Attorney, enabling him to provide competent assistance in intellectual property matters, in particular, patents. Member of the European Patent Institute (EPI) and member of its Professional Education Committee. Member of the International Association for the Protection of Intellectual Property (AIPPI) and of the Licensing Executives Society (LES). Within the scope of his expertise in production engineering, he represents Latvia's interests at the Research Fund for Coal and Steel (RFCS). LCS expert.

**Oskars Liniņš**, Candidate of Technical Sciences (1985), Dr.sc.ing (1992), Professor (2008), Leading Researcher. 54 years of academic and scientific work experience at RTU. At the moment, the main disciplines include "Fundamentals of construction" (MAB370), "Apparatus Design" (MAB357,375), "Tribosystems Calculation" (MAB540) and a new course "Wear Process Calculation" for the new PhD program, as well as classes in General Metrology, Electropneumo Technique. Additional work is carried out in the management of the Production Training Practicum, as well as the scientific supervision of the Bachelor and Master Theses. Prof. Liniņš has developed methodological materials and requirements for the presentation of design work in design courses. Books published: Pneumatics, Manufacturing Automation, Sensitive Element Systems, Locksmith Work, Machining and Applied Materials. More than ten scientific publications have been developed and submitted for publication during the last period of scientific work. Member of the scientific committee of several "Production Engineering" scientific conferences. Secretary of the Council of Faculty of Mechanical Engineering, Transport and Aeronautics and FMETA (2004-2018). Member of the Council of Professors of Mechanical Engineering (until 2018) and of the Promotion Council “RTU P-16”. During his academic career, he has received several Certificates of Honor from RTU.

**Gatis Muižnieks**, Dr.sc.ing., Assistant Professor of the Department of Mechanical Engineering and Mechatronics, FMETA. Professional experience in the academic environment since 2007, performing pedagogical work, working as an assistant professor, researcher, assistant, research assistant and laboratory assistant. Delivers the following courses - Material Science, "Structures and Properties of Engineering Materials, Additional Units of Materials Science. Additionally attends professional advancement courses in pedagogy at Riga Technical University and the European Association of Distance Teaching Universities. Scientific consultant at Ltd "Mašīnbūves kompetences centrs". Mechanical engineer at Ltd "LUCO", improves practical knowledge and skills in the development of production technologies, materials and their processing. Industry expert - evaluation of submitted projects. Scientific and research activities are related to the study of physical and mechanical properties, structures and other regularities of various materials.

**Jānis Ozoliņš**, RTU Professor Emeritus, State Researcher Emeritus, Dr.sc.ing., researcher. More than 60 years of professional experience in academia and administrative experience in higher education institutions. More than 50 years of scientific activity, specializing in the field of materials science. Expertise and consultancy for mechanical engineering companies in cooperation with the Association of Mechanical Engineering and Metalworking Industries. Author of the textbook 'Material Science'. The results of the latest scientific research are used in the study process. In addition to his work at RTU, he has been a guest lecturer at the Latvian Maritime Academy for 10 years. Participated in international scientific conferences on the history of engineering and materials science research. Video lectures created and implemented in several study courses during the period of distance learning.

**Antons Štekleins**, Dr.sc.ing., FMETA researcher. Professional experience: production manager at a vacuum equipment manufacturing and vacuum technology application research company for more than 8 years. Participated in several international vacuum equipment manufacturing projects. Many years of professional experience and qualification in a manufacturing company allow achieving the learning outcomes and complementing the theory with practical examples, which significantly improves the teaching process. Academic and scientific work experience of more than 2 years. Research competence in working with students is ensured by participation in scientific conferences and publications in internationally recognized journals indexed in SCOPUS, etc. The PhD degree provides the opportunity to deliver classes within academic study programs and to increase one's competence and knowledge by continuously keeping abreast of new developments in the industry. He uses the acquired professional and academic experience, knowledge, skills and competences in his pedagogical work by developing and improving the course content, choosing modern and appropriate teaching methods, as well as developing collaborative communication with students.

**Jānis Lungevičs**, Mg.sc.ing., PhD candidate, FMETA researcher and lecturer. More than 6 years of experience in assisting lectures in various engineering subjects as a laboratory assistant or assistant lecturer. Since 2018, he has been managing RTU Mitutoyo Metrology Laboratory equipped with high precision Mitutoyo dimensional measuring equipment. At least twice a year, he attends Mitutoyo training courses, which provide him with the latest knowledge on working with the equipment available at the laboratory, as well as on the global trends in dimensional metrology. Participation in various friction and abrasion related projects has provided for the acquisition of extensive knowledge in the fields of tribology and surface topography. In 2019, he received the RTU Annual Student Valorization Award that is awarded to the student who has contributed the most to RTU's cooperation with the industry. In 2021, nominated for RTU Annual Valorization Award.

### 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.

There have been changes in the academic staff during the reporting period. Two professors from the group of academic staff ceased their academic activity. The program departments "Department of Apparatus Construction" and "Department of Materials Processing Technology" were merged into the Department of Mechanical Engineering and Mechatronics in 2019. The merger increased the potential of the academic staff working at the Master study program "Production Engineering". It should be noted that the average age of the academic staff decreased as several scientific dissertations were publicly presented in the field. Consequently, the number of assistant professors has increased, and as a result of re-election, assistant professors have moved to the category of associate professors.

| Instructors | 2014/ 2015 | 2015/ 2016 | 2016/ 2017 | 2017/ 2018 | 2018/ 2019 | 2019/ 2020 | 2020/ 2021 |
|---|---|---|---|---|---|---|---|
| Professors | 5 | 5 | 5 | 5 | 4 | 4 | 4 |
| Associate professors | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| Assistant professors | 3 | 3 | 2 | 2 | 3 | 3 | 2 |
| Assist | | | | | | | |
| Lecturers | 0 | 0 | 2 | 2 | 2 | 2 | 2 |

During the period of drawing up of the self-assessment report, the academic staff of the Department of Mechanical Engineering and Mechatronics involved in the implementation of the study program "Production Engineering" actively carried out research and methodological work, published papers, participated in conferences, as well as improved their qualifications. Within the framework of the European Social Fund project "Strengthening academic staff of higher education institutions in areas of strategic specialization", the academic staff of the Department of Mechanical Engineering and Mechatronics had the opportunity to improve their English language skills and to participate in practical placements at various companies of the industry. During the reporting period, several members of the academic staff of the Department of Mechanical Engineering and Mechatronics participated in the practical placement program. Academic staff of the Department of Mechanical Engineering and Mechatronics also improved their English language skills in the framework of this project. This project, which has three main objectives: improving the competences of existing academic staff, renewing the academic staff by promoting the employment of PhD students in academic work, has led to the recruitment of three PhD students, contributing to the rejuvenation of the academic staff. The PhD students recruited will ensure the sustainability of the teaching process.

Distribution by academic qualification:

| Qualification | Number | % |
|---|---|---|
| Professors | 4 | 40 |
| Assoc. professors | 2 | 20 |
| Assistant professors | 2 | 20 |
| Lecturers | 2 | 20 |
| **Total:** | **10** | **100** |

The proportional distribution of the current academic staff by academic qualification in the academic year 2021/2020 indicates that the academic staff of the study program "Production Engineering" is highly scientifically qualified and experienced. The largest proportion of academic staff consists only of professors and assistant professors.

**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).**

It is essential to ensure cooperation between academic staff in the implementation of the study program. One of such cooperation mechanisms is the implementation of the course projects within the framework of several consecutive study courses. For example, to solve the problems of production technology, such study courses as MAT485 Mechanical Engineering, MAI430 Fundamentals of Scientific Research and MAI423 Test Data Processing are implemented. This promotes collaboration between academic staff and, in parallel, provides students with the skills and competences for the structured problem solving.

Departmental meetings are organized at least once a week at the Department of Mechanical Engineering and Mechatronics. Faculty project meetings and seminars are organized. In addition, the University and the Faculty have a system of regular academic conferences and professional development seminars to improve methodological teaching competences.

The academic staff of the existing study program additionally implements Master level study courses at the study programs of other organizational units. For example, MAB700 "Industrial Engineering" is implemented within the academic Master study program "Logistics and Supply Chain Management".

The average student-faculty ratio for a study program is 1 faculty member per 3-4 students. This ratio and the curriculum of the program ensure an individualized approach to studies, which is particularly important for the emphasis on research development. This allows for the integration of a student-centered approach and the development and improvement of the above-mentioned research competences.

# 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 | MMR0_diploms_dipl_pielik_dipl_supple-N.zip | MMR0_diploms_dipl_pielik_dipl_supple-N.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) | MMR0_CHE_opinion.zip | MMR0_AIP_atzin.zip |
| 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 | MMR0_stud_statist.docx | MMR0_stud_statist.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 | MMR0_ValzSt_6_annex (1).pdf | MMR0_ValzSt_6_pielik_ (1).pdf |
| 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 | MMR0_CoursMapp_8_annex.xlsx | MMR0_KursKart_8_pielik.xlsx |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MMR0_CurricStProgr_9_annex.pdf | MMR0_StudProgrPL_9_pielik.pdf |
| Descriptions of the study courses/ modules | MMR0_Studkurs_Apr_DescriptStud_cour.zip | MMR0_Studkurs_Apr_DescriptStud_cour.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 |

# Aviation Transport (42525)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Aviation Transport* |
| Education classification code | *42525* |
| Type of the study programme | *Professional bachelor study programme* |
| Name of the study programme director | *Andris* |
| Surname of the study programme director | *Rijkuris* |
| E-mail of the study programme director | *andris.rijkuris@rtu.lv* |
| Title of the study programme director | *Dr. chem.* |
| Phone of the study programme director | *29287492* |
| Goal of the study programme | *The aim of the study program is to have a wide profile and high quality Internationally recognized professionals with an integrated second-level professional in the field of education in the aviation transport sector and capable of performing maintenance on aircraft mechanical equipment or avionics systems and having a systematic understanding mindset and capable of effectively integrating into the international labor market.* |
| Tasks of the study programme | *1. To ensure the continuous improvement of the quality of the aviation sector by training highly qualified educational specialists for the private and public sectors in the field of aviation transport;<br>2. To develop students' ability to plan the tasks of an engineer related to the maintenance of aircraft mechanical equipment or the use, supervision, maintenance of electronic, electrical and electromechanical equipment;<br>3. To develop the ability to analyze economic aspects, plan the work to be carried out, prepare mechanical or electronic equipment for operation in accordance with the applicable regulatory instructions;<br>4. To develop students' ability to perform professional, innovative and research activities in the field of aviation transport, which would be the basis for reviewing the regulatory documentation of mechanical or avionics equipment and introducing new requirements;<br>5. To develop students' abilities to independently obtain, select and analyze information in the aviation transport system and use it, to make decisions and solve problems in the field of operation of mechanical or electronic equipment of aviation transport;<br>6. To promote cooperation between students and academic staff in the development of scientific works and practical implementation of the obtained results in aviation companies, as well as to publish the obtained results;<br>7. To stimulate the interest of students and graduates in studies in higher level study programs, lifelong learning, as well as to improve knowledge about innovations in the field and in the field of professional activity.* |

| | |
|---|---|
| Results of the study programme | *Graduate of the study programme:*<br>*1. Is able to demonstrate mechanics or avionics specific to the aviation industry basic and specialized knowledge and understanding of the most important concepts and regularities of the industry;*<br>*2. Is able to explain analytically the information on the system of assemblies and assemblies of mechanical or electronic equipment for aviation, using theoretical knowledge and acquired skills, to make decisions and solve problems in the field of air transport and aircraft technical operation and maintenance;*<br>*3. Is able to independently obtain, select, formulate and analytically describe information on mechanical or electronic equipment and make decisions in solving problems in aviation in the transport system sector;*<br>*4. Is able to explain and argue the technical aspects of aviation and aircraft maintenance issues of operational mechanical or electronic equipment with both specialists and non-specialists;*<br>*5. Is able to structure learning independently, to direct one 's own and subordinates' further learning, and professional development in aviation transport and related interdisciplinary fields demonstrate a scientific approach to problem solving, take responsibility and take the initiative to work individually, in a team or to lead other people decisions and solutions to changing or uncertain circumstances.* |
| Final examination upon the completion of the study programme | *Bachelor's Thesis including Project* |

# 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 aviation transport* |
| Qualification to be obtained (in english) | *Aircraft maintenance mechanical engineer or aircraft maintenance avionics engineer* |

**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) | *160* |
| 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) | *Professional Bachelor Degree in Aviation Transport* |
| Qualification to be obtained (in english) | *Aircraft maintenance mechanical engineer or aircraft maintenance avionics engineer* |

### 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.**

No significant changes have been introduced to the program. The volume of studies has been reduced from 162 to 160 CP. Changes in the curriculum are related to the updating and optimization of the study courses. The descriptions of the study courses have been updated by updating the tasks and the results to be achieved. The standard of the profession has been updated in accordance with the mapping of professions.

The accreditation certificate of the previous study field was issued in 2013. The current accreditation page of the program No.2020 / 43. Minimal changes have been made in the study program compared to the previous accreditation. The study program has been reduced by 2 CP. Practice reduced from 26 CP to 23 CP. A new study course "Environment and Climate Guide" (1 CP) has been introduced.

The total amount of the study program is 160 CP. According to the valid legislation, the study courses of the compulsory part (A) amount to 78 CP, incl. General education study courses 13 CP, Branch theoretical basic courses and information technology courses 36 CP, Branch professional specialization study courses - 29 CP.

Professional specialization study courses (B1) are divided into specialization (qualification) directions:

- Aircraft technical operation (mechanics) - 33 CP;
- Technical operation of aircraft electronic equipment (avionics) - 33 CP;
- Humanities and social studies courses (B2) make up 8 CP;
- Free choice study courses (C) - 6 CP;
- Practice (D) - 23 CP;
- Final examination (E) - 12 CP.

A similar program is implemented for foreign students in English.

**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 professional bachelor study program "Aviation Transport" fully corresponds to the study direction "Mechanics and Metalworking, Heat Power Engineering, Heat Engineering and Mechanical Engineering", because an aviation transport maintenance mechanical engineer or a maintenance avionics engineer is essentially a mechanical engineer specializing in aviation transport. Only 80% of the study program volume is acquired by aviation transport (both directions) students, the rest are RTU compulsory general study courses.

The degree to be obtained (Professional Bachelor's Degree in Aviation) and the professional qualification (Aircraft Maintenance Mechanical Engineer or Aircraft Maintenance Avionics Engineer) comply with the European Qualifications Framework (EQF) level 6 and each qualification meets the relevant objectives and tasks as well as the admission requirements.

The aim of the study program is to provide professional bachelor's education in the field of aviation transport and training of highly qualified aircraft mechanical or avionics maintenance specialists with appropriate qualifications (Aircraft Maintenance Mechanical Engineer or Aircraft Maintenance Avionics Engineer).

The tasks of the study program correspond to the aim of the study program to develop skills in the field of mechanics or avionics to formulate work problems related to the technical operation of aircraft mechanical or electronic equipment and the ability to solve them with modern technological methods.

The volume of the study program 160 CP has been chosen so that in addition to the regulations on the second level professional higher education state standard, professional standard and RTU uniform requirements for study programs, the study courses of the study field and only the study program could be included in a sufficient amount.

The duration of the study program for full-time full-time studies is 4 years.

The professional Bachelor study program “Aviation Transport” complies with the 6$^{th}$ level of the EQF and the LQF; thus, it is oriented towards secondary school graduates. Its name indicates the aim of the study program, which is to provide students with the opportunity to acquire practical skills and theoretical knowledge in the field of aviation transport in accordance with the state standard of 2$^{nd}$ level professional education for a professional Bachelor degree. To achieve the set aim, the tasks of the study program have been developed and they are designed to achieve specific learning outcomes. The aim of the program is reached if during the study process the students obtain these learning outcomes. Regarding its content, the program is designed in such a way that the aims and learning outcomes of the included study courses align with and ensure the achievement of the overall aim and learning outcomes specified in the program. Analyzing the name of the study program, the degree to be obtained, the aim and tasks, learning outcomes, as well as the admission requirements, it can be concluded that all these aspects are correlating.

To ensure full compliance with European regulations for the training and certification of aviation specialists, the AERTI has established a special training organization. RTU MTAF AERTI is the only state-funded higher education institution that offers opportunities to acquire such professions as aircraft maintenance mechanical engineer, aircraft maintenance avionics engineer and integrated professional bachelor training in accordance with European Regulations EC 1321/2014 Part 66 and 147. so graduate from this program not only receives a diploma for obtaining a professional bachelor 's degree, but also an industry - recognized certificate.

The studies are provided by the Maintenance Training Organization of the Institute of Aeronautics (TAMO), which has implemented a training and quality management system that meets the requirements of the European Aviation Safety Agency and the Latvian Civil Agency, which allows to train certified aircraft maintenance specialists.

In order to prepare specialists who comply with the State Standard of Professional Higher Education and the Standard of Professions (PS-127) set by the Ministry of Education and Science of the Republic of Latvia, as well as international regulatory documents in aviation - International Aviation Organization (ICAO), European Commission Regulation (EC) No. 1321/2014, the requirements of the European Aviation Safety Agency (EASA) and the Civil Aviation Agency of the Republic of Latvia (CAA), AERTI went through the certification process.

After certification, on September 8, 2014, the CAA approval certificate of the Republic of Latvia was issued to LV. 147. 0003 that RTU MTAF AERTI is a maintenance training organization (TAMO) in accordance with Regulation (EU) No 182/2011. Section A of Annex IV (Part-147) to Regulation (EU) No 1321/2014 confirming that AERTI provides training and examination for the issue of the relevant recognition certificate.

In order for AERTI to organize the training and examination process, "TAMO" Part-147 maintenance training organization exposition has been prepared. The self-characterization defines EC no. 1321/2014 Part 147 of the Maintenance Training Organization: "TAMO".

The structure of AERTI TAMO complies with EC no. 1321/2014 Part-147 (Part 147) A. 105.

The staff of AERTI TAMO consists of:

1. Management staff consisting of the Accountable Manager, the Training Manager, the Examination Manager and the Quality Manager;
2. Teaching staff consisting of lecturers, assessors and examiners;
3. Quality system staff;
4. Technical staff composed of AERTI TAMO clerk, laboratory technical staff;
5. Part-time teaching staff, made up of teaching staff from other institutions, guest lecturers, lecturers, etc.

The self-characterization fully regulates the whole training process.

1. Management (leading staff, organizational structure, list of theory examiners and practical assessors, description of training facilities, list of approved training courses);
2. Basic training and examination procedures (organization of training courses, preparation of training materials, preparation of training facilities), maintenance of basic theoretical and practical training, organization of examinations, verification and recording of examination results, preparation, control and certification of training certificates issuance).

AERTI TAMO offers Basic Training in the following categories:

1. 1 Turbine airplanes;
2. B 1.2 Turbine helicopters;
3. B2 Aviation electronics;
4. B3 Non-pressurized piston engine airplane with 2000 MTOM or less.

AERTI has a quality audit team (Quality Manager and 2 auditors) that ensures the audit process, prepares the necessary reports, applies corrective actions and subsequently checks the effectiveness of their implementation.

The independent audit procedure ensures that all EU no. 1324/2014 at least once every 12 months.

In order to verify the compliance of AERTI-trained specialists with certain requirements and to provide support for increasing efficiency, AERTI carried out planned process monitoring and the following activities:

1. Internal audit;

2. Preparation of the annual report;
3. Assessment of students 'and employers' satisfaction, etc.

AERTI study process in accordance with the requirements of the EC Regulation no. The CAA and EASA shall carry out regular and extraordinary audits of the requirements of Parts 147 and 66 of Regulation (EU) No 1321/2014. The CAA conducts regular annual audits.

In accordance with the requirements of the Regulation, the AERTI TAMO Quality Management System ensures regular compliance with the application of student training and examinations, as a result of which graduates can be issued internationally recognized certificates.

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

Since the last accreditation, the content of the study program has been updated and improved to meet the aim of the program and ensure the achievement of learning outcomes, as well as to fit within the field of aeronautic transport and the latest scientific trends and innovative solutions.

While elaborating RTU Development Strategy, recognizing the role of the university in the economic growth of the Baltic region and shaping the future of Latvia, the priorities of the European Union, as well as the guidelines of national and regional level education and innovation policy planning documents have been observed. Successful implementation of RTU Development Strategy is the basis for building a knowledge-based Latvian society and RTU is one of the most important partners in achieving strategic goal No 244 set in the National Development Plan of Latvia – education and knowledge for economic growth and technological excellence.

RTU mission is to provide the Latvian economy and society with internationally competitive high-quality scientific research, higher education, technology transfer and innovation.

The aim of the academic Bachelor study program “Aviation Transport” corresponds with the mission of RTU and focuses on the education and training of new specialists.

The content and implementation of the study program focus on the development of such competencies as adaptability and responsiveness to changes in students, following and even getting ahead of the labor market demand. RTU is one of the cornerstones of Latvia’s development, which ensures the training of specialists necessary for the Latvian economy, as well as the creation of new products and services, serving as a basis for Latvia’s sustainable growth. RTU Strategy includes the most important guidelines for the development of RTU in the period up to 2020, as well as determines the tasks and delegates responsibilities for the completion of these tasks.

Graduates of the study program easily find a job in their specialty. Students often find a job and work in the specialty already during the first year of their studies.

The Latvian Aviation Association, which consists of the absolute majority of representatives of the aviation industry, confirms the necessity of the program and the demand for its graduates. Since Riga International Airport is planning to expand because of the forecast increase of traffic, and other Latvian airports are also developing, the demand for the graduates of the program will be even higher. As the transport sector continues to grow rapidly, the importance of proper maintenance of the transport system and smart, science-based management of transport operations increases. Given the situation in the world, it is difficult to predict the potential demand for students, but it is clearly growing over time and at least 30-60 new specialists per year would be necessary to satisfy the needs of the Latvian economy. The largest employers of graduates in Latvia are AirBaltic and Airline Support Baltic. Smartlinx, which plans to carry out maintenance of its aircraft in Latvia in the future, will also be a potentially very large employer.

### 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 students of the study program “Aviation Transport” are provided in Appendix. Statistical data on students (LV, EN) in the study program "Aviation Transport" from 2013-2020. shown in the attached annex:

- number of students enrolled in full-time groups;
- changes in the number of students from the total number of students (%);
- number of students expelled (%);
- number of graduates from 2014 to 2021.

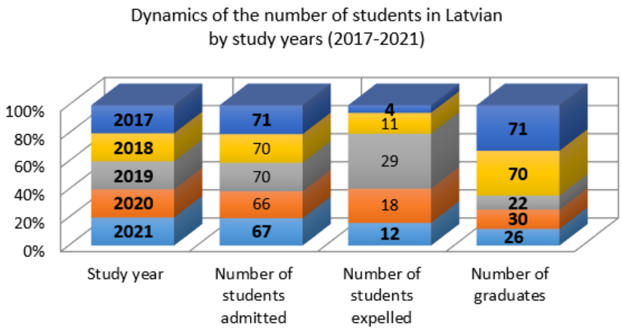
As the graph shows, the number of students is relatively stable and sufficient to provide qualitative training. Despite the demand from employers and the labor market for aviation transport specialists, the number of people willing to study has slightly decreased. After the improvements made to the program and a great promotion of the AERTI in academic year 2021/2022, there is an increase in the number of applications, as well as in the total number of students enrolled. In the year of enrollment in 2019, there was a positive growth trend of foreign students after a successful promotion campaign of RTU programs abroad, but in the years of enrollment in 2020 and 2021, due to Covid19 restrictions, the number of enrolled foreign students has decreased. In total, 2021/2022. In the academic year, the proportion of local students is 67% of local and 33% of foreign students.

The proportion of students enrolled, students expelled, and graduates remains at about the same optimal level, which is good. Students find physics and math to be the most challenging study courses. Although action is taken and additional tutorials are provided free of charge, these courses still have the largest number of unsuccessful students. This is due to the decline in the quality of education in primary and secondary schools.

From 2013, the number of students enrolled in the study program with funding from the state budget practically depended only on the number of allocated places. An average of 70 state budget places is allocated to the study program every year, where the number of budget places to be allocated is approved at the MTAF Council meeting, in accordance with RTU and MTAF decision-making regulations.

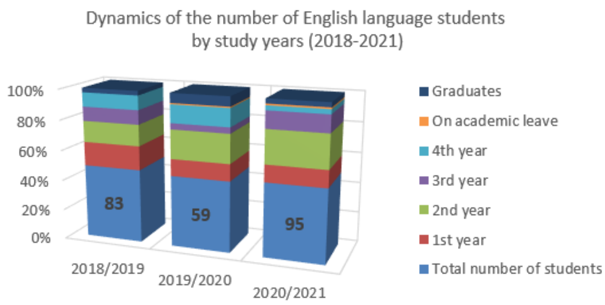
Dynamics of the number of Latvian language students by study years (2017-2021)

| Study year | Form of studies | Number of students admitted | Language | Number of students expelled | Number of graduates |
|---|---|---|---|---|---|
| 2021 | Full-time studies | 67 | LV | 12 | **26** |
| 2020 | Full-time studies | 66 | LV | 18 | **30** |
| 2019 | Full-time studies | 70 | LV | 29 | **22** |
| 2018 | Full-time studies | 70 | LV | 11 | **70** |
| 2017 | Full-time studies | 71 | LV | 4 | **71** |



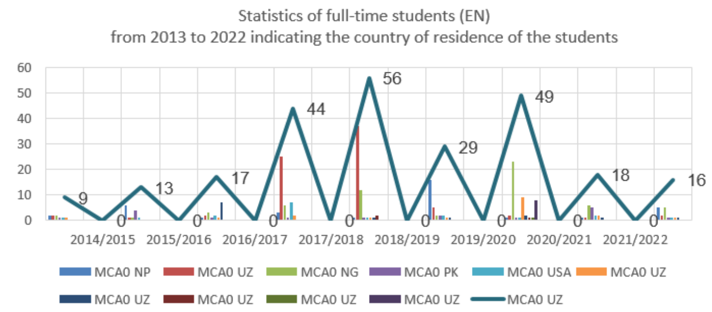

Dynamics of the number of English language students by study years (2018-2021)

| Number of bachelor program students on November 1 of the current study year | 2018/2019 | 2019/2020 | 2020/2021 |
|---|---|---|---|
| Total number of students | 83 | 59 | 95 |
| 1st year | 27 | 14 | 22 |
| 2nd year | 24 | 24 | 43 |
| 3rd year | 16 | 5 | 22 |
| 4th year | 16 | 15 | 6 |
| On academic leave | 0 | 1 | 2 |
| Graduates | 5 | 8 | 6 |




Statistics of full-time students (EN) from 2013 to 2022, indicating the home country of the students

| Studies | 2013/2014 | | 2014/2015 | | 2015/2016 | | 2016/2017 | | 2017/2018 | | 2018/2019 | | 2019/2020 | | 2020/2021 | | 2021/2022 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MCA0 | NP | 2 | IN | 6 | DZ | 1 | EG | 3 | ES | 1 | IN | 16 | EG | 1 | CN | 1 | IN | 5 |
| | UZ | 2 | TR | 1 | EG | 2 | IN | 25 | IN | 37 | LK | 5 | AZ | 2 | EG | 1 | KZ | 2 |
| | NG | 2 | USA | 1 | IN | 3 | LK | 6 | LK | 12 | PK | 2 | IN | 23 | IN | 6 | LK | 5 |
| | PK | 1 | UZ | 4 | PK | 1 | NG | 1 | US | 1 | TR | 2 | IL | 1 | LK | 5 | NG | 1 |
| | USA | 1 | PK | 1 | RU | 2 | UZ | 7 | UZ | 1 | UZ | 2 | KZ | 1 | TR | 2 | NP | 1 |
| | UZ | 1 | | | TJ | 1 | NP | 2 | HU | 1 | MD | 1 | LK | 9 | UZ | 2 | PE | 1 |
| | | | | | UZ | 7 | | | NP | 1 | NP | 1 | NP | 2 | HK | 1 | UZ | 1 |
| | | | | | | | | | RU | 2 | | | US | 1 | | | | |
| | | | | | | | | | | | | | TR | 1 | | | | |
| | | | | | | | | | | | | | UZ | 8 | | | | |
| | | **9** | | **13** | | **17** | | **44** | | **56** | | **29** | | **49** | | **18** | | **16** |




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

## 3.2. The Content of Studies and Implementation Thereof

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

The study program Aviation Transport has been developed taking into consideration proposals from employers and the demand of the labor market.

Typically graduates of the program are employed by aviation-related companies such as airports, maintenance organizations, airlines, designers, and manufacturers of aviation products, etc.

Considering the forecasts of employers, 30-60 graduates should complete the program per year.

The study courses are designed in accordance with the aim of the study program and observing the principles included in the description of the study program implementation.

The study program is designed so that the information included in the modules fully realizes the goals and objectives to be achieved in relation to the goals and objectives set in the program to prepare highly qualified aircraft maintenance engineers with two qualifications for the aviation industry:

- Aircraft Maintenance Mechanical Engineer

or

- Aircraft maintenance avionics engineer.

In the study program professional specialization modules (B1) are divided according to specialization (qualification) directions:

1. Aircraft maintenance mechanical engineer.

13 modules of this direction for 33 CP are mastered.

2. Aircraft maintenance avionics engineer.

14 modules of this direction for 33 CP are mastered.

There is a demand for specialists with both qualifications. Currently, in the 4th year of the study program "Aviation Transport", 24 students acquire the qualification "Aircraft Maintenance Mechanic Engineer", but 18 students acquire the qualification "Aircraft Maintenance Avionics Engineer".

The modules are created as described in the Law on Higher Education Institutions, which stipulates that a study module is part of a study program created by combining study courses or their parts, which have common aims and learning outcomes. The topicality and compliance of the content of study courses and modules with the needs of the labor market are maintained as the head of the program consults with the companies of the field, as well as RTU organizes regular meetings with employers' associations and other organizations. Employers participate in the commissions evaluating the public presentations of graduation papers, where they can ascertain that student are educated and trained well. After the public presentation, the representatives of employers can express their observations and recommendations. Scientific trends are considered by following the trends in the themes of projects, as well as by consulting with the instructors of the program (considering their competencies in a particular research field). The instructors of the program regularly participate in international conferences, which ensures their competence in the represented fields.

The demand for graduates of the program in the international labor market is ensured by compliance with international standards and norms, which in turn is realized through the integration of the requirements of the TAMO organizations and regulations described in Section 3.1.2 into the content of training courses.

**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).**

Not 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.**

RTU has adopted the Regulation on the Assessment of Learning Outcomes that is binding on all study programs.

Various methods are used to assess student's performance and ensure mastering the program courses and acquiring practical skills – case studies, group work, problem-oriented studies, use of information technology. RTU determines the organization of the study process by Order, which is regularly updated based on the situation in the country.

The principles of student-centered education have been taken into account in the implementation of the study program – student representatives have participated in the development of the program, its discussion and approval. The classes and the examinations are scheduled considering the possibilities of students as they combine studies with work. Students are informed about the examination methods, criteria and the procedure for appealing the assessment. Students are introduced to the expected learning outcomes of each course and the report form, as well as expected tests at the beginning of the study course. The content of the course, expected learning outcomes, recommended literature and other important information are provided in the description of each course.

The results of the study process are analyzed in discussions with the head of the study program, as well as during the meetings of the AERTI Council. The main issues addressed are the following:

- Execution of the study program and study plan in terms of content and volume;
- The level of students' knowledge, skills and abilities and its compliance with the requirements of a specialist qualification in professional programs;
- Performance of students in the course;
- Financial compliance of the study process with the possibilities and requirements of the Institute.

The quality of students' knowledge, abilities and skills is constantly monitored by:

- Operational accounting of records – the instructor performs operational evaluations of the progress and quality of the completion of study tasks during the semester;
- Credit test and exams – exams are written or supplemented by oral additions, explanations
- Public presentation of the study project – the content of the project or research and the public presentation are evaluated;
- Internship evaluation – fulfilment of individual task, evaluation of internship log entries;
- Evaluation of the qualification paper – diploma project – creative practical research and results.

Students' knowledge is assessed according to a 10-point grading scale. If the final form of assessment of a study course is a credit test, then, similarly to an exam, it is evaluated by a mark in a 10-point grading scale. Students' performance is mainly evaluated according to the results during the examination session and upon the completion of a course.

Learning outcomes are determined for each study course and lesson within the program – what the student knows, what skills and competences they have acquired, and what they are able to do after successful completion of the course. Learning outcomes of both the whole qualification, and each component separately – the course and the internship – are assessed.

Students' knowledge is assessed twice a year upon completion of courses during winter and spring examination sessions when students take exams in study courses in accordance with the developed individual study plans. Examination questions are designed to ensure that the student preparing for the exam achieves the aim of the study course described in the description of each course. If necessary, students demonstrate their knowledge of the study course on stands, using posters and mock-ups. Explanations shall be given orally. Examination questions, based on the course program, are developed by the instructor, who is responsible for the respective study course.

The viva voce examination of the Bachelor and Master Theses takes place orally, demonstrating presentation materials. Internship places in the respective field are provided in collaboration with the technical staff of internship companies.

**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).**

Internship at RTU is organized according to the “Procedure for Organizing Internship at Riga Technical University” approved by the RTU Senate.

Internships undertaken at companies are organized by dividing the total volume of internship by semesters. The head of the study program, a representative of the internship company and the intern sign an internship agreement. To ensure successful execution and management of the internship, a description of the internship has been developed, comprising the aim and tasks of the internship, the content of the internship and a report. Internships are intended to be undertaken at companies, which have signed a cooperation agreement. The number of interns usually is divided between several small companies, each accepting 2-5 students per year, however larger companies such as AirBaltic and Aviatest shall admit up to 70 students per semester.

Internship tasks are related to the achievement of the following study program learning outcomes:

- Acquiring the competence to ensure a company's technical maintenance, ability to understand the elements of schemes, functional, principal and assembly schemes, and perform calculations;
- Obtaining skills in diagnostics, testing, repair and control of equipment, ability to perform preventive and regulated work;
- Previously the volume of the internships for both specializations was 26 CP, but it is planned to reduce it to 23 CP at AERTI Bachelor study programs.
- To support the student during the internship, the AERTI provides an internship supervisor-consultant, who coordinates the internship, advises the student and solves internship-related issues with the respective company.

### 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.

Usually, students choose the theme of the Bachelor Paper from the list of themes provided by the AERTI during the first semester of the 4th year. After choosing a theme, students specify the chosen theme with a potential scientific adviser. Students may choose a theme which is not included in the list if the potential scientific adviser of the Bachelor Paper has approved it. The AERTI compiles the list of themes together with employers, including the managers of companies providing internship places, in accordance with the latest trends in the industry and the labor market and current topics of the European Aviation Safety Agency, as well as based on the current research trends.

The following themes of the Bachelor Theses were publicly presented in 2021:

- Development of Interfering Objects Warning System in Helicopter Landing Area.
- Development of a High Reliability Electric Generator for Aircrafts with Low-Voltage Power Supply Systems.
- Development of High Reliability Aviation Electric Generator.
- Development of an Autonomous Seaplane Prototype.
- Development of an Upgraded Enchanced Flight Vision System.
- Business Aircraft Jacking System Development.
- Development of an Unmanned Aerial Vehicle Remote Charging Antenna.
- Development of Antenna for the System of Interfering Objects Detection in the Landing Area of a Helicopter.
- Development of a Solid State Radar Rransmitter.
- Design of an Automobile Rear Wing for the Improved Aerodynamic Performance.
- Employment of 3D Printer in Aviation Part Manufacturing.
- Static strenght Analysis of a Turboshaft Engine on a Low Pressure Turbine Blade with Shroud.
- Development of Hybrid Jet Engine (HJE) on a Working Prototype.
- Design of a Portable Hydraulic Power Unit for the A220 Aircraft Jet Engine Thrust Reverser Door Opening.
- Design and Development of a Lightweight Quadcopter (drone).
- Stress State Analysis for a Turbofan Engine on a Low-Pressure Rotor Shaft in Different Conditions.
- Analysis for the Design Optimization on a Blade for the Performance Improvement of an Electric Engine Fan.
- Operational Modificaiton of a Turbocharger "CFM56-3" Motor Using High Pressure Compressor Stator Mechanization Devices.
- High Speed Drone Design for Car Racing Aerial Footage.
- Hydraulic Jack Modification for an Airbus A220.

- Aircraft Engine “PY-19-300” Stand Design and Calculation.
- Application of Aluminum Alloys in Aircraft Structures and Experimental Investigation of Their Mechanical Properties.
- CFD Analysis for the Noise Reduction in Aero-Engine Using Chevrons.
- Design Concept for the Vacuum Airship (VASh).
- Calculation and Design of Civil Airplane Centrifugal Fuel Pump.
- Drone Landing Development Using Parachute.

As can be seen from the list of themes chosen for the Bachelor Papers in 2020, they cover a wide range of themes related to safety issues, avionics, airport operations, engine evolution and, of course, aircraft maintenance. The selected themes reflect the issues that are topical for companies operating in the industry, as well as themes that are interesting in terms of research.

## 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.**

RTU Ķīpsala Campus currently has 54 study rooms, 187 laboratories, 19 special training rooms, 10 computer classrooms, 12 workshops and several research centers of national importance. There is also a student dormitory with 950 beds and a special block designed for people with special needs to ensure enjoyable and comfortable living.

For the implementation of the study program, all university equipment is available, but for the implementation of the study program the in premises of the Institute of Aeronautics hereinafter - the Institute) of Riga Technical University  (at Ķīpsalas Street 6B and Lauvas Street 8 in Riga), 23 study rooms and specialized study rooms, training laboratories, workshops and simulation facilities are equipped with computers, projectors, webcams, audio systems, and other technical aids. The average number of work stations in the study rooms is 18. Lecturers have their own work rooms in each of the buildings, which are equipped with computers with Internet connection and printers.

The Institute has 2 computer classrooms with total of 60 work stations. RTU centralized computer classrooms, laboratories and library are also available for the implementation of the program. RTU HPC Centre provides high-performance computer resources and software for the study process and research. RTU organizational units may use software free of charge. The following software packages are available:

| No | Software | For research | For use in class | To be installed on student PCs |
|---|---|---|---|---|
| 1. | *Adams* | √ | | |
| 2. | *Altium Designer* | √ | √ | √ |
| 3. | *Ansys* | √ | √ | √ |
| 4. | *ArcGIS* | √ | √ | √ |
| 5. | AutoCAD (Autodesk) | √ | √ | √ |
| 6. | *COMSOL* | √ | √ | √ |
| 7. | *BM SPSS Statistics* | √ | | |
| 8. | *Intel Parallel Studio* | √ | | |
| 9. | *Mathcad* | | √ | |
| 10. | *Mathworks MATLAB* | √ | √ | |
| 11. | *OriginPro* | √ | | |
| 12. | *RETScreen* | √ | √ | √ |
| 13. | *SolidWorks* | √ | √ | √ |

In addition to the centrally purchased scientific software, the AERTI has purchased the following computer programs to improve research activities: ANSYS Academic Research (1 task) - TEC Technical Support, ANSYS Academic Research (1 task) - TEC Technical Support period.

The computer programs required for planning the curriculum, accounting, record keeping, personnel management and executing other administrative functions are provided centrally and are interconnected in a unified RTU system.

Database subscription agreements are signed both directly with the supplier and through the state agency Cultural Information Systems Centre, which is the national representative of Latvia in the international non-profit organization EIFL (Electronic information for Libraries, http://www.eifl.net/). The EIFL licensing program offers national libraries a subscription to internationally recognized databases at a significantly reduced subscription fee than is offered to individual subscribers, reducing the Library's expenditures. RTU Scientific Library has subscription to the following databases (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazeseresursi/abonetas-datubazes):

- ProQuest Ebook Central, Academic Search Complete EBSCOhost, Applied Science & Technology Source EBSCOhost, Business Source Ultimate EBSCOhost, EBSCOhost eBook Academic Collection, Wiley Online Library, SpringerLink, The International Monetary Fund;
- Subscriptions funded by the Ministry of Education and Science (ScienceDirect, SCOPUS (Elsevier), Web of Science);

Latvian databases LETA, Letonika, Latvian Standards Database (available only on-site in the library).

The intensity of database use in RTU Scientific Library has been growing since 2016. The issuance of electronic resources has increased from 75,391 to 525,194 units. The new premises of the Library have allowed expanding the range of services for users. Since the opening of the new premises, the number of visits to the Library increased from 103,825 to 235,600 in 2018. RTU Scientific Library is available to anyone interested. It is open to users from Monday to Saturday. There is a 24-hour reading room. In summer, the Library is open every weekday and works part-time. (https://www.rtu.lv/lv/studijas/biblioteka/pakalpojumi-3) Information sources of the Library are organized in an open access collection.

A librarian helps navigate the collection. Bibliographers (information specialists) provide more detailed information and advice. A field-specific librarian service has been established in the Library (https://www.rtu.lv/lv/studijas/biblioteka/nozaru-informacija). Library resources can be found using the search tool Primo Discovery (https://www.rtu.lv/lv/studijas/biblioteka/vienota-informacijas-meklesana). It gives an opportunity to search for information in the library catalogue (https://kopkatalogs.lv/F/?func=find-b-0&local_base=rtu01), in the subscribed databases, as well as in the databases created by RTU Scientific Library (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazeseresursi/bibliotekas-veidotas-datubazes) within one interface. By searching for information in the electronic joint catalogue (https://kopkatalogs.lv/F), you can simultaneously obtain information about the available resources in 12 Latvian libraries. Both the electronic catalogue and RTU portal ORTUS have an option to reserve library resources remotely, remote access to databases is also provided. Since the introduction of RFID technology, users have been able to use five self-service book machines to take out books and return them at any time of the day. The Library provides students, academic staff and other interested parties with various levels of individual consultations and group training sessions on information literacy (https://www.rtu.lv/lv/studijas/biblioteka/lietotajuapmacibas).

The AERTI laboratories, workshops and other equipment are not reserved for particular programs and sharing of existing facilities is encouraged. Scientific equipment is also involved in the study process within Master and Doctoral programs (under the strict supervision of the laboratory manager). Within the framework of the study program, students have an opportunity to use, strengthen and improve their knowledge, skills and competencies in practical, specialized study rooms, laboratories, workshops or simulation cabins and aircraft:

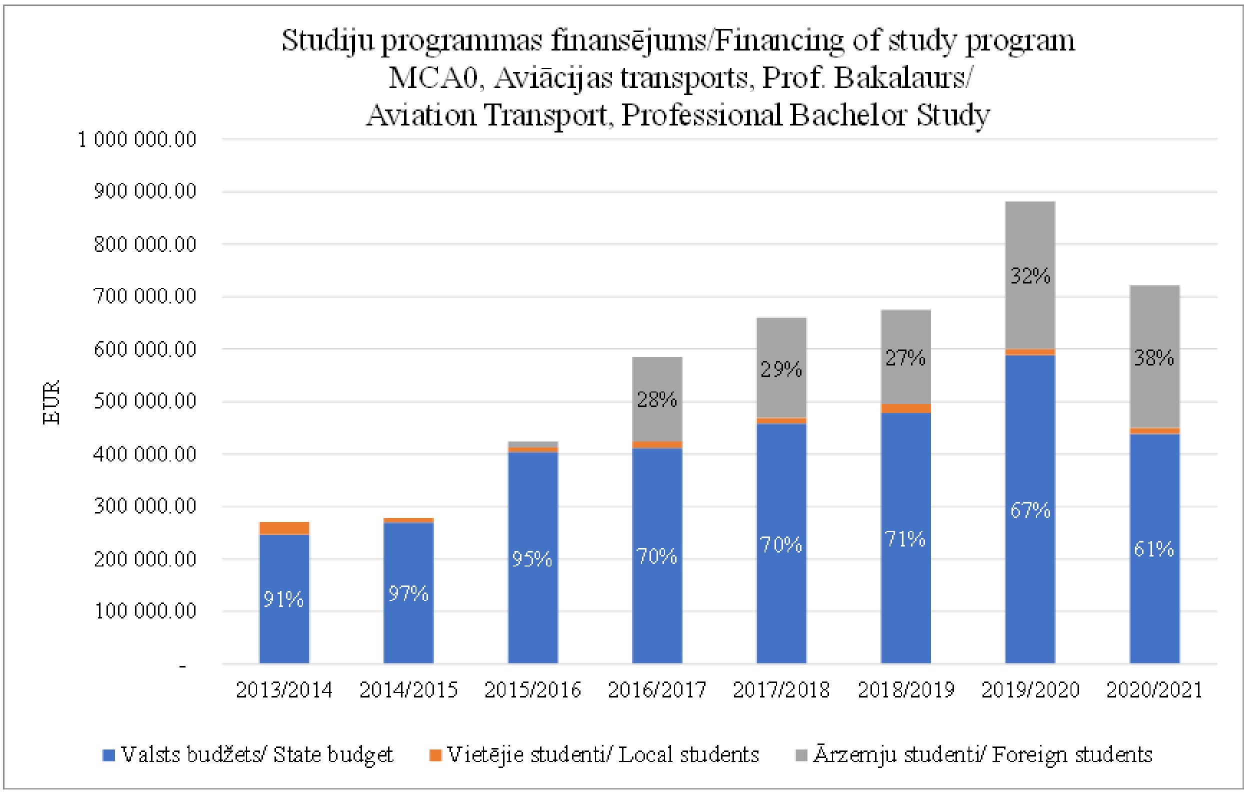
| No. | Name |
|---|---|
| 1. | Computer Simulation Aeronautics Laboratory |
| 2. | Metalworking Workshop with CNC Milling Cutters and CNC Laser Cutters and Other Equipment |
| 3. | Experimental Materials Laboratory |
| 4. | Module Manufacturing Laboratory/Workshop |
| 5. | Aircraft Navigation and Instrumentation System Laboratory |
| 6. | Fundamentals of Electronics and Electrical Engineering Training Laboratory |
| 7. | Aircraft Maintenance and Repair Training Laboratory |
| 8. | Aircraft Systems Training Laboratory |
| 9. | Propeller Training Laboratory |
| 10. | Aerodynamics Laboratory |
| 11. | Digital and Electronic Equipment Laboratory |
| 12. | JAK-42 Simulation Cabin |
| 13. | A-24 Simulation Cabin |
| 14. | AN-2 Simulation Cabin |
| 15. | Non-Destructive Testing Laboratory |
| 16. | Trainer Plane Socata Rallye |
| 17. | Trainer Plane VEF I-16 |
| 18. | Trainer Helicopter Mi-2 |
| 19. | Aircraft Engine Training Laboratory |
| 20. | Composite Material Manufacturing Workshop |
| 21. | Nanocoating Laboratory |

Every year, in addition to the centrally procured books, the AERTI purchases study literature corresponding to the study programs worth more than 1,000 EUR; these resources are included in the collection of RTU Scientific Library (see https://kopkatalogs.lv/F).

Provided resources are sufficient for the successful implementation of the study program.

**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).**




RTU funding from the state basic budget consists of study base funding, which corresponds to the list of study programs and the number of students. This funding comprises finances for utility payments, taxes, infrastructure maintenance (including providing data for the Register of Students and Alumni), purchase of inventory and equipment and staff salaries, as well as funding for research. The number of study positions is allocated after negotiations with the Ministry of

Education and Science. Study base funding from the state budget is intended to be used for fulltime studies. It is calculated based on the number of study positions determined by the state at RTU, as well as the costs of the study position determined by the state and the study cost coefficients in the thematic spheres of education. RTU funding from the state basic budget for the study positions in the respective academic year is distributed in accordance with RTU Senate decision “On the Methodology for Distribution and Use of Basic Budget, Performance Financing and Student Tuition Fees between RTU Organizational Units” from the respective academic year. This Methodology is annually reviewed and approved considering the necessary changes. RTU has a decentralized budget and a separate budget is planned for each organizational unit. A budget essentially is a plan of revenue and expenditure for a specific period, work, event, or function. RTU revenues and expenditures are managed according to the principles approved by the Senate or determined by an authorized Vice-Rector for Finance.

According to the Methodology, funding for organizational units is allocated either according to the financial or budget year or immediately upon receipt of funding. The financial or budget year of RTU organizational units is from October to September of the following year, for this period the funding is calculated and distributed: the subsidies or the basic budget funding (education and training of state-funded students) is allocated in a form of a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month; financing for students, who pay tuition fees (education and training of students who pay tuition fees, including debtors’ finances) is distributed twice a year (in October and April) as a monthly limit – each organizational unit receives 1/6 of the calculated funding for the semester per month; performance funding (research support funding) is allocated as a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month; research base funding (research support funding) is allocated as a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month. Analysis of the general procedure for financing study programs at RTU reveals that the basic budget and tuition fee funding from local students who pay tuition fees are determined following the basic principles set by the state. In the process of determining the amount of funding, the study cost coefficients of the thematic spheres and the values of the study cost coefficients according to the level of the study program, as well as the number of students at the study program and the corresponding study courses are considered. As mentioned above, by using the study cost coefficients of the thematic spheres of education, it is possible to determine the amount of funding required for the implementation of a specific study program and study course. RTU Senate has decided that in the future the study cost coefficients of the thematic spheres of education will be applied individually to each study course included in the study program, thus ensuring even more appropriate funding for the implementation of the study courses. To implement this system, an expert commission was established by the order of the Vice-Rector for Academic Affairs, which determined the thematic area of each study course.

Financial resources of the study program are sufficient for successful implementation of the study program and their use is regularly controlled by the administration as well as RTU Office of ViceRector for Finance.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

The costs per student within the study program are calculated by the Office of the Vice-Rector for Finance. The average cost per student in 2013-2020 was 5468.87 EUR. The number of study places is allocated after negotiations with the Ministry of Education and Science. The amount of study funding is determined on the basis of the number of study places determined by the state at RTU, as well as the base costs of the study place determined by the state and the study cost coefficients of the thematic areas of education.

## 3.4. Teaching Staff

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

The academic staff involved in the implementation of the study program are highly qualified and competent to ensure the acquisition of the necessary research skills, theoretical knowledge, practical skills and competencies. The qualification of the academic staff meets the criteria specified in Articles 28, 30, 32, 36, 37 and 40 of the Law on Higher Education Institutions. 17 highly qualified lecturers of the MTAF Aeronautics Institute and 9 lecturers of the Faculty of Computer Science and Information Technology and E-study Technologies and Humanities with appropriate qualifications and academic education are involved in the implementation of the study program. In order to increase the quality of studies and identify current events in the field, specialists from the field are attracted, who provide specific knowledge and share their experience. The qualification of the teaching staff and specialists included in the study program enables students to obtain a quality education and achieve the results set for the program. 3 habilitated doctors of science and 8 lecturers with a doctoral degree are involved in the implementation of the specialized study courses of the study program. The academic staff meets the requirements for the implementation of study courses. This is evidenced by the scientific and methodological development of the teaching staff, participation in international and RTU-organized scientific and methodological conferences.

All teaching staff of the academic staff has professional experience in the relevant field:

- 3 lecturers have a habilitated doctor of science degree, professors;
- 8 lecturers have a doctoral degree, i.e. sk. 3 assoc. professors, 8 docents;
- 6 lecturers have a master's degree in engineering, incl. 3 docents (pract.), 3 assistants.

### 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.

| Academic year | Professors | Associate professors | Assistant professors | Lecturers | Assistants | Guest professors | Guest assist. prof. | Guest lecturers | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| 2013/2014 | 11 | 1 | 7 | 3 | 6 | 1 | 0 | 2 | **31** |
| 2014/2015 | 13 | 1 | 7 | 4 | 8 | 3 | 0 | 4 | **40** |
| 2015/2016 | 12 | 0 | 7 | 6 | 9 | 0 | 1 | 2 | **37** |
| 2016/2017 | 12 | 1 | 9 | 4 | 4 | 2 | 1 | 1 | **34** |
| 2017/2018 | 11 | 1 | 10 | 4 | 5 | 0 | 0 | 0 | **31** |
| 2018/2019 | 11 | 1 | 11 | 3 | 2 | 1 | 2 | 3 | **34** |
| 2019/2020 | 10 | 1 | 10 | 1 | 7 | 0 | 2 | 2 | **34** |
| 2020/2021 | 10 | 2 | 9 | 3 | 6 | 1 | 2 | 3 | **36** |
| 2021/2022 | 10 | 4 | 11 | 4 | 2 | 1 | 2 | 3 | **37** |

The study process in academic year 2013/2014 was carried out by 31 members of academic staff, including 11 professors, 1 guest professor, 7 assistant professors, 3 lecturers, 3 guest lecturers and 6 assistants. Based on the results of the analysis, it can be concluded that during the reporting period, in accordance with the strategic aims of the study field and study programme development, the qualitative value of academic staff has increased, with particular emphasis on the increase in the number of associate professors and assistant professors. Thus, the study process in academic year 2021/2022 is carried out by 10 professors, 1 guest professor, 4 associate professors, 11 assistant professors and 2 guest assistant professors. According to the table, the core academic staff of the program are professors, who represent the older generation of knowledgeable and experienced specialists, and assistant professors, who mostly represent the younger generation and are the successors of the existing professors’ experience and knowledge. Therefore, it can be concluded that the quality of academic staff has increased.

**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).**

Not 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).

Academic staff members representing both professional and academic backgrounds participate in the implementation of the study programs, ensuring a balanced environment in which the staff help achieve the set aim and learning outcomes of the study program.

Members of academic staff communicate and cooperate with each other during the meetings of methodological commissions, individual conversations with the heads of study programs, conversations among academic staff members, as well as in meetings of AERTI academic staff, discussing various topical issues of the AERTI, higher education and professional fields. The academic staff of the study program cooperate in the implementation and updating of the content of the study courses, coordinating the topics to avoid repetition of the same content. The academic staff also cooperate within the research groups, offer ideas for sample themes of qualification papers and suggestions for improvement of study programs. Simultaneously, academic staff participate in the development of extracurricular activities for students, for example, to organize student study trips to employer’s companies or to invite guest lecturers.

In accordance with the internal normative documents regulating the study process at RTU, the Methodological Committee (hereinafter – the Committee) operates within the study program (hereinafter – the program) and acts as one of the elements for ensuring the quality of the program implementation.

The main operation areas of the Committee are the following:

1. Evaluation of study course descriptions for the approval at a meeting of the appropriate department and approval by RTU Study Department.
2. Review and approval of study and methodological materials.
3. Organization of class attendance and analysis of results.
4. Organization of methodological seminars on current issues.
5. Providing suggestions for the development and improvement of new study courses.
6. Coordination of Master Thesis themes.
7. Discussion of novelties in the use of information technologies in the study process and providing recommendations to the management of the Institute/Faculty.

Academic staff cooperation is also facilitated by teamwork in joint research projects and contract work. Every year, the AERTI carries out several projects involving employees of various RTU organizational units, as well as foreign partners.

The proportion of students and teachers (including foreign students) is currently (autumn 2021) about 8 students per lecturer. The tendency of the ratio during the reporting period is to decrease the number of students per lecturer, which can be explained by a small decrease in the number of students, as well as the involvement of new lecturers in the implementation of the study program. The new lecturers initially read one small study course, as a result of which the total number of lecturers increases.

# 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 | MCA0_diploms_dipl_supple.zip | MCA0_diploms_dipl_pielik.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) | | |
| 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 | MCA0_stud_statist_EN.docx | MCA0_stud_statist_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 | MCA0_StEdSt_6_annex.docx | MCA0_ValzSt_6_pielik.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) | MCA0_ProfSt_7_annex.pdf | MCA0_ProfSt_7_pielik.pdf |
| 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 | RMCA0_CoursMapp_8_annex.pdf | RMCA0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MCA0_CurricStPogr_9_annex.docx | MCA0_ StudProgrPL_9_pielik.docx |
| Descriptions of the study courses/ modules | MCA0_DescriptStud_cour.zip | MCA0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | Internship_Management_Procedure.pdf | Prakses_organizesanas_kartiba.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Aeronautics and Transport Systems Engineering (43525)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Aeronautics and Transport Systems Engineering* |
| Education classification code | *43525* |
| Type of the study programme | *Academic bachelor study programme* |
| Name of the study programme director | *Ilmārs* |
| Surname of the study programme director | *Blumbergs* |
| E-mail of the study programme director | *ilmars.blumbergs@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., asociētais profesors* |
| Phone of the study programme director | *29596694* |
| Goal of the study programme | *The aim of the bachelor's academic study program is to provide demanded by labour market aeronautics and transport systems specialists with set of main knowledges, who are able to analyze information, make decisions and have the ability to work independently, as well as to prepare students for further master's studies.* |
| Tasks of the study programme | *1. To provide competitive education in accordance with the level of bachelor's studies and international standards by preparing high-class specialists in the field of aeronautics and transport systems;<br>2. To provide students with comprehensive knowledge, develop skills and develop competencies in accordance with the requirements of the labor market for the transport (including aviation) system engineer, preparing students for practical work;<br>3. To ensure the development and changes of the content of the study program, study process, scientific research work, in accordance with the changes in the international regulatory enactments of transport institutions;<br>4. To promote students' interest in further professional development, supplementation of academic knowledge, master's studies, to develop skills of scientific research work and to promote their use;<br>5. To stimulate students' interest in the processes taking place in society, to form a personality who is able to act independently and make decisions;<br>6. Promoting international cooperation and participation in international exchange programs.* |

| | |
|---|---|
| Results of the study programme | *Knowledge (knowledge and understanding)*<br>*Students can demonstrate basic knowledge and expertise in the field of air transport systems and be able to critically assess the knowledge gained. The students acquire knowledge on the latest achievements in the field of air transport systems. Students can demonstrate understanding of the most important concepts and regularities in the field of air transport systems.*<br>*Are able to demonstrate understanding of the regularities and essential concepts of air transport industry.*<br>*Skills (ability to use knowledge, communication, general skills)*<br>*By applying theoretical knowledge and skills of a transport systems engineer, students are able:*<br>*- carry out professional, innovative and research activities;*<br>*- practically work in the fields of transport and logistics;*<br>*- apply theoretical and practical knowledge in formulating concrete tasks and their solution in the transport industry;*<br>*- design advanced technological systems for transport, including CAD/CAM/CAE systems;*<br>*- demonstrate skills in using mathematical models for solution of transportation related tasks;*<br>*- demonstrate professional skills in information analysis, application of research results, understanding of the regulatory documents, drawing up of reports and publication;*<br>*- formulate and analytically describe information, problems and solutions in the field of air transport systems engineering and professional activity of a transport systems engineer.*<br>*Students can independently structure their studies, influence their own advancement in the studies and professional growth, demonstrate scientific approach to problem solving, assume responsibility and initiative for individual work, team work or managing other people's work, make decisions and find creative solutions in changeable or uncertain conditions.*<br>*Competence (analysis, synthesis and evaluation):*<br>*Students can independently obtain, select and analyze information related to air transport systems, use this information, make decisions and solve problems in the field of air transport and aircraft maintenance. Students can show understanding of professional ethics, assess the influence of their own professional activities on the environment and society as well as participate in the development of the field of air transport systems.* |
| Final examination upon the completion of the study programme | *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) | *Bachelor degree in mechanical 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 - 4 years - english**

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *4* |
| Duration in month | *0* |
| Language | *english* |
| Amount (CP) | *160* |
| 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 in mechanical 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.**

The main planned changes in the program are, at the same time as the current accreditation, to move from professional to the academic bachelor's program and update / change the name of the program.

The name of the program is to be changed from Transport Systems Engineering to Aeronautics and Transport Systems Engineering.

After accreditation, the program is planned to be implemented in Latvian and English.

Due to the transition to the academic program, the qualification of Transport Systems Engineer will no longer be awarded. The program is planned to be implemented only in one duration: 4 years -160 CP. In connection with the transition from the professional bachelor's program to the academic one, as well as in connection with the updating of the program, a number of changes have been made to the curriculum and courses, which are reflected in the new program plan and program

In the program in 2021, due to the termination of employment with RTU, the program director has been changed from Margarita Urbaha to Ilmārs Blumbergs.

**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.**

Due to the growing demand in the industry for specialists who have acquired both practical skills and are well-versed in theory and able to think systematically, the transition from a professional to an academic program is planned with the current accreditation. RTU AERTI has always had a good theoretical basis and the transition to an academic program will allow the program to occupy a specific and demanded niche. The specialists trained in the program will be prepared for future professions where there is currently no professional standard. With the development of remote-controlled and unmanned transport, will become demanded specialists who will be able to repair and maintain, operate and manage the fleet of such vehicles and organize transportation in accordance with the developed regulations. Ensuring cooperation between manned and remotely piloted or unmanned vehicles will be important. Solutions for airspace surveillance and flight coordination will change, which in turn will create new professions. The transition to new energy sources will change the vehicles themselves, as well as their refueling with new safety requirements. With the development of IT technologies and remotely piloted and unmanned vehicles, the arsenal of offenders is also increasing. This will create new professions for safety and security. The processing of information and related services from artificial satellites will create a wide range of professions and businesses.

Taking all the above into account, in consultation with the industry and taking into account the experience itself, a program has been developed that incorporates the positive legacy of the previous program and allows you to choose and specialize in a promising profile through limited and optional courses. Given the rapid development of the aeronautics industry, the program is structured to provide a good, time-stable theoretical basis to which up-to-date specialized profiles are added.

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

Since the last accreditation, the content of the study program has been updated and improved to meet the aim of the program and ensure the achievement of learning outcomes, as well as to fit within the field of aeronautic transport and the latest scientific trends and innovative solutions.

While elaborating RTU Development Strategy, recognizing the role of the university in the economic growth of the Baltic region and shaping the future of Latvia, the priorities of the European Union, as well as the guidelines of national and regional level education and innovation policy planning documents have been observed. Successful implementation of RTU Development Strategy is the basis for building a knowledge-based Latvian society and RTU is one of the most important partners in achieving strategic goal No 244 set in the National Development Plan of Latvia – education and knowledge for economic growth and technological excellence.

RTU mission is to provide the Latvian economy and society with internationally competitive high-quality scientific research, higher education, technology transfer and innovation.

The aim of the academic Bachelor study program “Aeronautics and Transport Systems Engineering” corresponds with the mission of RTU and focuses on the education and training of new specialists.

The content and implementation of the study program focus on the development of such competencies as adaptability and responsiveness to changes in students, following and even getting ahead of the labor market demand. RTU is one of the cornerstones of Latvia’s development, which ensures the training of specialists necessary for the Latvian economy, as well as the creation of new products and services, serving as a basis for Latvia’s sustainable growth. RTU Strategy includes the most important guidelines for the development of RTU in the period up to 2020, as well as determines the tasks and delegates responsibilities for the completion of these tasks.

Graduates of the study program easily find a job in their specialty. Students often find a job and work in the specialty already during the first year of their studies.

The Latvian Aviation Association, which consists of the absolute majority of representatives of the aviation industry, confirms the necessity of the program and the demand for its graduates. Since Riga International Airport is planning to expand because of the forecast increase of traffic, and other Latvian airports are also developing, the demand for the graduates of the program will be even higher. As the transport sector continues to grow rapidly, the importance of proper maintenance of the transport system and smart, science-based management of transport operations increases. Given the situation in the world, it is difficult to predict the potential demand for students, but it is clearly growing over time and at least 20 new specialists per year would be necessary to satisfy the needs of the Latvian economy.

#### 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 students of the study program “Aeronautics and Transport Systems Engineering” are provided in Appendix. As the graph shows, the number of students enrolled has fallen, but it is still sufficient to provide qualitative training. To prevent a further drop in the number of applications, it was decided to introduce significant changes to the program. As in other universities, the highest drop-out rate is after the first year. One of the biggest stumbling blocks is the Mathematics course. In order to reduce the failure in this course, additional work is being done with students to retrain the content of secondary school mathematics, as students from secondary schools are becoming less and less prepared for this course. Another important reason for not completing studies is the employment of students in companies. On the one hand, labor market demand and employment are good indicators, but on the other hand, good earning opportunities are beginning to dominate the learning process, which usually results in failure and drop-outs.

In the last 10 years, the number of programs with similar content in Latvia increased, which also negatively impacted the number of students enrolled. The passivity of the previous head of the study program must be acknowledged as well. Since the spring of 2020, the head of the program has been replaced and a lot of work has been put into developing scenarios for the development of the program. Consequently, the necessary changes have been duly deliberated with employers and academic staff, and it has been decided to make the transition to an academic Bachelor program and focus more on aeronautics. As a result, the program will occupy a unique niche in Latvia that will have a high demand in the future.

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

## 3.2. The Content of Studies and Implementation Thereof

#### 3.2.1. Analysis of the content of the study programme. Assessment of the interrelation between the information included in the study courses/ modules, the intended learning outcomes, the set aims and other indicators with the aims of the study course/ module

**and the aims and intended outcomes of the study programme. Assessment of the relevance of the content of the study courses/ modules and compliance with the needs of the relevant industry, labour market and with the trends in science on how and whether the content of the study courses/ modules is updated in line with the development trends of the relevant industry, labour market, and science.**

The study program Aeronautics and Transport Systems Engineering has been developed on the basis of proposals from employers and in accordance with the demand of the labor market.

The largest employers of graduates of the program are companies related to freight and passenger transport and logistics in general, but there are no such companies with strong employment leaders.

Taking into account the forecasts of employers, the program would require 20-50 graduates per year.

The topicality and conformity of the content of study courses and modules to the needs of the market is maintained by the program director in consultation with the companies of the branch, as well as regular meetings with employers' associations and other organizations are organized at RTU. Employers participate in the thesis defense commissions, where the quality of student preparation can be verified, as well as a discussion takes place after the defense, in which the employers' representatives examine their observations and recommendations. Scientific trends are taken into account by following the trends in the topics of the project calls, as well as in consultation with the lecturers of the program, taking into account their competencies in research directions. The lecturers of the program regularly participate in international conferences, which ensure their competence in the represented fields.

The compliance of the program with the needs of the sector's labor market is confirmed by a positive feedback on the program from the leading association of the sector - the Latvian Aviation Association, which includes the absolute majority of companies in the sector.

The content of the study program includes and implements a study module that ensures professional competencies in business, technology transfer and product development in accordance with the requirements of the Law on Higher Education Institutions. In the program this module is offered and described as a separate study course, the content of which and its implementation meet the basic conditions set by the module. For a description of the module, see as course description SDD700 Innovative Product Development and Entrepreneurship.

**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).**

Not 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.

RTU has adopted the Regulation on the Assessment of Learning Outcomes that is binding on all study programs.

Various methods are used to assess student's performance and ensure mastering the program courses and acquiring practical skills – case studies, group work, problem-oriented studies, use of information technology. RTU determines the organization of the study process by Order, which is regularly updated based on the situation in the country.

The principles of student-centered education have been taken into account in the implementation of the study program – student representatives have participated in the development of the program, its discussion and approval. The classes and the examinations are scheduled considering the possibilities of students as they combine studies with work. Students are informed about the examination methods, criteria and the procedure for appealing the assessment. Students are introduced to the expected learning outcomes of each course and the report form, as well as expected tests at the beginning of the study course. The content of the course, expected learning outcomes, recommended literature and other important information are provided in the description of each course (Appendix xx).

The results of the study process are analyzed in discussions with the head of the study program, as well as during the meetings of the AERTI Council. The main issues addressed are the following:

- Execution of the study program and study plan in terms of content and volume;
- The level of students' knowledge, skills and abilities and its compliance with the requirements of a specialist qualification in professional programs;
- Performance of students in the course;
- Financial compliance of the study process with the possibilities and requirements of the Institute.
- The quality of students' knowledge, abilities and skills is constantly monitored by:
- Operational accounting of records – the instructor performs operational evaluations of the progress and quality of the completion of study tasks during the semester;
- Credit test and exams – exams are written or supplemented by oral additions, explanations;
- Public presentation of the study project – the content of the project or research and the public presentation are evaluated;
- Internship evaluation – fulfilment of individual task, evaluation of internship log entries;
- Evaluation of the qualification paper – diploma project – creative practical research and results.

Students' knowledge is assessed according to a 10-point grading scale. If the final form of assessment of a study course is a credit test, then, similarly to an exam, it is evaluated by a mark in a 10-point grading scale. Students' performance is mainly evaluated according to the results during the examination session and upon the completion of a course.

Learning outcomes are determined for each study course and lesson within the program – what the student knows, what skills and competences they have acquired, and what they are able to do after successful completion of the course. Learning outcomes of both the whole qualification, and each component separately – the course and the internship – are assessed.

Students' knowledge is assessed twice a year upon completion of courses during winter and spring examination sessions when students take exams in study courses in accordance with the developed individual study plans. Examination questions are designed to ensure that the student preparing for the exam achieves the aim of the study course described in the description of each course. If necessary, students demonstrate their knowledge of the study course on stands, using posters and mock-ups. Explanations shall be given orally. Examination questions, based on the course program, are developed by the instructor, who is responsible for the respective study course.

The viva voce examination of the Bachelor and Master Theses takes place orally, demonstrating presentation materials. Internship places in the respective field are provided in collaboration with the technical staff of internship companies.

**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 at RTU is organized in accordance with the "Procedure for Organizing the Internship at the Riga Technical University" approved by the RTU Senate.

Internships undertaken at companies are organized by dividing the total volume of internship by semesters. The head of the study program, a representative of the internship company and the intern sign an internship agreement. To ensure successful execution and management of the internship, a description of the internship has been developed, comprising the aim and tasks of the internship, the content of the internship and a report. Internships are intended to be undertaken at companies, which have signed a cooperation agreement. The number of interns usually is divided between several small companies, each accepting 2-5 students per year. Number of cooperating companies with which traineeship agreements are concluded are attached in Appendix

Internship tasks are related to the achievement of the following study program learning outcomes:

- acquiring the competence in route planning, cargo handling, ability to understand logistics schemes, evaluate ecological issues related to transportation;
- acquiring skills in diagnostics, testing and control of equipment, ability to perform preventive tasks.

Previously the volume of the internship was 26 CP, but it is planned to reduce it to 6 CP.

To support the student during the internship, the AERTI provides an internship supervisor-consultant, who coordinates the internship, advises the student and solves internship-related issues with the respective company.

### 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.

Usually, students choose the theme of the Bachelor Paper from the list of themes provided by the AERTI during the first semester of the 4th year. After choosing a theme, students specify the chosen theme with a potential scientific adviser. Students may choose a theme which is not included in the list if the potential scientific adviser of the Bachelor Paper has approved it. The AERTI compiles the list of themes together with employers, including the managers of companies providing internship places, in accordance with the latest trends in the industry and the labor market and current topics of the European Aviation Safety Agency, as well as based on the current research trends.

The following themes of the Bachelor Papers were publicly presented in 2021:

| | |
|---|---|
| • Loģistikas uzņēmuma izmaksu mazināšana apvienojot funkcionālās teritorijas.<br>• Reduction of Logistics Company Costs By Combining Functional Territories. | |
| • Degvielas piegāžu izmaksu samazināšanas pasākumu izstrāde mazumtirdzniecības uzņēmumā.<br>• Development of Fuel Supply Cost Reduction Measures in a Retail Company. | |
| • Alternatīva maršruta projektēšana salikto kravu piegādēm no Ķīnas uz Eiropas valstīm.<br>• Designing an Alternative Route for Cargo Deliveries from China to European Countries. | |
| • Rīgas beramkravu termināla modernizācija.<br>• Modernization of the Riga Bulk Cargo Terminal. | |
| • Salikto kravu pasūtījumu apstrādes automatizācija un 3D modelēšana.<br>• 3D modeling and automation of cargo order processing. | |
| • Atkārtoti lietojamo taras vienību uzskaites sistēmas uzlabošana un RFID automatizācijas ieviešana.<br>• Reusable Transport Item (RTI) Accounting system Improvement and RFID Automation Implementation. | |
| • Lietotu automašīnu piegādes maršrutu izpēte un optimizācija.<br>• Research Optimization of Used Vehicle Route Delivery. | |
| • Plazmas griešanas metodes izpēte un optimizācija transportamašīņu jomā.<br>• Study and Optimization of Plasma Cutting Techniques in the Transport Machinery Sector. | |
| • Autoservisa darbība un tā funkcionalitātes uzlabošana.<br>• Car Service Operation and Improvement of its Functionality | |
| • Noliktavas automatizācijas veidu izpēte un optimālo risinājumu ieviešana loģistikas uzņēmumos.<br>• Research of Warehouse Automation Types and Implementation of Optimal Solutions in Logistics Companies. | |
| • Elektromobīļu uzlādes infrastruktūras izpēte un optimizācija Rīgā un tās apkārtnē.<br>• Research and Optimization of Electric Vehicle Charging Infrastructure in Riga and Its Surroundings. | |
| • Tirdzniecības uzņēmuma kases sistēmu remonta metodes un loģistikas procesu uzlabošana.<br>• Cash Register System Maintenance and Logistic Process Impovement. | |
| • Loģistikas procesu izmaksu optimizācija salikto kravu autopārvadājumos Baltijas un Skandināvijas valstīs<br>• Cost optimization for LCL road freight forwarding logistic processes in the Baltic states and Scandinavia | |
| • Transporta vadības sistēmas izstrāde un ieviešana loģistikas uzņēmumā.<br>• Developmental Implementation of Transport Management System in a Logistic Company. | |

As can be seen from the list of themes chosen for the Bachelor Papers in 2021, there is a wide range of themes related to safety issues, avionics, airport operations, engine evolution and, of course, aircraft maintenance. The selected themes reflect the issues that are topical for companies operating in the industry, as well as themes that are interesting in terms of research

## 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.**

RTU Ķīpsala Campus currently has 54 study rooms, 187 laboratories, 19 special training rooms, 10 computer classrooms, 12 workshops and several research centers of national importance. There is also a student dormitory with 950 beds and a special block designed for people with special needs to ensure enjoyable and comfortable living.

For the implementation of the study program all the university equipment is available for the but for the implementation of the study program in the premises of the Institute of Aeronautics of Riga Technical University (hereinafter - RTU) (at Ķīpsalas Street 6B and Lauvas Street 8 in Riga), 23 study rooms and specialized study rooms, training laboratories, workshops and simulation facilities are equipped with computers, projectors, webcams, audio systems, and other technical aids. The average number of work stations in the study rooms is 18. Lecturers have their own work rooms in each of the buildings, which are equipped with computers with Internet connection and printers.

The Institute has 2 computer classrooms with total of 60 work stations. RTU centralized computer classrooms, laboratories and library are also available for the implementation of the program. RTU HPC Centre provides high-performance computer resources and software for the study process and research. RTU organizational units may use software free of charge. The following software packages are available:

| No | Software | For research | For use in class | To be installed on student PCs |
|---|---|---|---|---|
| 1. | *Adams* | √ | | |
| 2. | *Altium Designer* | √ | √ | √ |
| 3. | *Ansys* | √ | √ | √ |
| 4. | *ArcGIS* | √ | √ | √ |
| 5. | AutoCAD (Autodesk) | √ | √ | √ |
| 6. | *COMSOL* | √ | √ | √ |
| 7. | *BM SPSS Statistics* | √ | | |
| 8. | *Intel Parallel Studio* | √ | | |
| 9. | *Mathcad* | | √ | |
| 10. | *Mathworks MATLAB* | √ | √ | |
| 11. | *OriginPro* | √ | | |
| 12. | *RETScreen* | √ | √ | √ |
| 13. | *SolidWorks* | √ | √ | √ |

In addition to the centrally purchased scientific software, the AERTI has purchased the following computer programs to improve research activities: ANSYS Academic Research (1 task) - TEC Technical Support, ANSYS Academic Research (1 task) - TEC Technical Support period.

The computer programs required for planning the curriculum, accounting, record keeping, personnel management and executing other administrative functions are provided centrally and are interconnected in a unified RTU system.

Database subscription agreements are signed both directly with the supplier and through the state agency Cultural Information Systems Centre, which is the national representative of Latvia in the international non-profit organization EIFL (Electronic information for Libraries, http://www.eifl.net/). The EIFL licensing program offers national libraries a subscription to internationally recognized databases at a significantly reduced subscription fee than is offered to individual subscribers, reducing the Library's expenditures. RTU Scientific Library has subscription to the following databases (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazeseresursi/abonetas-datubazes):

- ProQuest Ebook Central, Academic Search Complete EBSCOhost, Applied Science & Technology Source EBSCOhost, Business Source Ultimate EBSCOhost, EBSCOhost eBook Academic Collection, Wiley Online Library, SpringerLink, The International Monetary Fund;
- Subscriptions funded by the Ministry of Education and Science (ScienceDirect, SCOPUS (Elsevier), Web of Science);
- Latvian databases LETA, Letonika, Latvian Standards Database (available only on-site in the library).

The intensity of database use in RTU Scientific Library has been growing since 2016. The issuance of electronic resources has increased from 75,391 to 525,194 units. The new premises of the Library have allowed expanding the range of services for users. Since the opening of the new premises, the number of visits to the Library increased from 103,825 to 235,600 in 2018. RTU Scientific Library is available to anyone interested. It is open to users from Monday to Saturday. There is a 24-hour reading room. In summer, the Library is open every weekday and works part-time. (https://www.rtu.lv/lv/studijas/biblioteka/pakalpojumi-3) Information sources of the Library are organized in an open access collection.

A librarian helps navigate the collection. Bibliographers (information specialists) provide more detailed information and advice. A field-specific librarian service has been established in the Library (https://www.rtu.lv/lv/studijas/biblioteka/nozaru-informacija). Library resources can be found using the search tool Primo Discovery (https://www.rtu.lv/lv/studijas/biblioteka/vienota-informacijas-meklesana). It gives an opportunity to search for information in the library catalogue (https://kopkatalogs.lv/F/?func=find-b-0&local_base=rtu01), in the subscribed databases, as well as in the databases created by RTU Scientific Library (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazeseresursi/bibliotekas-veidotas-datubazes) within one interface. By searching for information in the electronic joint catalogue (https://kopkatalogs.lv/F), you can simultaneously obtain information about the available resources in 12 Latvian libraries. Both the electronic catalogue and RTU portal ORTUS have an option to reserve library resources remotely, remote access to databases is also provided. Since the introduction of RFID technology, users have been able to use five self-service book machines to take out books and return them at any time of the day. The Library provides students, academic staff and other interested parties with various levels of individual consultations and group training sessions on information literacy (https://www.rtu.lv/lv/studijas/biblioteka/lietotajuapmacibas).

The AERTI laboratories, workshops and other equipment are not reserved for particular programs and sharing of existing facilities is encouraged. Scientific equipment is also involved in the study process within Master and Doctoral programs (under the strict supervision of the laboratory manager). Within the framework of the study program, students have an opportunity to use, strengthen and improve their knowledge, skills and competencies in practical, specialized study rooms, laboratories, workshops or simulation cabins and aircraft:

| No. | Name |
|---|---|
| 1. | Computer Simulation Aeronautics Laboratory |
| 2. | Metalworking Workshop with CNC Milling Cutters and CNC Laser Cutters and Other Equipment |
| 3. | Experimental Materials Laboratory |
| 4. | Module Manufacturing Laboratory/Workshop |
| 5. | Aircraft Navigation and Instrumentation System Laboratory |
| 6. | Fundamentals of Electronics and Electrical Engineering Training Laboratory |
| 7. | Aircraft Maintenance and Repair Training Laboratory |
| 8. | Aircraft Systems Training Laboratory |
| 9. | Propeller Training Laboratory |
| 10. | Aerodynamics Laboratory |
| 11. | Digital and Electronic Equipment Laboratory |
| 12. | JAK-42 Simulation Cabin |
| 13. | A-24 Simulation Cabin |
| 14. | AN-2 Simulation Cabin |
| 15. | Non-Destructive Testing Laboratory |
| 16. | Trainer Plane Socata Rallye |
| 17. | Trainer Plane VEF I-16 |
| 18. | Trainer Helicopter Mi-2 |
| 19. | Aircraft Engine Training Laboratory |
| 20. | Composite Material Manufacturing Workshop |
| 21. | Nanocoating Laboratory |

Every year, in addition to the centrally procured books, the AERTI purchases study literature corresponding to the study programs worth more than 1,000 EUR; these resources are included in the collection of RTU Scientific Library (see https://kopkatalogs.lv/F).

Provided resources are sufficient for the successful implementation of the study program.

**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).**

RTU funding from the state basic budget consists of study base funding, which corresponds to the list of study programs and the number of students. This funding comprises finances for utility payments, taxes, infrastructure maintenance (including providing data for the Register of Students and Alumni), purchase of inventory and equipment and staff salaries, as well as funding for research. The number of study positions is allocated after negotiations with the Ministry of Education and Science.  Study base funding from the state budget is intended to be used for full-time studies. It is calculated based on the number of study positions determined by the state at RTU, as well as the costs of the study position determined by the state and the study cost coefficients in the thematic spheres of education. RTU funding from the state basic budget for the study positions in the respective academic year is distributed in accordance with RTU Senate decision “On the Methodology for Distribution and Use of Basic Budget, Performance Financing and Student Tuition Fees between RTU Organizational Units” from the respective academic year. This Methodology is annually reviewed and approved considering the necessary changes. RTU has a decentralized budget and a separate budget is planned for each organizational unit. A budget essentially is a plan of revenue and expenditure for a specific period, work, event, or function. RTU revenues and expenditures are managed according to the principles approved by the Senate or determined by an authorized Vice-Rector for Finance.

According to the Methodology, funding for organizational units is allocated either according to the financial or budget year or immediately upon receipt of funding. The financial or budget year of RTU organizational units is from October to September of the following year, for this period the funding is calculated and distributed: the subsidies or the basic budget funding (education and training of state-funded students) is allocated in a form of a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month; financing for students, who pay tuition fees (education and training of students who pay tuition fees, including debtors’ finances) is distributed twice a year (in October and April) as a monthly limit – each organizational unit receives 1/6 of the calculated funding for the semester per month; performance funding (research support funding) is allocated as a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month; research base funding (research support funding) is allocated as a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month. Analysis of the general procedure for financing study programs at RTU reveals that the basic budget and tuition fee funding from local students who pay tuition fees are determined following the basic principles set by the state. In the process of determining the amount of funding, the study cost coefficients of the thematic spheres and the values of the study cost coefficients according to the level of the study program, as well as the number of students at the study program and the corresponding study courses are considered. As mentioned above, by using the study cost coefficients of the thematic spheres of education, it is possible to determine the amount of funding required for the implementation of a specific study program and study course. RTU Senate has decided that in the future the study cost coefficients of the thematic spheres of education will be applied individually to each study course included in the study program, thus ensuring even more appropriate funding for the implementation of the study courses. To implement this system, an expert commission was established by the order of the Vice-Rector for Academic Affairs, which determined the thematic area of each study course.

Financial resources of the study program are sufficient for successful implementation of the study program and their use is regularly controlled by the administration as well as RTU Office of Vice-Rector for Finance.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

The costs per student within the study program are calculated by the Office of the Vice-Rector for Finance. The average cost per student in 2013-2020 was 4075.28 EUR. The number of study places is allocated after negotiations with the Ministry of Education and Science. The amount of study funding is determined on the basis of the number of study places determined by the state at RTU, as well as the base costs of the study place determined by the state and the study cost coefficients of the thematic areas of education.

## 3.4. Teaching Staff

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

The teaching staff involved in the implementation of the study program is highly qualified and competent in order to ensure the acquisition of the necessary research skills, theoretical knowledge, skills and competencies. The qualification of the teaching staff complies with the criteria specified in Sections 28, 30, 32, 36, 37 and 40 of the Law on Higher Education Institutions.

Employees involved in the implementation of the study program, working in various scientific projects and conferences, transfer the knowledge gained to the study program by improving the content of the study courses. Also, experience of the work in industry and cooperation with industry allows to enrich the study content with up-to-date information, examples and real work environment tasks.

### 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.

| Academic year | Professors | Associate professors | Assistant professors | Lecturers | Assistants | Guest professors | Guest assist. prof. | Guest lecturers | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| 2013/2014 | 11 | 0 | 9 | 2 | 10 | 4 | 0 | 3 | **39** |
| 2014/2015 | 9 | 0 | 9 | 1 | 2 | 1 | 0 | 1 | **23** |
| 2015/2016 | 9 | 3 | 8 | 2 | 5 | 2 | 2 | 0 | **31** |
| 2016/2017 | 10 | 2 | 8 | 2 | 3 | 0 | 0 | 0 | **25** |
| 2017/2018 | 9 | 3 | 7 | 3 | 3 | 1 | 0 | 0 | **26** |
| 2018/2019 | 9 | 2 | 8 | 3 | 2 | 0 | 1 | 0 | **25** |
| 2019/2020 | 7 | 2 | 9 | 3 | 2 | 1 | 2 | 2 | **28** |
| 2020/2021 | 6 | 2 | 11 | 3 | 1 | 1 | 1 | 1 | **26** |
| 2021/2022 | 6 | 3 | 15 | 3 | 0 | 1 | 1 | 1 | **30** |

The study process in academic year 2013/2014 was carried out by 39 members of academic staff, including 11 professors, 4 guest professors, 9 assistant professors, 2 lecturers, 3 guest lecturers and 10 assistants. Based on the results of the analysis, it can be concluded that during the reporting period, in accordance with the strategic aims of the study field and study programme development, the qualitative value of academic staff has increased, with particular emphasis on the increase in the number of associate professors and assistant professors, as well as the significant reduction in the number of assistants to 0.  As a result, in academic year 2021/2022 the study process is mainly provided by 6 professors, 1 guest professor, 3 associate professors and 15 assistant professors. Consequently, it can be concluded that the quality of academic staff has increased.

**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).

Academic staff members representing both professional and academic backgrounds participate in the implementation of the study programs, ensuring a balanced environment in which the staff help achieve the set aim and learning outcomes of the study program.

Members of academic staff communicate and cooperate with each other during the meetings of methodological commissions, individual conversations with the heads of study programs, conversations among academic staff members, as well as in meetings of AERTI academic staff, discussing various topical issues of the AERTI, higher education and professional fields. The academic staff of the study program cooperate in the implementation and updating of the content of the study courses, coordinating the topics to avoid repetition of the same content. The academic staff also cooperate within the research groups, offer ideas for sample themes of qualification papers and suggestions for improvement of study programs. Simultaneously, academic staff participate in the development of extracurricular activities for students, for example, to organize student study trips to employer’s companies or to invite guest lecturers.

In accordance with the internal normative documents regulating the study process at RTU, the Methodological Committee (hereinafter – the Committee) operates within the study program (hereinafter – the program) and acts as one of the elements for ensuring the quality of the program implementation.

The main operation areas of the Committee are the following:

1. Evaluation of study course descriptions for the approval at a meeting of the appropriate department and approval by RTU Study Department.
2. Review and approval of study and methodological materials.
3. Organization of class attendance and analysis of results.
4. Organization of methodological seminars on current issues.
5. Providing suggestions for the development and improvement of new study courses.
6. Coordination of Master Thesis themes.
7. Discussion of novelties in the use of information technologies in the study process and providing recommendations to the management of the Institute/Faculty.

Academic staff cooperation is also facilitated by teamwork in joint research projects and contract work. Every year, the AERTI carries out several projects involving employees of various RTU organizational units, as well as foreign partners.

The ratio of the number of students to the number of teaching staff within the study program is on average two students per lecturer. The relatively small number of students per lecturer can be explained by the interdisciplinarity of the program. This means that there are a relatively large number of teachers who teach one or two courses. Unfortunately, the number of students in the program has also fallen in recent years, which of course has affected this proportion. Taking into account the prepared changes in the program, as well as the plan to offer the program in English, the number of students in the program must increase. The existing teaching staff is able to qualitatively ensure the preparation of a larger number of students.

# 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 | MCL0_dipl_dipl_supl.zip | MCL0_diploms_dipl_pielik.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) | MCL0_CHE_opinion.docx | MCL0_AIP_atzin.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 | MCL0_stud_statist.pdf | MCL0_stud_statist.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 | MCL0_StEdSt_6_annex.pdf | MCL0_VaIzSt_6_pielik.pdf |
| 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 | MCL0_CoursMapp_8_annex.pdf | MCL0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MCL0_CurricStPogr_9_annex.docx | MCL0_StudProgrPL_9_pielik.docx |
| Descriptions of the study courses/ modules | MCL0_DescriptStud_cour.zip | MCL0_Studkurs_apr.zip |
| Description of the organisation of the internship of the students (if applicable) | Internship_Management_Procedure.pdf | Prakses_organizesanas_kartiba.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | Confirmation - on compliance of the academic staff.edoc | Apliecinājums - AL 55. pants par prof. skaitu akadēmiskās programmās.edoc |

# Automotive Transport Engineering (47525)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Automotive Transport Engineering* |
| Education classification code | *47525* |
| Type of the study programme | *Professional master study programme* |
| Name of the study programme director | *Juris* |
| Surname of the study programme director | *Kreicbergs* |
| E-mail of the study programme director | *juris.kreicbergs@rtu.lv* |
| Title of the study programme director | *MSc., MBA, Docents prakt.* |
| Phone of the study programme director | *29245628* |
| Goal of the study programme | *The aim of the study program is to provide professional master's education in Automotive and Heavy Vehicle Engineering in order to promote sustainable operation and development of high quality automotive and heavy vehicle engineering sectors based on in-depth knowledge, creative thinking, research skills and competences of graduates, providing society with safe, efficient, accessible, smart and sustainable mobility solutions, promoting the country's economic growth, regional development and moving towards a climate-neutral economy.* |
| Tasks of the study programme | *1. To provide students with knowledge, skills and competencies that are required by European transport and heavy vehicle engineering businesses and Latvian employers;<br>2. To develop skills of identifying, formulation and analysis of professional and scientific problems in vehicle engineering and to take analysis based and informed decisions; to train knowledge from various fields integration skills; to build research skills;<br>3. To deepen comprehension of research results and professional activities impact on environment and the society.* |
| Results of the study programme | *Graduates of the study programme are:<br>1. Able to formulate and critically analyse professional and scientific problems in the automotive and heavy vehicle engineering;<br>2. Able to make analytically-based decisions;<br>3. Able to integrate knowledge from automobile transport, engineering, business, social and other fields;<br>4. Able to conduct research and develop methods of professional activities;<br>5. Understand the potential impact of professional activities and research results on environment and the society.* |
| Final examination upon the completion of the study programme | *Master's Thesis* |

# Study programme forms

**Full time studies - 1 years, 6 months - latvian**

| | |
|---|---|
| Study type and form | *Full time studies* |

| | |
|---|---|
| Duration in full years | *1* |
| Duration in month | *6* |
| Language | *latvian* |
| Amount (CP) | *60* |
| Admission requirements (in English) | *1. Professional bachelor degree and/or fifth level qualification in automotive engineering or transport sector(s), or comparable education 2. Professional bachelor degree and/or second level professional higher education, or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in automotive engineering* |
| Qualification to be obtained (in english) | *Automotive and heavy vehicle specialist* |

### 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 professional master's study program Automobile Transport was established in 2004 by the decision of the RTU Senate of December 13, protocol No. 491. The study program was created as a continuation of the training of automotive engineers at RTU, which was started in 1977. From the beginning, the study program had three variants.

The first variant with the amount of 60 CP with admission requirements for bachelor’s professional degree and / or fifth level professional qualification in the field of automobile transport or other transport means. Duration of studies 1.5 years and the degree to be obtained is a professional master's degree in automobile transport. No qualification was awarded. Most of the students in the program came from the professional bachelor's study program Automobile Transport

The second variant with the amount of 102 CP with admission requirements for bachelor's degree in the field of automobile transport or other transport means. Duration of studies 2.5 years and the degree to be obtained is a professional master's degree in automobile transport and an engineer's qualification in automobile transport. This version of the program was primarily intended for students enrolled in the transport academic bachelor's study program until 2004. As students were no longer admitted to the academic bachelor's study program from 2005, the variant has lost its relevance and is not being submitted for accreditation.

The third variant with the amount of 69 CP with the admission requirements for a bachelor's professional degree in engineering or economics and / or a fifth level professional qualification in engineering or economics. The duration of studies was 1.75 years and the degree to be obtained is a professional master's degree in automobile transport. No qualification was awarded. Students who were interested in specializing in road transport and road safety entered the study program.

Until 2013, when the accreditation sheet of the previous study field was issued, the basic parameters of the study program have not been changed, only the study courses included in the study program have been changed, with changes taking place in 2008, after accreditation also in 2017 and 2021.

In 2017, in accordance with the revised unified requirements for study programs (URSP) approved at the RTU Senate meeting on November 21, 2016 (Protocol No. 604), the number of variant 2 credit points was reduced to 100 and the number of variant 3 CPs to 60, including a note that in accordance with RTU uniform requirements for study programs with higher professional education obtained in related fields, additional requirements must be met, the amount and content of which are determined on the basis of comparison of the acquired and acquired program, part of additional requirements courses may be study courses from Part B.

In 2017 changes have also been made to study courses. In accordance with the URSP and taking into account the development of the road transport sector, the need to strengthen the research skills of master students, the study course Research in Road Transport volume in the study program has been increased from 2 CP to 6 CP, moving from the compulsory part to the optional part the Business in Transport and the Construction of Transport Systems. In order to be able to choose study courses more precisely in accordance with the existing training and interests of different students, the study course blocks were eliminated, including courses among the limited elective courses. The basic courses were revised, the distribution of their credit points was changed and the course titles were changed, avoiding the special courses in the titles (Road Traffic Safety, Automotive Manufacturing and Rebuilding Technology, Automotive Effective Service Technology, Sustainable Multimodal Transport Technology), compulsory elective study courses supplemented by several courses (Innovative Mobility Vehicles, Electric Road Vehicles Technology, Innovative Automotive Technology, Combustion and Emissions in an Internal Combustion Engines, Technology of Reciprocating Internal Combustion Engines, Road Vehicle Dynamics and Performance, Automotive Propulsion System Integration, Automotive Company and Technology Development History, Automotive Aftersales Technology). The study program has been redesigned so that students who have previously dropped out of their studies can easily resume their studies by re-learning only the full range of research in road transport. The title of the study program in English was changed to Automotive Transport Engineering.

In 2021, in accordance with the standard PS-183 of the profession Automotive and Heavy Vehicles Specialist developed in 2021, the volume of the compulsory study course section for the first and third variant of the program was increased to 14 CP (the second variant of the program was amended, because it is intended to be ceased with the foreseen graduation of the last student), so that the amount of the compulsory part together with the amount of practical placement and the master's thesis corresponds to the minimum amount of professional master' s programs 40 CP. As the Employers' Confederation's occupational standard development group called for the standard to be extended to include heavy vehicle content, the mandatory part of the program was supplemented with Vehicle Effective Service Technology and Sustainable Vehicle Technology courses in the first variant, and Modern Automotive Technology, Road Transportation and Road Traffic Safety in the second variant. Taking into account that in the period from 2017 the lecturers of the Department of Automotive Engineering are involved in the training of driving instructors and driving school teachers of the programs "Road Traffic Regulations and Road Safety" and "Technical Information and Road Transport" according to Cabinet Regulation No. 358 on Drivers training and driver training programs, among other requirements, require a level 2 professional higher education, and whereas the content of the elective study courses in the professional study program Automotive Transport Engineering already covers most of the topics required for the teachers and driving instructors, and that the planned amount of 132 hours for teacher training is not optimal, taking into account that Latvia has one of the worst road safety indicators in Europe, as well as the fact that in countries with a high level of road safety teachers are already trained at the university from the state budget, it was concluded that in order for the level of the professional master's degree in Automotive Transport Engineering to correspond to the required level of competencies of driving school teachers, the program has been supplemented with a larger 6 CP study course Basics of Safe Driving and Teaching Methodology. Therefore, for the specialization of the program Road traffic safety and road transport, along with accreditation, it is proposed to change the qualification requirements that comply with the regulations of the Cabinet of Ministers. In order to take into account, the different level of knowledge of the students admitted to the study program and the corresponding required knowledge, the program includes free choice study courses in the amount of 6 CP. Involvement of students with different previous education in the study process promotes the development of the competencies required by the professional standard Road Transport and Heavy Vehicles Specialist PS-183 in terms of the ability to integrate knowledge from different fields into innovative vehicle technology design and the ability to integrate engineering, business, humanities, social and other knowledge. It also helps to ensure the goal of the study program, which is to build on the in-depth knowledge, skills and competencies of the students of the study program in various fields. This is also confirmed by the previous experience, when three variants with different admission requirements were accredited in the previous accreditation and the qualification of the graduates also met the requirements of the professional standard.

Considering that the level of students' knowledge of languages has significantly improved in recent years, language teaching has been excluded from the optional part of the study program, but in order to strengthen professional and scientific language skills, a scientific paper in English on thesis research topic has to be included in the master's thesis. Certain elective courses were also excluded from the study program, but students can continue to choose them as free elective courses. The dropped-out students who recover for completion of the study program can also refer excluded but completed study courses to free elective courses.

Within the framework of the study field evaluation procedure, a change is planned to specify the degree and professional qualification to be obtained, in accordance with the new professional standard, determining the degree and professional qualification “Professional Master Degree in Automotive Engineering and Qualification of Automotive and Heavy Vehicle Specialist”. It is also proposed to change the title of the study program to “Automotive Transport Engineering”. It is planned to change the requirements for the required prior education for the 3rd implementation variant of the study program to “professional bachelor degree and/or second level professional higher education, or comparable education”, as well as not to submit the 2nd implementation variant of the study program in the amount of 100 credit points for accreditation, while until the accreditation of the study field decision, allowing the last student studying in the 2nd implementation variant to complete the studies. The changes were supported at the meeting of the RTU Senate on September 27, 2021 (protocol No. 653), deciding to submit the changes together with the evaluation and approval of the study field “Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering” to the Study Quality Commission together with accreditation.

**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 study program Automotive Transport Engineering fully corresponds to the study field Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering, as most students start their studies with a qualification of an Automotive engineer, which is essentially a mechanical engineering engineer specializing in motor transport. Field of specialization Road transport and heavy vehicle technologies fully corresponds to the field of study both in terms of content and the acquired knowledge, skills and competencies. Field of specialization Road traffic safety and road transport technologies largely corresponds to the field and are based on the study methods, study content and study results specific to the field. Special attention is paid to the integration of various previous experiences in the further development of road transport engineers by obtaining the qualification of an automotive and heavy vehicle specialist.

The former title of the study program Automobile Transport was initially related to other programs in the field, Aviation Transport and Railway Transport, thus emphasizing the belonging to a single field of study and one faculty. However, the term 'road transport' is not clearly understood as automotive engineering. With the expansion of the use of the word “engineering” in the Latvian titles of study programs, together with accreditation, it is proposed to change the program title to “Automotive Transport Engineering”, thus more precisely compliance with the standard of the profession “Automotive and Heavy Vehicle Specialist” and the corresponding professional qualification. The program codes (RMGU0 for the first variant of the program, RMGUB - for the former second variant and RMGUC - for the third variant) are created at the RTU level and correspond exactly to each study program.

The degree to be obtained and the professional qualification correspond to the 7th level of the European Qualifications Framework (EQF) with the corresponding goal and tasks, expected study results, as well as admission requirements. Admission requirements for the third variant of the study program (which will become the second variant) are planned to be extended in accordance with the requirements of Cabinet Regulation No. 358 for driving school teachers to “professional bachelor degree and/or 2nd level professional higher education, or comparable education”.

The aim of the study program is to provide professional master's education in Automotive and Heavy Vehicle Engineering in order to promote sustainable operation and development of high quality automotive and heavy vehicle engineering sectors based on in-depth knowledge, creative thinking, research skills and competences of graduates, providing society with safe, efficient, accessible, smart and sustainable mobility solutions, promoting the country's economic growth, regional development and moving towards a climate-neutral economy.

The tasks of the study program correspond to the aim of the study program and are to provide students with knowledge, skills and competencies that are required by European transport and heavy vehicle engineering businesses and Latvian employers; to develop skills of identifying, formulation and analysis of professional and scientific problems in vehicle engineering and to take analysis based and informed decisions; to train knowledge from various fields integration skills; to build research skills; to deepen comprehension of research results and professional activities impact on environment and the society.

The planned study results are subordinated to the aim and tasks of the study program, creating studies so that the graduates of the study program are able to formulate and critically analyse professional and scientific problems in the automotive and heavy vehicle engineering, able to make analytically-based decisions, able to integrate knowledge from automobile transport, engineering, business, social and other fields, able to conduct research and develop methods of professional activities, understanding potential impact of professional activities and research results on environment and the society.

The volume of the study program 60 CP has been chosen so that in accordance with the regulations on the second level professional higher education state standard and RTU uniform requirements for study programs, as well as the fact that the compulsory part of the study program must provide a qualification according to the professional standard, the study program could include a sufficient amount of specialization study courses.

The duration of implementation is 1.5 years and corresponds to 60 CP. Some students who work in full time in parallel choose to complete their studies for 1.5 years, but to complete and defend their master's thesis in the fourth semester, thus compensating for the fact that the master's program is not offered as part-time studies. It is not possible to evaluate the study program for part-time studies as practically purposeful.

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

The offer of the study program until 2019 allowed to complete groups of students who filled all the offered state funding budget places, which from the economic point of view is more useful than working with small groups. Due to the pandemic, enrolment in 2020 and 2021 was lower and student training has been more social than ever, providing the desired education for a small number of students, the industry's need for road transport professionals and the university's need for postgraduate researchers who would have the opportunity to continue their doctoral studies.

In the whole period between accreditations, practically all master's students are already employed in the profession, which is also stimulated by the requirement of the study program for internship in the specialty in the amount of 6 CP. The management of the study program has no information about the graduates of the master's program who would change their employment to another profession after graduation.

### 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 students in the study program are shown graphically in Annex 5, where the analysis of the change in the number of students is also performed.

From 2013 to 2018, the number of students enrolled in the study program corresponded to the number of admission places with state budget funding - an average of 16 students per year. After that, in 2019, according to a smaller number of graduates of the bachelor's program, only 10 students were admitted, but in the pandemic years in 2020 and 2021, 9 and 8 students. In order to compensate for the lower number of enrolled students, additional work was done to attract students who had previously dropped out of school, and in 2021, 7 students resumed their studies.

The trend in recent years is that there are up to five students enrolled in the first year who do not start their studies and do not even try to complete the first semester. If in 2021 there was only 1 student, then 3 students in 2020, 3 in 2019, 5 in 2018, 4 in 2017, 3 in 2016, 3 in 2015, 1 in 2014, 3 in 2013. The main reasons for not starting studies are the inability to combine the schedule of classes with full-time work or changes in private life since the submission of documents for studies.

An average of 6 graduates graduated from the program each year. Although it is less than 50% of those admitted, some of the non-graduates have completed a theoretical course and could complete a master's degree in the coming years.

### 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 information included in the study courses, the results to be achieved, the set goals, the content of the permanent work comply with the goals and results of the study program, as well as the requirements of the professional standard “Automotive and Heavy Vehicle Specialist”.

The sustainable operation and development of high-quality automotive and heavy vehicle engineering industries is fostered by students acquiring and strengthening competencies that help provide society with safe, efficient, accessible, smart and sustainable mobility solutions, thus contributing to the country's economic growth, regional development and progress towards the climate-neutral economy. This is achieved by students acquiring knowledge and skills, acquiring competencies, developing the ability to independently formulate and critically analyse professional and scientific problems in road transport and vehicle engineering and make informed and informed decisions, improving the ability to integrate knowledge from different fields, develop research skills, deepen understanding of scientific results and the impact of the professional activity on the environment and society.

The requirements of the industry in 2021 are formulated in the professional standard developed by the representatives of the industry organizations, led by the Confederation of Employers, where duties and tasks are assigned to the automotive and heavy vehicle specialist.

Integrated road transport system planning and management competencies, planning road transport operational and organizational processes, organizing the operation of an automotive company and forecasting the development of the road transport system, are developed in study courses Road Transportation, Sustainable Multimodal Transport Technology.

Development of sustainable vehicle technologies, creating an understanding of global requirements for vehicle technologies, is acquired in the study courses Sustainable Vehicle Technologies. Advanced vehicle technologies and processes are studied in the study courses Innovative Mobility Vehicles, Road Vehicle Dynamics and Performance, Automotive Propulsion System Integration, Combustion and Emissions in an Internal Combustion Engines.

Alternatives to vehicle power supply are critically analysed in the study courses Sustainable Vehicle Technology, Modern Automotive Technology, Electric Road Vehicles Technology, Technology of Reciprocating Internal Combustion Engines and Innovative Automotive Technology.

Analysis of damage to vehicles during production, operation and use, analysis of optimal restoration of vehicles and components to technical condition, study courses Vehicle Effective Service Technology, Automotive Manufacturing and Rebuilding Technology, Modern Automotive Technology.

Analysis, planning and implementation of professional and scientific research, scientific articles, theses, research reports and opinions are written in the study course Research in Road Transport. The course also teaches methods for reporting on research in the road transport and vehicle industry to a variety of audiences.

Creating a safe and sustainable environment in road transport and road traffic by developing a sustainable strategy and action policy in a road transport company, thus organizing safe working conditions in road transport and creating a sustainable environment in road transport and promoting safe use and participation in road traffic, is trained in study courses Vehicle Effective Service Technology, Road Traffic Safety, Automotive Manufacturing and Rebuilding Technology, Automotive Company and Technology Development History and Automotive Aftersales Technology. Improving road safety and techniques for developing and improving road users' safe driving skills are analysed in the study courses Road Traffic Safety, Road Traffic Safety, Basics of Safe Driving and Teaching Methodology.

Education, the promotion of vocational training and the development of programs in the field of road transport and heavy vehicles are covered in the Research in Road Transport course and in various elective study courses, where students are given the opportunity to specialize in a particular field and acquire knowledge and skills not acquired in the previous studies. The competencies acquired in the optional courses Pedagogy and Psychology also help to develop training modules and programs for automotive and vehicle specialists, implement training and certification of road transport and vehicle specialists in the company, create professional development plans for specialists, organize professional conferences and seminars, develop informative, scientific and training materials in automotive and heavy vehicle technology.

The implementation and observance of the general basic principles of professional activity for students has been practiced by most of the study courses of the previous study periods. To communicate in professional and scientific English, using professional terminology, students learn both by using literature in foreign languages and by developing a scientific paper in English about the research of their master's thesis. In general, the study program improves students' professional competencies and increases their scientific qualification.

The updating of study courses is carried out by the structural units responsible for the study courses, the teaching staff responsible and the teaching staff involved in the implementation of the study courses. There are almost no courses with little variable content in the study program. In turn, the content of specialized courses is developing so fast that a part of the content of each study course is renewed annually.

**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 award of a professional master's degree is based on the achievements and findings of the Land Transport sub-sector of the Engineering and Technology sector. Master's theses and study papers are developed on important issues for the industry.

An essential part of the master's thesis is a scientific article in English about the research analysed in the master's thesis. The essence of the scientific article is to analyse the achievements of the field of science in the examined issue, to point out unresolved or incompletely solved questions, to propose and describe their research method and research technology, and to describe and analyse results that are not possible without relying on latest scientific achievements and findings in the study field.

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

The study program is implemented both in the traditional way of RTU, dividing the weekly contact hours into lectures, practical work and laboratory work, and separate courses are implemented in the form of modules.

Part two of the study course Sustainable Multimodal Transport Technology is implemented in the form of modules, where students can acquire knowledge in a concentrated manner that complies with Regulation No. 1071/2009 of the European Parliament and of the Council establishing common rules for the road transport operators. After completing the course, students, together with road transport entrepreneurs, can take an exam organized by the Road Transport Directorate to receive a certificate of professional competence. The second part of the study course Road Traffic Safety is also organized in the form of a module, where students conduct group research in road traffic safety.

This is not a joint study program, the study program is not implemented in a foreign language or in the form of distance learning.

Many principles of student-centred teaching and learning (SCL) are followed in the study process. The contingent of students and the diversity of their needs are taken into account and respected. As the study program admits students not only with the qualification of an automotive engineer, their previous experience in the specialty is discussed with each student individually, the choice of optional courses, as well as the study methods of compulsory study courses are discussed. The wishes of former automotive students in the continuation of studies also tend to differ significantly, therefore the elective courses do not distinguish between two specializations, but students have the opportunity to develop their own individual specialization.

As the pedagogical methods used in each study course are chosen by the responsible lecturers and the pedagogical methods are not determined centrally, there is a great diversity of them.

The student's tendency to independence is promoted, at the same time the guidance and support of the teaching staff is provided. Mutual dignity is fostered in the relationship between student and teacher, even when it may seem exaggerated to senior teachers.

There are appropriate procedures for dealing with student complaints. However, it can be stated that complaints are quite rare. However, not all complaints are resolved at the study program level.

All assessors are informed and familiar with the examination and examination methods, receive support to improve their assessment skills. There is a requirement of RTU that the evaluation criteria and methods, as well as the criteria for posting marks, have been previously published in the e-learning environment ORTUS.

There is a procedure for reviewing student appeals, but no appeals have taken place, due to low interest of employers in student assessment, in many cases students are not interested in receiving a higher grade, but students who want a higher grade are informed about the assessment system at the beginning of the semester.

### 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 study program includes practical placement in the amount of 6 CP. The internship is organized in the first and second semester in the amount of 3 credit points. As practically all master students work in the specialty, the internship should be used more as an opportunity to combine work with studies, as students with very few exceptions undergo internships in their independent workplace. As a result, students do not need the help of a university to find an internship, but such help is offered.

The study program is not implemented in a foreign language, therefore there are no language barrier problems for students in practice places. However, students are encouraged to work abroad, which is not used by master's students, mainly due to employment in a local company.

During the internship students train to independently formulate and critically analyse professional and scientific problems in automotive and vehicle engineering, make analytically based decisions, acquire skills to integrate knowledge of road transport, engineering, business, humanitarian, social and other fields, improve understanding of the potential impact of professional and scientific results the environment and society.

### 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.

The Master Thesis is the final work of the Master's professional study program, which confirms the achievement of the study results planned in the study program. Elaboration and defense of the master's thesis is a part of the final examination of the master's practical study program, the aim of which is to assess the student's theoretical knowledge, abilities and skills to independently solve problems in the automotive transport sector, the ability to convincingly defend the results obtained in the research and to substantiate the proposed proposals, as well as to assess the student's readiness for further studies in the highest level - doctoral study program.

The master's thesis is an analytical study with elements of scientific work in the field of science represented in the study program on the topic chosen or assigned and approved by the student. The master's thesis is a research conducted independently by the student, the conclusions and recommendations of which are based on an information-evaluating report on a problem formulated within the study program or to be solved in practice.

The master's thesis is developed on current issues in the field of road transport and vehicle technologies. The topics of the work include topical issues that correspond to the guidelines for the development of transport or scientific and technical achievements and the market situation of goods and services.

The student chooses the topic of the master's thesis from the list of topics offered by the Department of Automotive Engineering, but the student has the right to choose the topic of the thesis independently, based on his or her interests, but directly related to the respective study program. Possible main directions of work: research, evaluation of solutions of current, scientific and technical problems and proposing a reasonable solution to the problem in the field of vehicle operation, repair, maintenance materials, road safety or road haulage, based on appropriate research methods and engineering calculations, development of scientific and technical solutions in the field of vehicle operation, repair, maintenance materials, road safety or road haulage, based on appropriate research methods and engineering calculations, research, manufacture, operation of various vehicle construction systems and their individual components, selection, improvement and performance analysis of repair technology variants, basing the choice of the chosen variant on appropriate research methods and engineering calculations.

The development of the master's thesis takes place in accordance with the work completion schedule, which the student develops together with the supervisor. The actual progress of each student's master's thesis is supervised by the supervisor. During the elaboration of the master's thesis, in accordance with the study schedule, mid-term examinations-discussions of the master's thesis are organized, in which students present the progress of the elaboration of the thesis. In the last test (pre-defense), the results of the work are checked by a commission of academic staff appointed by the Department of Automotive Engineering. The aim of the pre-defense is to give the student the opportunity to improve the skills of public defense of the work, but to give the academic staff the opportunity to get acquainted in more detail with the master's thesis and evaluate the results of the thesis. If the commission in the pre-defense of the master's thesis finds that the student has not fulfilled the task of the master's thesis and has not observed the requirements set for the work, then the student is not admitted to the defense of the master's thesis. In this case, the student is given the opportunity to improve his or her performance and defend his or her work at the end of the next study semester.

Developers of the master's thesis are invited to speak at the RTU Student Scientific Conference or the RTU International Scientific Conference on the issues and technological solutions to be developed in the master's thesis in order to provide an opportunity to improve the skills of public defense.

Experienced, highly qualified specialists in the field of road transport who work outside the RTU structural unit represented by the supervisor of the master's thesis or in another organization outside RTU, or other qualified specialists by order of the Dean of FMETA are appointed as reviewers of the master's thesis. Since 2019, we have introduced the practice of appointing experienced, professionally proven graduates of our specialty as reviewers of master's theses. In the future, it is planned to cooperate more closely with the Latvian Society of Automotive Engineers (LSAE) in order to involve the specialists in the field of road transport represented by LSAE in the review of master's theses.

The master's thesis is defended publicly in the State Examination Commission. Students' performance in the development of a master's thesis in final examinations is evaluated by the State Examination Commission, which is established in accordance with the Regulations on Final Examination Examinations at Riga Technical University approved by the RTU Senate. The State Examination Commission of the Master's professional study program consists of the chairman of the commission and at least four members of the commission. At least half of the members of the commission, including the chairman of the commission, are representatives of professional organizations or employers in the field of road transport, whose main place of work is not RTU. Leading specialists of road transport and road transport companies, independent technical experts, specialists of the technical department of the Road Traffic Safety Directorate, specialists from the Latvian Association of Automotive Engineers and the Automobile Association are invited to the commission as industry specialists.

The commission evaluates the student's master's thesis and its defense in a closed session with a mark, based on the author's defense report and the quality of answers to questions that relate both to the developed work and to the knowledge gained in the study process. To evaluate the results of the master's thesis, a summative evaluation approach is used, in the final evaluation the evaluation of the supervisor of the master's thesis, the reviewer and each member of the State Examination Commission is evaluated and the average evaluation is determined. The development of a research model, analysis of previous research, selection of research methods, research data acquisition process, data processing and analysis, content and quality of the dissertation part, as well as the attached scientific article on master's thesis research in English and drawn up in accordance with the requirements of a journal or conference proceedings in the road transport sector. Based on the results of the development and defense of the master's thesis, the student is awarded a professional master's degree.

In order to stimulate the quality of the development of master's theses, the academic staff of the Department of Automotive develops and regularly updates methodological guidelines for the development of master's theses. The instructions are intended for students of the RTU Faculty of Mechanical Engineering, Transport and Aeronautics, Master's professional study program in Road Transport. The instructions have been developed on the basis of the instructions of the RTU Department of Studies for the design of final theses and the Regulations on final examinations at Riga Technical University.

The topics of the master's theses developed in the period since 2013 have been directly related to the Transport Development Guidelines of the Republic of Latvia 2014-2020. (improved mobility opportunities, reduced GHG emissions from transport and improved environmental quality, competitive transport and logistics infrastructure and services, increased transport safety and security, innovation and training of highly qualified professionals in the sector) and beyond (2021-2027) (improving road safety, promoting the development of micromobility and alternative mobility, intelligent technologies for traffic management, the use of alternative fuels and the development of infrastructure) and the challenges arising from the guidelines (ensuring convenient, accessible, reliable mobility for people and goods, energy-efficient transport and efficient, the development of smart, sustainable solutions for the development of transport and logistics services, including the development of relevant infrastructure).

Within the process of developing a master's thesis, students mostly carry out applied research. Analyzing the topics of master's theses developed during the reporting period, it can be concluded that master's students often choose topics for the field or company in which they work, as well as based on their previous education in the field of engineering in the field of road transport.

Examples of master's thesis topics in the field of micromobility and alternative mobility: Operation Quality Test of an Experimental Motorcycle (2013), Electric Formula Education Project Implementation Options in Latvia (2013), Slot – Racing Prototype Chassis Development and Analysis by Changing Weight Distribution (2017).

Examples of master's thesis topics in the field of emission reduction: Research of Rapeseed Oil Injection in BELARUS 800 tractor (2013), Study of the Engine Parameters Running with Gasoline and LPG (2013), Deployment Possibilities of Electric Drive Buses in Riga Public Transport Bus Routes and Charging Station Project (2013), Plastic waste recycling into diesel engine fuel (2014), Diesel particulate filter (DPF) effects on engine operating parameters (2014), Periodic Car Technical Test Data Analysis (2016), Analysis of Electric Vehicles Energy Consumption and Fast Charging Parameters (2016), Development of Internal Combustion Engine Laboratory Test Bench (2016), Indirect-Injection Engine Pressure Data Analysis (2016), Research of Tyre Adhesion on Road Horizontal Markings (2016), Inline Fuel Injection Pump Injection Pressure Depending on Fuel Kinematic Viscosity (2016), Cetane Engine IDT-69 Equip with Critical Flow Nozzle (2017), Compression Ignition Fuel Additive Evaluation Using a Research Engine (2017), Effect of Adding Butanol on Diesel Engine Combustion Characteristics (2018), Evaluation of Effect of Diesel Fuel Additive on Combustion in CFR Engine (2018), Measurement of the mechanical efficiency of a spark ignition engine (2019), Twin choke sidedraught carburettor operation analysis (2019), Influence of isopropanol additive on diesel fuel combustion parameters (2019).

Examples of master's thesis topics in the field of traffic safety: Off-Road Truck Passability (2013), Tire Tread Depth and Age Analysis of Vehicles Used in Latvia During the Winter Season (2015), Riga City Unregulated Pedestrian Crossing Hazard Research According to Traffic Safety Parameters (2016), Research of Tyre Adhesion on Road Horizontal Markings (2016), Periodic Car Technical Test Data Analysis (2016), Influence of Coordinated Traffic Light Control on Road Traffic in Riga City (2016), Power Supply Voltage Effect on Car Headlamp Photometric Characteristics (2016), Assessment of Drivers Work and Rest Periods in Public Transportation Company (2016), The Impact of The Stationary Speed Cameras on Traffic Flow Speed (2017), Inappropriate HID Bulb Usage Impact on Headlight Parameters and Traffic Safety (2017), Public Transport Bus Road Traffic Accidents on Riga City Routes (2017), Shock Absorber Fluid Quantity Impact on Shock Absorber Performance (2018), Car Speed and Fuel Consumption OBD Measurements in Riga City (2018), Factors affecting commercial vehicle driver fatigue (2019).

Examples of master's thesis topics in the field of competitive transport and services: Analysis of Riga Public Transport Roadside Assistance Service and Proposals for Optimisation (2013), Performance estimation for electric sports car in the Pikes Peak race track (2014), Automotive workshop work improvement, using work records (2014), Corrosion research of car bodies (2014), Periodic Car Technical Test Data Analysis (2016), Evaluation of Impact of Turbo-charging System

Intercooling Efficiency on Vehicle Dynamics (2017).

The most common shortcomings in the development of master's theses that need to be corrected during the development of master's theses are: in the introduction and also in other chapters students often present the knowledge gained during the study (including the development of the master's thesis), copy transcripts and images from information sources. In previous research analysis, students often only present research reports, reports of scientific conferences, scientific publications, describe such sources of information, the content and quality of which do not correspond to the scientific and research level of the master's thesis. In the section of research results, students often evaluate and analyse the results. In conclusions provide conclusions that do not follow from the results of the research carried out by the student, the conclusions often provide a justification of the topicality of the topic or a report on the work done. The list of sources of information often includes vague, inaccurate, difficult-to-identify and difficult-to-find sources of information.

In order to eliminate the mentioned shortcomings, it is suggested to choose topics of master's theses relevant to the national economy, not to recount the knowledge gained during the studies (including the elaboration of the master's thesis) in the introduction and other chapters, not to rewrite texts and images from information sources. We encourage a detailed analysis of such research reports, scientific conference reports, scientific publications, the content and quality of which correspond to the scientific and research level and direction of the master's thesis, thoroughly and comprehensively argue the results in both to summarize and present in tables, pictures, graphs so that they are transparent and can be described in the shortest possible form. In the conclusions and proposals we suggest to indicate the conclusions that do not follow from the results of the student's research, to arrange the conclusions according to their significance, as to indicate the most important conclusion obtained in the process of elaboration of the master's thesis, to indicate specific, identifiable and precisely findable sources of information in accordance with the procedure specified in the list of information sources.

## 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 provision,has significantly improved since the Laboratory House was built for the Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA), where it was possible to establish laboratories from 2016. The Department of Automotive Engineering could house the Automotive Engine Laboratory, which was previously located in a private area with very little facilities, as well as the Automotive Operation and Diagnostic Laboratory, which, according to an agreement with Robert Bosch Latvia, also housed the Bosch Training Centre, providing access for students to Bosch laboratory equipment. Several master's study courses were planned in the new laboratory.

In the summer of 2019, it was possible for the FMETA, including the Department of Automotive

Engineering, to move to the building of the Ķīpsala faculty at Ķīpsalas Street 6b, using the absence of study workload during the vacations. The new building was equipped with two auditoriums, a laboratory for automotive electrical equipment, which was used for the development of master's theses, a laboratory for automotive construction and mechanics, a laboratory for vehicle repair and a student projects.

Although the RTU library has always been accessible to automotive students, even when the whole special study process took place 10 km away, the location next door made the library much more accessible. In addition, in the period since the previous accreditation, the possibility for the study program to purchase books worth 1000 to 1500 EUR annually, which are available to students in the library, has significantly stabilized. If until then the lecturers of the Department of Automotive Engineering had to provide the latest books from private funds, which would be available for work in the Ezermalas Street building, then from 2019 the situation has significantly improved, worsening students' access to library resources during the pandemic. Including the database resources available through ORTUS, the provision of the information base is sufficient for the development of the study program. Especially helpful for research studies are available e-resources, including databases of scientific articles that were not available before the previous accreditation.

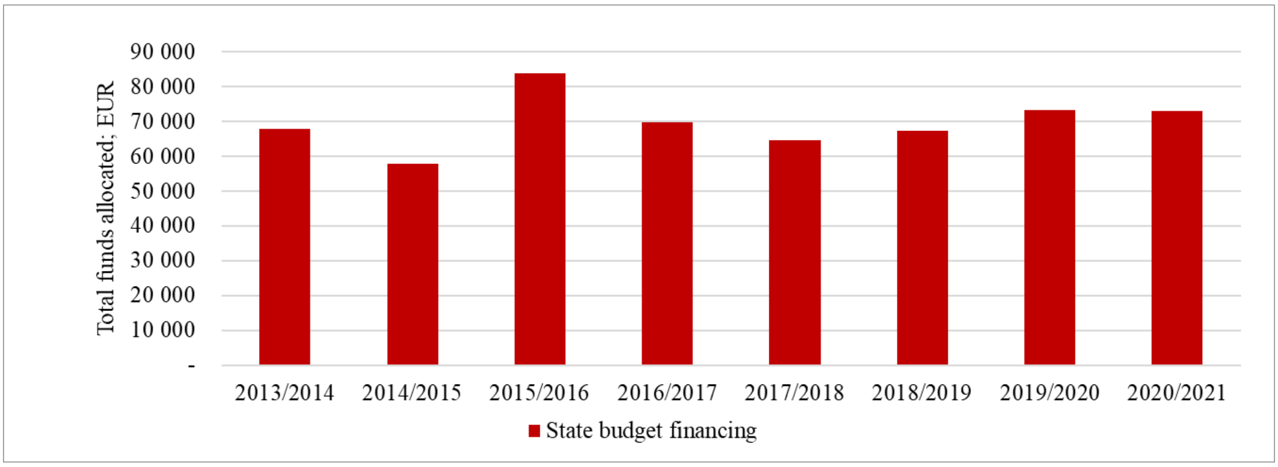
### 3.3.2. Assessment of the study provision and scientific base support, including the resources provided within the framework of cooperation with other science institutes and higher education institutions (applicable to doctoral study programmes) (if applicable).

Not 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).

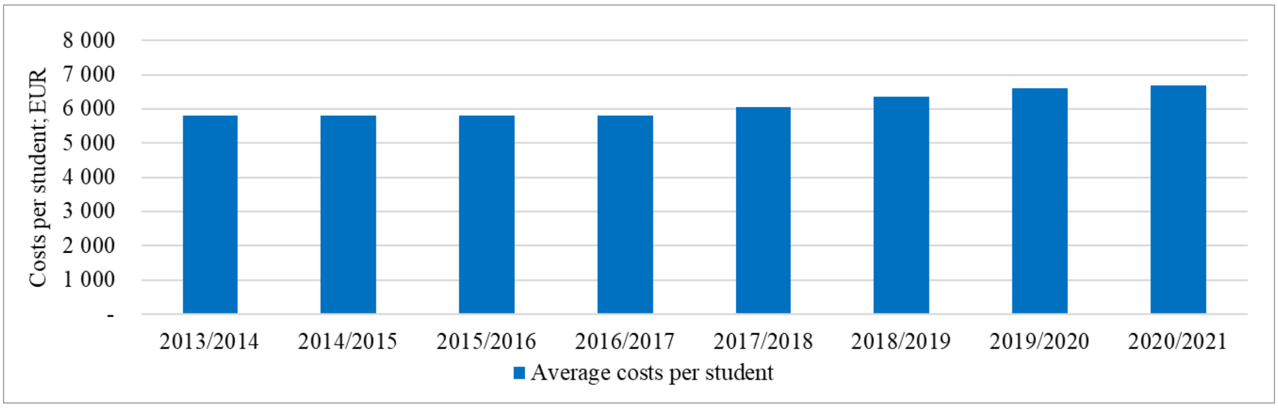
Practically all funding for the study program comes from the state budget. There have been no self-paid students in the study program, because RTU has a sufficient number of study places financed from the state budget. By attracting various private funds, including the equipment of the auditorium and the purchase of equipment, as well as the teaching staff of the study program working not only with projects, but also in other organizations, it has been managed to maintain the proper functioning of the study program. However, for the significant development of the study program it is necessary to look for additional funds.

State budget funding is calculated annually after deducting amounts to cover the university's centralised expenses according to the number of students and credits, and a number of other criteria. Changing and unpredictable funding every year does not allow much planning for development. The changes in the total funding for the study program between accreditations are shown below:




Financing for the study program MGU0, Automotive Transport Engineering

The costs per student within the study program, calculated by the Office of the Vice-Rector for Finance, are shown in the figure below.




Costs per student, MGU0, Automotive Transport Engineering

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

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

The qualification of the teaching staff (academic staff, associate visiting professors) involved in the implementation of the study program complies with the conditions for the implementation of the study program, as it is checked both in the election process of the academic staff and when concluding employment contracts. 1 professor, 2 associate professors, 1 assistant professor, 3 practical assistant professors, 2 lecturers, 1 researcher are involved in the implementation of the study program, 4 of them with a doctoral degree (8th LQF level) and 6 with a master's degree (7th LQF level).

The qualification of the teaching staff undoubtedly helps to achieve better study results. However, the changes in the composition of the teaching staff are not so dynamic that it is possible to quantify how the change in the qualification of the teaching staff affects the study process.

### 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.

Although the change in the composition of the teaching staff is not very dynamic, in order to be able to quantitatively observe the impact of the changes in the qualification of the teaching staff on the study process, there are some positive examples.

In the fall semester of 2015 and the spring semester of 2016, a visiting professor from Wayne State University, Detroit, Marcis Jansons, worked with Automotive Engineering students. All lectures of the visiting professor were attended not only by students, but also by two lecturers of the Department of Automotive Engineering - Māris Gailis and Juris Kreicbergs. Māris Gailis implemented the knowledge gained in Marcis Jansons' lectures and joint research both in the conducting study courses related to Automotive Engines (Combustion and Emissions in an Internal Combustion Engines) and in his doctoral thesis, which was defended in 2020 on the potential for reducing emissions from bioethanol combustion in positive ignition engines.

Due to the very minimal funding, it is impossible to attract young teachers to the study program, attracting them financially. Therefore, the involvement of several new and high-quality teachers, all of whom have been among the best graduates of the study program, in the teaching of specialization courses is particularly successful.

From 2015, after completing a professional bachelor's and professional master's program in automotive engineering as well as a master's program in Germany, and four years of experience in the world-leading automotive research company FEV, Deniss Makarčuks joined the Department of Automotive Engineering while working in research and internal combustion engines development at UAV Factory. Deniss teaches the study courses Automotive Propulsion System Integration and Internal Combustion Piston Engine Technologies in the master's program.

Introducing a new study course Electric Road Vehicles Technology, the first year of the study course was taught by Arnis Rubīns, a graduate of the RTU Automotive Engineering program with further studies in an international study program of three countries, acquiring new electric car technologies and gaining practical work experience in Latvia, working with electric go-karts and electric bicycles. Unfortunately, after the first year of teaching, direct responsibilities in the main job at Aerodium, where Arnis is the technical director and develops new products, led to the termination of student training.

Therefore, the involvement of Artūrs Bogdanovs, another graduate of the RTU professional bachelor's program in automotive engineering, in teaching the new study courses Electric Automotive Technology, Innovative Automotive Technology and Sustainable Vehicle Technology after graduating from Ingolstadt University of Technology in Germany and working experience at the Latvian bus manufacturing company AMO Plant and trolleybus development project at Riga Electrical Engineering Factory.

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

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

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

The study process is not effectively possible without the mutual cooperation of the teaching staff within the structural unit responsible for the study program. There are separate study courses (Research in Road Transport, Road Traffic Safety, Sustainable Multimodal Transport Technology, Basics of Safe Driving and Teaching Methodology), where even lectures are led by several lecturers, while the work of different lecturers in lectures and practical or laboratory work is practiced for a long time. Cooperation between the teaching staff of different structural units is limited both by the RTU funding mechanism and, until 2020, by the location of the faculty in another district of the city. From 2020, when MTAF is located in Ķīpsala student campus, a practically new opportunity for cooperation with other faculties has opened up.

It is very difficult to determine the exact ratio of the number of students and lecturers within the study program, as many lecturers work part-time, as well as are involved in the provision of various study programs. There are a total of 23 day students in the study program at the time of submitting the self-assessment report. Around 10 lecturers work with the students of the study program, the number of which is variable and who are also involved in the provision of other study programs.

# 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 | MGU0_diploms_dipl_supple.zip | MGU0_diploms_dipl_pielik.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) | | |
| 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 | MGU0_stud_statist.pdf | MGU0_stud_statist.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 | MGU0_StEdSt_6_annex.pdf | MGU0_ValzSt_6_pielik.pdf |
| 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) | MGU0_ProfSt_7_annex.pdf | MGU0_ProfSt_7_pielik.pdf |
| 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 | MGU0_CoursMapp_8_annex.pdf | MGU0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MGU0_CurricStPogr_9_annex.pdf | MGU0_StudProgrPL_9_pielik.pdf |
| Descriptions of the study courses/ modules | MGU0_DescriptStud_cour.zip | MGU0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | Internship_Management_Procedure.pdf | Prakses_organizesanas_kartiba.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Automotive Transport Engineering (42525)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Automotive Transport Engineering* |
| Education classification code | *42525* |
| Type of the study programme | *Professional bachelor study programme* |
| Name of the study programme director | *Juris* |
| Surname of the study programme director | *Kreicbergs* |
| E-mail of the study programme director | *juris.kreicbergs@rtu.lv* |
| Title of the study programme director | *MSc., MBA, Docents* |
| Phone of the study programme director | *29245628* |
| Goal of the study programme | *The aim of the study program is to provide professional bachelor education in Automotive Engineering to facilitate sustainable and high quality operation and development of automotive transport industry providing society with safe, environmentally friendly and efficient mobility solutions.* |
| Tasks of the study programme | *1. To provide students with knowledge, skills and competencies that are required by European transport businesses and Latvian employers;*<br>*2. To provide students with comprehensive basic, specialized and selective high achievements knowledge common for automotive industry and to facilitate skills of critical analysis of the knowledge;*<br>*3. To build skills to create, introduce and develop road vehicle maintenance and repair technologies;*<br>*4. To develop skills to implement and manage the road transport system formation and development activities and to create innovations.* |
| Results of the study programme | *Graduates of the study programme are:*<br>*1. Able to demonstrate basic, specialized and high achievement knowledge in the automotive transport sector as well as a critical understanding of this knowledge;*<br>*2. Able to develop, implement and improve design, construction, maintenance and repair technologies used in the automotive transport sector;*<br>*3. Capable to provide professional education and create professional training programs in the automotive transport sector;*<br>*4. Able to promote, implement and manage innovations and automotive transport system formation and development activities;*<br>*5. Able to apply knowledge for creation, development and management of integrated and balanced road transportation system;*<br>*6. Able to demonstrate an understanding of key concepts and theories in the automotive transport sector.* |
| Final examination upon the completion of the study programme | *Bachelor's Thesis with a Design Project* |

## Study programme forms

**Full time studies - 4 years, 6 months - latvian**

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *4* |
| Duration in month | *6* |
| Language | *latvian* |
| Amount (CP) | *180* |
| 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 automotive engineering* |
| Qualification to be obtained (in english) | *Automotive engineer* |

**Places of implementation**

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

**Part time extramural studies - 5 years - latvian**

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *5* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *180* |
| 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 automotive engineering* |
| Qualification to be obtained (in english) | *Automotive engineer* |

**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 professional bachelor's study program Automobile Transport was established in 2004 by the decision of the RTU Senate of December 13, protocol No. 491. The study program was created as a continuation of the training of automotive engineers at RTU, which was started in 1977. Since the establishment of the study program, its basic parameters - the amount of 180 CP, the nominal duration of studies is 4.5 years for full-time and 5 years for part-time studies, no changes have been in awarding the engineer qualification in automobile transport and professional bachelor degree in automobile transport, the alterations only concerned the study courses, changes taking place in 2008, 2017 and 2021.

The previous accreditation of the study program was performed in 2013.

In 2017, in accordance with the RTU Senate decision of March 23, 2015 “On Riga Technical University Uniform Requirements for Study Programs” (URSP) and taking into account the development of the automotive industry, the study module Innovative Product Development and Entrepreneurship that includes business, technology transfer and product development professional competencies, replacing the elective courses in economics and management and the basic course in economics, as it is already taught more fully in secondary education. Also, with the development of students' computer skills, the more general course Computer Science, where students learned the basics of Mathcad, was replaced by Computer Technology in Transport, a widely used computing environment for engineering, such as Matlab. In order to ensure the involvement of young students in research, the study course Introduction to Specialty was extended to Introduction to Specialty and Automotive Research. Taking into account the graduates' assessments that they would have wanted deeper design skills in the study program, Mechanical Engineering Drawing and Road Vehicle Technological Equipment Design were introduced. Following the development of automotive technologies, two study courses Electric Road Vehicles Technology and Innovative Automotive Technology have been introduced. Due to the difficulties of students to develop the study project Automotive Dynamics, the number of credit points in Automotive Dynamics has been increased. Pursuant to the requirement of URSP, which stipulates that the humanities subjects that develop communicative and organizational skills must be included in the limited elective part of the program, the section of optional study courses in humanities and social sciences has been increased to 4 CP, including the Basics of Communication and Fundamentals of Law, expanding the choice with the study course Sociology of Personalities and Small Groups, so that the list of optional courses would be more equal for transport study programs. According to the URSP, Sports has been excluded from the study program, giving students the opportunity to participate in sports activities in a new order. The titles of several study courses have been upgraded and the courses have been transferred between the parts of the study program. The addition of extra courses and the increase of credit points was mainly carried out in accordance with the URSP, reducing the amount of Practical Placement from 26 to 20 CP, which was purposeful, as almost all senior students already worked in the specialty, and the bachelor's thesis was reduced from 16 CP to 12 CP because large-scale bachelor's thesis together with student employment created problems to complete studies. The title of the study program in English was changed to Automotive Engineering.

In 2021, in accordance with the URSPs amended by the RTU Senate on March 30, 2020, the study course of environmental protection in the amount of 1 CP Environment and Climate Roadmap is included in the study program. Analysis and Synthesis of Mechanisms is excluded from the program to allow this inclusion. Strengthening the compliance of the study program with the automotive development trends, the amount of the study course Innovative Automotive Technology has been increased by 1 CP, also adding laboratory works. The transfer of study courses by parts of the program has also been performed.

Within the framework of the study field evaluation procedure, a change is planned to specify the degree and professional qualification to be obtained, in accordance with the standard PS-182 of the profession Automotive Engineer revised in 2021, determining the degree and professional qualification "Professional Bachelor Degree in Automotive Engineering and Qualification of Automotive Engineer". It is also proposed to change the name of the study program to "Automotive Transport Engineering". The changes were supported at the RTU Senate meeting on September 27, 2021 (protocol No. 653), deciding to submit the changes together with the evaluation and approval of the study field "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering" to the Study Quality Commission together with accreditation.

**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 study program Automotive Transport Engineering fully corresponds to the study field Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering, because an automotive engineer is essentially a mechanical engineer with a specialization in motor transport. The courses of the study program include each of the words mentioned in the Latvian title of the field - mechanics (Theoretical Mechanics, Strength of Materials), metalworking (Mechanical Engineering, Structures and Properties of Engineering Materials), heat engineering (Heat Study), mechanical engineering (Machine Elements). Slightly over 30% of the study program volume is study courses, which are acquired only by automotive students (slightly above 50%, if RTU compulsory study courses are deducted), the content of other courses is in most study programs of the field.

The title of the study program Automobile Transport was initially related to other programs in the field, Aviation Transport and Railway Transport, thus emphasizing the belonging to a single field of study and one faculty. However, the term 'road transport' is not clearly understood as automotive engineering. As the use of the word "engineering" in the Latvian titles of study programs expands, together with accreditation, it is proposed to change the study program title to "Automotive Transport Engineering", thus more precisely establishing compliance with the standard of the profession "Automotive Transport Engineer" and the corresponding professional qualification. Program codes (RMCU0) are generated at RTU level and correspond exactly to each study program.

The degree to be obtained and the professional qualification correspond to the European Qualifications Framework (EQF) level 6 with the corresponding goal and tasks, expected study results, as well as admission requirements.

The aim of the study program is to provide professional bachelor education in Automotive Engineering to facilitate sustainable and high-quality operation and development of automotive transport industry providing society with safe, environmentally friendly and efficient mobility solutions.

The tasks of the study program correspond to the aim of the study program and are to provide students with knowledge, skills and competencies that are required by European transport businesses and Latvian employers, to provide students with comprehensive basic, specialized and selective high achievements knowledge common for automotive industry and to facilitate skills of critical analysis of the knowledge, to build skills to create, introduce and develop road vehicle maintenance and repair technologies, to develop skills to implement and manage the road transport system formation and development activities and to create innovations.

The planned study results are subordinated to the aim and tasks of the study program, creating studies so that the graduates of the study program are able to demonstrate basic, specialized and high achievement knowledge in the automotive transport sector as well as critical understanding of this knowledge, able to develop, implement and improve design, construction, maintenance and repair technologies used in the automotive transport sector, capable to provide professional education and create professional training programs in the automotive transport sector, able to promote, implement and manage innovations and automotive transport system formation and development activities, able to apply knowledge for creation, development and management of integrated and balanced road transportation system, able to demonstrate understanding of key concepts and theories in the automotive transport sector.

The volume of the study program 180 CP has been chosen so that in addition to the regulations on the second level professional higher education state standard and RTU uniform requirements for study programs, the study courses of the study field and only the study program specific study courses could be included in a sufficient amount. The duration of implementation 4.5 years for full-time studies corresponds to the amount of 180 CP. Duration 5 years of part-time study is a challenge for many part-time students, but some students are able to meet the required time.

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

The offer of the study program has allowed practically all full-time student groups to be completed, which from the economic point of view is significantly more useful than working with small groups of students. As a large part of the study courses coincide with those offered in other study programs and by the Transport Institute, which is the structural unit responsible for the program, many courses are developed as outsourcing from other structural units, which reduces the total cost per student while maintaining higher study quality.

An automotive engineer is not among the regulated professions; therefore, no public registers are maintained on the number of automotive engineers working in the specialty. RTU's e-mail addresses created during studies and, accordingly, the addresses stored in the study database name.surname@rtu.lv were discontinued after graduation, thus making it difficult to communicate with graduates about their employment, therefore two options have to be used as employment criteria. The first - starting the employment of senior students before graduation. Throughout the period between accreditations, most senior students are already employed in the profession, thus demonstrating the need for trained professionals. The second is the number of graduates who are interested in vacancies in the specialty and asking advice from university lecturers. The last time such an interest was felt was during the 2008 crisis, and in recent years there have been only a few cases of interest in a specific, narrowly limited area of employment, such as an expert in road traffic accident reconstruction.

### 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 students in the study program are shown graphically in Annex 5, where the analysis of the change in the number of students is also performed.

From 2013, the number of students enrolled in the study program with funding from the state budget practically depended only on the number of admission places allocated, including in 2016, when the Faculty of Mechanical Engineering, Transport and Aeronautics conducted an experiment to enroll more students than usual; 81 students, thus filling the proposed number of budget funding places. In other years, 55 to 69 students were admitted, depending on the number of places offered. The number of students admitted for tuition fees also depended greatly on the number of state budget financed study places offered at the secondary enrollment in other study programs. The trend of the last five years is that there are up to ten students enrolled in the first year who do not start their studies and do not even try to complete the first semester. As a good indicator of how many students do not start their studies after joining, one can see the ORTUS study course Introduction to the specialty and automotive transport research, where no prior knowledge is required and where everyone has a small task to complete and submit to ORTUS. As of 2013, an average of 8 students, or 14% of those enrolled, did not even join the study course at least once, but the simple assignment was submitted by an average of 37 students, or 62% of those enrolled in the study course. The highest number of enrolled students did not even seriously start their studies in 2016 (24%), the lowest in 2020 (4%, apparently after months spent online in the school due to pandemics, students wanted full-time studies). In 2020, the largest percentage of students also submitted simple homework, which was necessary to achieve a positive assessment in the study course (78%), however, even then it was seen that more than 20% did not even try to pass the first semester. As the number of students trying to complete the first semester has increased in recent years, it can be considered that the work with first-year students is improving.

The number of full-time students admitted for a fee has changed from 0 to 15, in most cases from 3 to 7 students. In formal statistics, cadets who, in cooperation with the Latvian National Defense Academy at RTU, were trained together with Road Transport students, were are also included in the study program externally financed student statistics, as they were assigned a separate study program code but were not assigned a different study program name, and they took courses from the program in the amount of 76 CP. The cadets later completed their studies at the NDA and obtained a professional bachelor's degree in military command of the Land Forces. In total, slightly more than 150 NDA cadets have studied at RTU. Paid students studying without study debts (except for NDA cadets) had the opportunity to transfer to state-funded study places. This was used by the majority of self-financed students, so it is not worth listing separately graduates that have studied for fee.

The number of part-time students has ranged from 7 to 24, with a minimum in 2021, apparently due to the pandemic. However, the number shown corresponds more to the number of students who submitted documents and made the first payment, as the number of active students at the end of the first semester which did not exceed 10, judging from the feedback, due to the unexpected amount of mathematics. Part-time students in the study course Introduction to the specialty and automotive research ORTUS have not looked at a little over 30% of the enrolled students on average, but only about 30% have tried to get a grade. Here, too, student activity has grown in recent years.

As described above, the dynamics of a larger decrease in the number of students is observed between the first and second year of study, usually between 20 and 30% for full-time students, but between 2020 and 2021 due to pandemics and distance learning, including the observed tendency not to start the studies, exceeded 50%. In further study years, the trend usually decreases, being in the range of 10 to 20%. For part-time students, the decrease after the first year of study is between 40 and 70%, after the second year of study 20 to 50%, further remaining at around 20%.

The consequences of the dynamics of the decrease in the number of students are the number of graduates. Each year, 13 to 22 full-time students and 3 to 6 part-time students graduate from 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 information included in the study courses, the results to be achieved, the set goals, the content of the permanent work comply with the goals and results of the study program, as well as the requirements of the professional standard Automotive Engineer PS-182.

In order to provide the society with safe, environmentally friendly and efficient mobility solutions, students acquire the knowledge and skills of a mechanical engineer, which envisages the development, use and utilization of safe and environmentally friendly vehicles and their maintenance technologies. Students learn modern technologies that are more environmentally friendly, including electric car technologies. Road Traffic Safety is covered in a separate study course, modern mobility solutions in the study course Road Transportation.

The requirements of the industry in 2021 have been renewed in the standard of an automotive engineer developed by the representatives of industry organizations, led by the Confederation of Employers, where duties and tasks are assigned to a road transport engineer.

Development of vehicle constructions is acquired both in such study field common courses as Descriptive Geometry and Engineering Graphics, Mechanical Engineering Drawing, Computer Graphics in Mechanical Engineering and Machine Elements, as well as in a special Vehicle Construction Course. The development of kinematic, hydraulic, electrical and pneumatic circuits of automotive technological equipment is acquired in the study courses of Theoretical mechanics, Fluid mechanics, Electrical engineering and Electronics, Fluid Mechanics, and Electropneumatic Technique, which are later integrated in the course Design of Vehicle Technological Equipment. Studies of the Structures and Properties of Engineering Materials and Material Science help to select the materials of automotive structures and their processing technologies. Learning the basics of Strength of materials helps to calculate the properties of parts and structures of automotive products. To analyze the advanced technology of road transport products, students train in Vehicle mechanics study courses. The acquired skills in Transport Computer Technologies and Vehicle Dynamics help to model the operation of the vehicles and their components. Students learn to develop documentation for automotive designers by developing five projects of the study program, including the Bachelor's thesis with the project part.

The first stage of the development and production of automotive and road transport technological equipment – the prototyping is studied in Innovative product development and Entrepreneurship course, automotive product production technology and production technological process planning are mastered by studying Mechanical engineering technologies, automotive product and prototype testing is learnt in Automotive testing elective course, the development of technological documentation is practiced in study projects and final thesis.

Planning and organization of operation processes of vehicles and their technological equipment, acquisition of effective diagnostic methods for determining the technical condition and organization of technical operation of fleets are analyzed in study courses Vehicle Maintenance, Automobile Electrical and Electronic Systems. Heat study, Automotive Engines and Electric Road Vehicles Technology help to understand the optimal energy supply and energy efficiency of vehicles and their technological equipment. The study course Vehicle Fuels, Lubricants and Liquids promotes the sustainable and economically sound use of automotive materials. Students practice technological planning of automotive companies both in the course of Automotive companies and in the development of bachelor theses.

Students practice the development, implementation and improvement of vehicle repair technologies, evaluating the possibilities of road vehicle and its technological equipment performance and resource renewal, developing mechanization and automation tools for vehicle repair in Automotive Repair Technology and Road Vehicle Technological Equipment Design courses.

Students learn the creation of a safe and sustainable environment in road transport by improving environmental technologies in automotive companies, both in the Basics of Labor Protection and Civil Defense course and in the Environment and Climate Roadmap course, each student developing occupational health and safety and environment protection chapters in their final thesis.

The education of staff and the development of modules of professional training programs in the field of road transport as a duty of an automotive engineer are endorsed both by acquiring professional specialization courses in the field specific professional study courses and humanities and social sciences study courses.

Students learn the development of a sustainable road transport system, advanced automotive technology systems, freight and passenger transport technology systems and logistics schemes in the Road Transportation course. The basics and theoretical substantiation of road safety are covered in the Road Traffic Safety course. Entrepreneurship in the field of road transport, including the ability to analyze the usefulness of the company's technological assets, students acquire by studying Economics and Management of Transport, as well as each student in the bachelor's thesis develops a business analysis chapter, looking at the business plan of their technological offer.

The implementation and observance of the general basic principles of professional activity for students is practiced by most general education study courses. The study courses Introduction to Specialty and Automotive Research, General Metrology, Basics of Labor Protection, Civil Defense help to comply with the regulations, standards and other requirements binding on the field, including labor protection, civil protection, environmental protection and fire safety. Professional terminology in the state language is used and developed in practically all study courses. To communicate in professional English, using professional terminology, students study for two semesters in the first year and using literature in foreign languages in other studies.

The updating of study courses is carried out by the structural units responsible for the study courses, the teaching staff responsible and the teaching staff involved in the implementation of the study courses. Changes in study courses with less variable content (Mathematics, Physics, Chemistry for Engineers, Descriptive Geometry and Engineering Graphics, Theoretical Mechanics, etc.) are based on solving the problems of computer technology entry.

**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).**

Not 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 study program is implemented in the traditional way of RTU, dividing contact hours into lectures, practical work and laboratory work. The usefulness of modular study training in the implementation of the bachelor's study program is limited by the involvement of many structural units in the provision of studies therefore the studies are not organized in modules. The benefits of involving a larger number of departments are valued higher than the organization of module training, which is more difficult to coordinate and plan due to the large number of departments.

This is not a joint study program; the study program is not implemented in a foreign language or in the form of distance learning.

Many principles of student-centered teaching and learning (SCL) are followed in the study process. The contingent of students and the diversity of their needs are considered and respected. Concluding that the study program is chosen by many students with insufficient secondary school level knowledge, an additional elective study course Elementary mathematics has been created at RTU level, which students acquire according to the test results. In its turn, the study course Automotive Science Fundamentals is offered to the first-year students of automotive engineering, in the form of a free elective course, in which the concepts of mechanics, electricity and optics of secondary school physics are considered based on the automotive technology examples. The course also provides an insight into machine elements, as students' previous experiences of young technicians also differ significantly.

As the pedagogical methods used in each study course are chosen by the responsible lecturers and pedagogical methods are not determined centrally, their great diversity is possible.

The student's tendency to independence is promoted, at the same time the guidance and support of the teaching staff is provided. Mutual dignity is fostered in the relationship between student and teacher, even when it may seem exaggerated to senior teachers.

There are appropriate procedures for dealing with student complaints. However, it can be stated that complaints are quite rare. However, not all complaints are resolved at the study program level.

All assessors are informed and familiar with the examination and examination methods, receive support to improve their assessment skills. There is a requirement of RTU that the evaluation criteria and methods, as well as the criteria for posting marks, have been previously published in the e-learning environment ORTUS.

There is a procedure for reviewing student appeals, but no appeals have taken place, due to low interest of employers in student assessment, in many cases students are not interested in receiving a higher grade, but students who want a higher grade are informed about the assessment system at the beginning of the semester.

**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 study program includes a practical placement in the amount of 20 CP. Currently, the internship is organized in the autumn semester for the 3rd, 4th and 5th year students with a credit distribution of 5 + 5 + 10 CP. Several options for organizing internships have been tried in recent years. From the organizational point of view and the possibility to get a better internship place, the internship at the end of the studies was the best, working on the bachelor's thesis in parallel with the internship. This type of internship organization led to the deep involvement of students in the workplace and left many people with the time and desire to return to developing a bachelor's thesis. The attempt to organize an internship two days a week led to a deeper involvement of many students in the company's operations, when two days a week was no longer enough. It came to the current model, when students can go to practice at the beginning of the semester in September and October. Students who want a longer employment, if the company wants it, have the opportunity to start working on an internship already in the summer, thus eliminating the main disadvantage of organizing such an internship - the short internship period, when it is difficult to fit into the company environment.

Students who want it have the opportunity to receive help from the university to find an internship, but it is rarely used, because the workforce in the industry is also in demand for a shorter period of time, students have the opportunity to choose an internship closer to home or personal interests where one can get paid for the work. In addition, students are encouraged to choose a type of employment where they have less experience, which is very individual for each student.

The study program is not implemented in a foreign language, therefore there are no language barrier problems for students in practice places. However, students are encouraged to work abroad, which has been used by several students, including through the ERASMUS program.

During the internship students develop knowledge and skills specific to the automotive industry, improve the design, construction, operation and repair of road transport technologies, in practice observe the development and improvement of automotive systems, improve the understanding of the most important concepts and regularities of the automotive industry.

### 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.

The bachelor's thesis is the final work of the professional bachelor's study program, which confirms the achievement of the study results planned in the study program. The elaboration and defense of the bachelor's thesis is a part of the final examination of the practical bachelor's study program, the aim of which is to assess the theoretical level of the student's readiness, the ability to apply knowledge in solving engineering issues.

The bachelor's thesis is developed on current automotive industry issues. The bachelor's thesis is developed on a topic chosen by the student or on a topic recommended by the Department of Automotive Engineering. The topics of the work include topical issues that correspond to the guidelines for the development of transport in the period or scientific and technical achievements and the market situation of goods and services.

The main areas of work are projects related to the development of new structures (design or improvement of new machines, units and assemblies, design, maintenance, assembly, dismantling, repair, restoration and restoration of machines, assemblies and parts; design of machines, assemblies, assemblies design of training and research equipment), technological design of vehicle maintenance and repair companies or individual areas with the development of in-house equipment, development of new technologies or improvement of the technological process with the development of technological equipment, any other projects relevant to the study program, solutions, content and investment of time required to meet the requirements of the bachelor's study program and current economic issues in the field of road transport.

The elaboration of the final work takes place according to the work completion schedule, which is developed by the student together with the supervisor. The actual progress of each student's final thesis is supervised by the supervisor. During the elaboration of the bachelor's thesis, in accordance with the study schedule, mid-term examinations-discussions of the bachelor's thesis are organized, in which the students present the progress of the elaboration of the thesis. In the last semester, weekly discussions are organized for the last three months. In the last test (pre-defense), the results of the work are checked by a commission of academic staff appointed by the Department of Automotive Engineering. The aim of the pre-defense is to evaluate the results of the work development and to provide the student with recommendations for the improvement of the work until its defense. If the commission in the pre-defense of the bachelor's thesis finds that the student has not fulfilled the task of the bachelor's thesis and the requirements set for the thesis, then the student is not admitted to the defense of the bachelor's thesis. In that case, the student is given the opportunity to improve his or her performance and defend his or her work at the end of the next study semester.

Experienced, qualified specialists in the field of road transport who work outside the RTU structural unit represented by the bachelor's thesis supervisor or in another organization outside RTU, or other qualified specialists by order of the dean of MTAF, are appointed as reviewers of the bachelor's thesis. Since 2019, we have introduced the practice of appointing experienced graduates of the specialty of automotive engineering as reviewers of bachelor's theses. In the future, it is planned to cooperate more closely with the Latvian Society of Automotive Engineers (LSAE) in order to involve the specialists in the field of road transport represented by LSAE in the review of bachelor's theses.

The bachelor's thesis is defended publicly in the State Examination Commission. Students' performance in the development of a bachelor's thesis in final examinations is evaluated by the final examination commission, which is established in accordance with the Regulations on Final Examination Examinations at Riga Technical University approved by the RTU Senate.

The State Examination Commission of the Professional Bachelor's Study Program consists of the Chairman of the Commission and at least four members of the Commission. At least half of the members of the commission, including the chairman of the commission, are representatives of professional organizations or employers in the automotive sector whose main place of work is not RTU. The State Examination Commission consists of at least two doctors of the relevant field of science. Leading automotive specialists of road transport and road transport companies, independent experts, specialists of the technical department of the Road Traffic Safety Directorate, specialists from the Latvian Association of Automotive Engineers and the Automobile Association are invited to the commission as industry specialists.

A summary evaluation approach is used to evaluate the results of the bachelor's thesis, in the final evaluation the evaluation of the bachelor's thesis supervisor, the reviewer and each member of the examination commission is evaluated and the average evaluation is determined. In the final examination, the student defends not only the findings and results developed in the bachelor's thesis, but also the examination of the knowledge acquired in the most important study courses. Engineering solutions, inventions, scientific research, patents, information analysis, systematization, comparison and evaluation of information, logical argumentation of the chosen constructive or technological variant or conclusions, substantiating it with regularities, logical judgments, engineering, economic, engineering calculations etc. are evaluated.

Based on the results of the development and defense of the bachelor's thesis, the student is awarded a professional bachelor degree and an engineer's qualification.

The information sources and materials required for the bachelor's thesis are also obtained during the internship by being in the field of road transport or similar companies.

In order to promote the quality of the development of bachelor's theses, the Department of Automotive Engineering regularly updates methodological guidelines for the development of bachelor's theses. General methodological instructions for the development of a bachelor's thesis for students of automotive engineering are offered, Instructions for drawing up a part of the bachelor's thesis description for students of automotive engineering as well as auxiliary material for the development of a graphic part of a bachelor's thesis for students of automotive transport. The instructions are intended for RTU Faculty of Mechanical Engineering, Transport and Aeronautics and the Department of Evening and Correspondence Professional Bachelor of Road Transport. The instructions have been developed on the basis of the instructions of the RTU Department of Studies for drawing up the final theses and on the Regulations on final examinations at Riga Technical University.

The topics of the bachelor's theses developed in the period since 2013 have been directly related to the Transport Development Guidelines in the Republic of Latvia 2014-2020 (improved mobility opportunities, reduced GHG emissions from transport and improved environmental quality, competitive transport and logistics infrastructure and services, increased transport safety and security, innovation and training of highly qualified professionals in the sector) and beyond (2021-2027) (improving road safety, promoting the development of micromobility, intelligent technologies for traffic management, the use of alternative fuels and the development of infrastructure) and the challenges arising from the guidelines (ensuring convenient, accessible, reliable mobility for people and goods, energy-efficient transport, the development of smart, sustainable solutions for the development of transport and logistics services, including the development of relevant infrastructure). The topics of the bachelor's theses have been related to the solution of economic problems and the provision of services in the road transport sector, public transport companies, the National Armed Forces, the fire service, people with special needs, etc.

Examples of bachelor thesis topics in the field of micromobility and alternative mobility: Off-road vehicle reduction hub project (2013), Electric bicycle project (2014), Buggy design project (2014), Electric Go-Kart Project (2015), Project of Electric Motorcycle (2015), Snow Blower Project (2015), Style Bicycle Project (2015), RC buggy project (2016), Project of electric powered velomobile (2017), Pneumobile chassis and control devices (2017), Pneumobile powertrain (2017), Pedal Go Kart Project (2018)

Examples of bachelor's thesis topics in the field of emission reduction: Electric vehicle project

(2013), Synthetic fuel pyrolysis reactor (2013), Biogas station project (2014), Waste oil product transportation and suction equipment (2014), Project of electric powered velomobile (2017), Diesel fuel lubricity test rig project (2019)

Examples of bachelor thesis topics in the field of traffic safety: Mobile Roller Brake Tester Project (2013), Reconstruction of Technical Inspection and Diagnostics Post at No2 Fleet of Trolleybuses of Rīgas Satiksme Ltd in Riga (2013), Mobile test station project (2015), Tyre Rolling Resistance Test Machine (2016), Tyre Treadwear Testing Machine Project (2016), Automobile skid inducing device (2016), Kit for motorcycle driving skills improvement (2016), Project of Emergency Braking Test Machine (2017), Seat belt usage convincer (2017), Adaptive high beam headlight prototype project (2020).

Examples of bachelor thesis topics in the field of competitive transport and services: E.M.R Ltd car service workshop reconstruction project (2013), BM Auto service workshop reconstruction project (2013), Project of Timber Transportation Trailer (2013), Offroad vehicle reduction hub project (2013), Project of National Armed Forces vehicle technical inspection and maintenance center (2013), Bus AMO PLANT Ambassador SB-180 and SB-200 pneumatic system optimisation (2014), Car mounted wheelchair lift (2014), Rebuilding Project Of Porsche 924 (2015), Truck workshop "Scania Latvia" Daugavpils service center reconstruction project (2015), Renault Kerax Fire Truck Water Tank Project (2016), O1 category`s universal trailer project (2017), Auto body rotisserie (2017), Auto Garkalne Ltd Car Service Workshop Project (2018).

The most common shortcomings in the development of bachelor's theses that need to be corrected during the development of bachelor's theses are: analogous analysis is not the analysis of the product as a whole and its component assembly’s technological design from the perspective of designer and manufacturer but rather made as an educational text or product guide and sales offer or buyer analysis, when describing the designed object, well-known constructions and purchased assemblies are explained in the description section of the designed object, engineering calculations are not performed for the most laden structural elements and assemblies, uniform calculations are performed, standard labour protection solutions are often rewritten or normative acts are described, without offering specific solutions in relation to the device to be designed or the technology to be developed, the environmental protection chapter often rewrites standard environmental protection solutions or regulatory enactments, without offering specific solutions in relation to the device or technology under development.

In order to eliminate these shortcomings, it is encouraged to create an analogous analysis as a product and from the point of view of the user, the designer and the manufacturer. We encourage engineering calculations to be performed on the most heavy loaded structural elements and assemblies, to perform various types of calculations. In the business analysis chapter we encourage students to envisage offering the designed equipment to the economy and other users, rather than developing the structure for own use only. In the chapter of labour protection, we encourage students to evaluate the issues of labour protection, production sanitation and fire safety related to the use of the designed equipment or the developed production technological process, and to develop and offer specific solutions related to the device or technology to be developed. In the chapter of environmental protection, we encourage students to analyse the harmful factors caused to the environment and human health of the developed object and the possibilities to reduce or eliminate them, and to develop specific effective solutions in connection with the device or technology to be developed.

## 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 base has significantly improved since the Laboratory House was built for the Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA), where it was possible to establish laboratories from 2016. The Department of Automotive Engineering was able to house there the Automotive Engine Laboratory, which was previously located in a private area with very little facilities, as well as the Automotive Operation and Diagnostics Laboratory, which, according to an agreement with Robert Bosch Latvia, also housed the Bosch Training Centre providing access to Bosch automotive diagnostics equipment. New laboratories were also available to several FMETA departments working with automotive students

In the summer of 2019, it was possible for the FMETA, including the Department of Automotive Engineering, to move to the building of the Ķīpsala faculty at Ķīpsalas Street 6b, using the absence of study workload during the vacations. The new building was equipped with two auditoriums, a laboratory for automotive electrical equipment, which was used for the development of master's theses, a laboratory for automotive construction and mechanics, a laboratory for vehicle repair and a student projects, although some vehicle repair equipment was lost during the relocation process.

Although the RTU library has always been accessible to road transport students, even when the whole special study process took place 10 km away, the location next door made the library much more accessible. In addition, in the period since the previous accreditation, the possibility for the study program to purchase books worth 1000 to 1500 EUR annually, which are available to students in the library, has significantly stabilized. If until then the lecturers of the Department of Automotive Engineering had to provide the latest books, which would be available for work in the Ezermalas Street building, from private funds, then from 2019 the situation has significantly improved, only worsening students' access to library resources during the pandemic. Including the database resources available through ORTUS, the provision of the information base is sufficient for the development of the study program. In addition, in the autumn of 2021, the lecturers of the Department of Automotive Engineering purchased individual physics textbooks in English for automotive students from funds obtained outside RTU projects, so that they could compensate for the incomplete knowledge acquired during school. The textbook project on modern automotive technologies for use by the junior students is also coming to an end.

### 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).

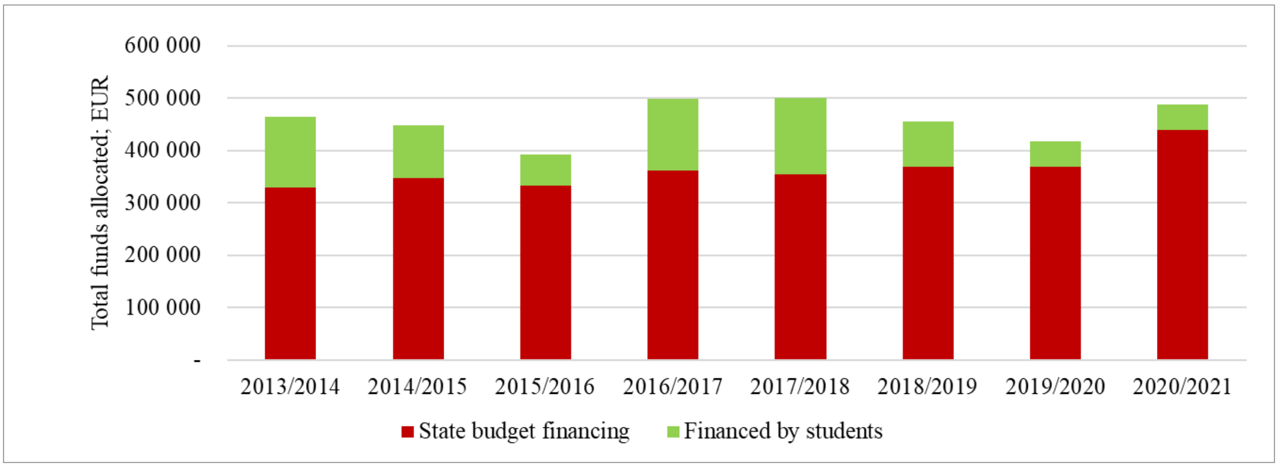
### 3.3.3. Indicate data on the available funding for the corresponding study programme, its funding sources and their use for the development of the study programme. Provide information on the costs per one student within this study programme, indicating the

**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).**

Most of the funding for the study program comes from the state budget. The share of paid students in the total funding was more significant during the period when NAA cadets were trained. By attracting various private funds, including the equipment of the auditorium and the purchase of equipment, as well as the teaching staff of the study program working not only with projects, but also in other organizations, it has managed to maintain the proper functioning of the study program. However, for the significant development of the study program it is necessary to look for additional funds

Most of the funding for the study program comes from the state budget. The share of students with external financing in the total funding was more significant during the period when NDA cadets were trained. By attracting various private funds, including the equipment of the auditorium and the purchase of equipment, as well as the teaching staff of the study program working not only with projects, but also in other organizations, it has been managed to maintain the proper functioning of the study program. However, for the significant development of the study program it is necessary to look for additional funds.

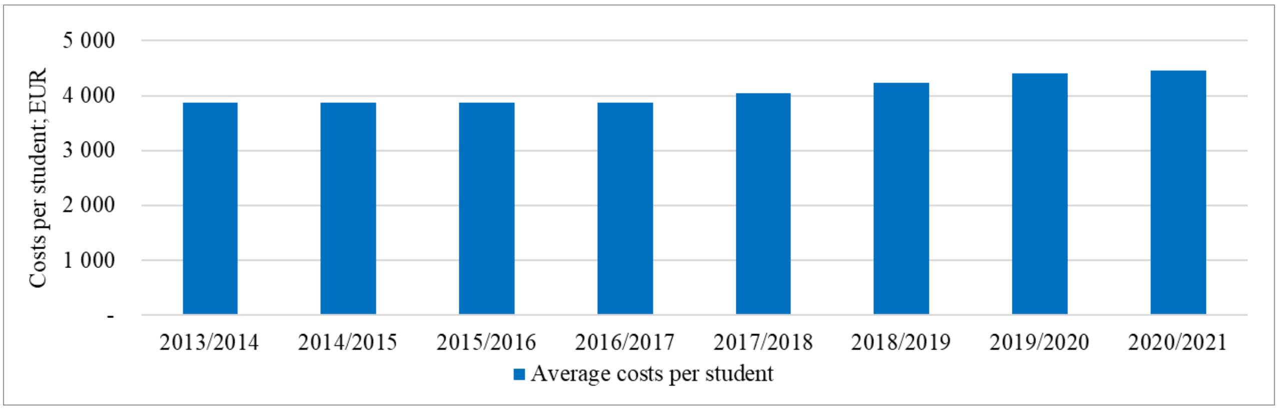
State budget funding is calculated annually after deducting amounts to cover the university's centralised expenses according to the number of students and credits, and a number of other criteria. Changing and unpredictable funding every year does not allow much planning for development. The changes in the total funding for the study program between accreditations are shown in the figure below:




Financing for the study program MCU0, Automotive Transport Engineering

The costs per student within the study program, calculated by the Office of the Vice-Rector for Finance, are shown in the figure below.

The costs per student within the period between accreditations have raised from EUR 3866 to 4463, on average near 2 % per year.




Costs per student, MCU0, Automotive Transport Engineering

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

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

The qualification of the teaching staff (academic staff, associate visiting professors) involved in the implementation of the study program complies with the conditions for the implementation of the study program, as it is checked both in the election process of the academic staff and when concluding employment contracts. 7 professors, 6 associate professors, 10 assistant professors, 7 practical assistant professors, 5 lecturers, 2 researchers, 1 research assistant are involved in the implementation of the study program, 24 of them with a doctoral degree (8th LQF level) and 14 with a master's degree (7th LQF level).

The qualification of the teaching staff undoubtedly helps to achieve better study results. However, the changes in the composition of the teaching staff are not so dynamic that it is possible to quantify how the change in the qualification of the teaching staff affects the study process.

**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.**

Although the change in the composition of the teaching staff is not very dynamic, in order to be able to quantitatively observe the impact of the changes in the qualification of the teaching staff on the study process, there are some positive examples.

In the fall semester of 2015 and the spring semester of 2016, a visiting professor from Wayne State University, Detroit, Marcis Jansons, worked with Automotive Engineering students. All lectures of the visiting professor were attended not only by students, but also by two lecturers of the Department of Automotive Engineering - Māris Gailis and Juris Kreicbergs. Māris Gailis implemented the knowledge gained in Marcis Jansons' lectures and joint research both in the conducting study courses related to Automotive Engines (Automotive Engines and Automotive Engines, study project) and in his doctoral thesis, which was defended in 2020 on the potential for reducing emissions from bioethanol combustion in positive ignition engines.

Due to the very minimal funding, it is impossible to attract young teachers to the study program, attracting them financially. Therefore, the involvement of several new and high-quality teachers, all of whom have been among the best graduates of the study program, in the teaching of specialization courses is particularly successful.

From 2015, after completing a professional bachelor's and professional master's program in automotive engineering as well as a master's program in Germany, and four years of experience in the world-leading automotive research company FEV, Deniss Makarčuks joined the Department of Automotive Engineering while working in research and internal combustion engines development at UAV Factory. Deniss participates in the teaching of professional bachelor study course Road Vehicle Dynamics (with study project).

Introducing a new study course Electric Road Vehicles Technology, the first year of the study course was taught by Arnis Rubīns, a graduate of the RTU Automotive Engineering program with further studies in an international study program of three countries, acquiring new electric car technologies and gaining practical work experience in Latvia, working with electric go-karts and electric bicycles. Unfortunately, after the first year of teaching, direct responsibilities in the main job at Aerodium, where Arnis is the technical director and develops new products, led to the termination of student training.

Therefore, the involvement of Artūrs Bogdanovs, another graduate of the RTU professional bachelor's program in automotive engineering, in teaching the new study courses Electric Automotive Technology and Innovative Automotive Technology after graduating from Ingolstadt University of Technology in Germany and working experience at the Latvian bus manufacturing company AMO Plant and trolleybus development project at Riga Electrical Engineering Factory.

There have been no significant qualitative changes in the composition of the teaching staff in the period between accreditations. Currently, 38 lecturers work with 54 study program courses - 7 professors, 7 associate professors, 9 assistant professors, 7 assistant professors (practical), 5 lecturers, 2 researchers and 1 research assistant, 24 of them with a doctor's degree, 14 with a master's 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).

The study process is not effectively possible without the mutual cooperation of the teaching staff within the structural unit responsible for the study program. There are several study courses (Introduction to Speciality and Automotive Research, Automotive Science Fundamentals), where even lectures are led by several lecturers, while the work of different lecturers in lectures and practical or laboratory work is practiced for a long time. Cooperation between the teaching staff of different structural units is limited both by the RTU funding mechanism and, until 2020, by the location of the faculty in another district of the city. From 2020, when MTAF is located in Ķīpsala student campus, a practically new opportunity for cooperation with other faculties has opened up.

It is very difficult to determine the exact ratio of the number of students and lecturers within the study program, as many lecturers work part-time, as well as are involved in the provision of various study programs. There are a total of 124 full time students and 31 part-time students in the study program at the time of submitting the self-assessment report. Around 40 teaching staff work with the students of the study program, the number of which is variable and who are also involved in the provision of other study programs.

# 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 | MCU0_diploms_dipl_supple.zip | MCU0_diploms_dipl_pielik.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) | | |
| 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 | MCU0_stud_statist.pdf | MCU0_stud_statist.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 | MCU0_StEdSt_6_annex.pdf | MCU0_VaIzSt_6_pielik.pdf |
| 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) | MCU0_ProfSt_7_annex.pdf | MCU0_ProfSt_7_pielik.pdf |
| 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 | MCU0_CoursMapp_8_annex.pdf | MCU0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MCU0_CurricStPogr_9_annex.pdf | MCU0_StudProgrPL_9_pielik.pdf |
| Descriptions of the study courses/ modules | MCU0_DescriptStud_cour.zip | MCU0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | Internship_Management_Procedure.pdf | Prakses_organizesanas_kartiba.pdf |
| **III - Description of the Study Programme - 3.4. Teaching Staff** | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Industrial Design (42548)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Industrial Design* |
| Education classification code | *42548* |
| Type of the study programme | *Professional bachelor study programme* |
| Name of the study programme director | *Anita* |
| Surname of the study programme director | *Anita Geriņa-Ancāne* |
| E-mail of the study programme director | *anita.gerina-ancane@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing, asociētā profesore* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study program is to provide students with the opportunity to acquire professional knowledge in the field of industrial design, according to the standard of profession, providing theoretical and practical knowledge in the design and production of products and design elements.*<br>*The acquired knowledge, skills and competencies will provide an opportunity to work in design and manufacturing companies that design and / or manufacture industrial products or develop design concepts for industrial products, may be an individual entrepreneur.* |
| Tasks of the study programme | *1. To provide students with comprehensive knowledge of industrial design, build skills and develop competencies in accordance with the requirements formulated by the labor market;*<br>*2. To provide comprehensive knowledge of the construction of industrial products and / or their components, production and processing technologies, choice of materials and their interaction, promoting the product life cycle and sustainability;*<br>*3. To develop skills for performing engineering calculations for the needs of industrial design projecting;*<br>*4. To provide knowledge in the development of concepts of aesthetics and ergonomics of product and design elements;*<br>*5. To encourage participation in the development of an industrial product by analyzing and understanding consumer needs, following trends;*<br>*6. To provide knowledge to develop the technical documentation of the industrial product or its elements necessary for the production process, in accordance with regulatory enactments and standards for the development of technical drawings;*<br>*7. To promote the practical application of theoretical skills in cooperation with industry manufacturing companies and interdisciplinary specialists;*<br>*8. To develop skills to perform layout work and organize prototype creation;*<br>*9. To develop business competencies, work planning and presentation skills;*<br>*10. To develop scientifically research work skills and promote their use.* |

| | |
|---|---|
| Results of the study programme | *The graduate of study programme:*<br>*1. Is able to apply the acquired theoretical and practical knowledge in the development and / or improvement of innovative products;*<br>*2. Is able to analyze the functional, aesthetic, economic and other preconditions that justify the need to design a new product or redesign an existing product;*<br>*3. Is able to develop product conceptual solutions according to the customer's needs and market requirements by visualizing conceptual solutions in sketches, drawings, 3-dimensional virtual visualizations, as well as in layouts / prototypes;*<br>*4. Is able to use traditional and modern computer-aided design manufacturing technologies and surface finishing options and computer-based calculation systems in the design process;*<br>*5. Is able to design products in accordance with their standards of use, taking into account also the environmental requirements about the recycling options of the product at the end of its life cycle;*<br>*6. Is able to implement research activities, professionally systematize information, implement research results, apply normative documents;*<br>*7. Is able to work in workgroups, join the teamwork, as well as are able to substantiate and present their conceptual solution.* |
| Final examination upon the completion of the study programme | *Bachelor's Thesis including Project* |

# 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 industrial design* |
| Qualification to be obtained (in english) | *Industrial design engineer* |

**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 title of the study programme, the degree to be obtained, the professional qualification, the aims, tasks, learning outcomes and admission requirements of the study programme are mutually consistent. The study programme is implemented in the form of full-time studies in Latvian. In line with industry trends, as well as students' recommendations for the development and improvement of the programme content, changes are made almost every year to the study course syllabi and the curriculum. The course syllabi are regularly reviewed, analysed, and improved, existing study courses are supplemented and updated, and the latest teaching methods and results of scientific research are integrated into them. The latest teaching methods are incorporated, and the most relevant topics are included. New academic staff are recruited for individual study courses as required.

The professional Bachelor study programme "Industrial Design" has been developed in accordance with the requirements of the labour market and the latest scientific trends. The programme was established in 2017, its licence No 04051-172 was granted on 21 June 2017 based on decision No 34-L of the Study Programme Licensing Committee as of 29 May 2017. The study programme is implemented in the form of full-time studies. Current accreditation certificate No 2020/43.

The place of implementation of the study programme is Riga. The mode of implementation is full-time (4 years). Studies at RTU are organised in accordance with the decisions of RTU Senate and the orders of the administration. RTU standard plan of each study year consists of 2 semesters, the duration of each semester is 20 weeks - 16 study weeks and 4 examination session weeks.

The Department of Industrial Design (hereinafter – DID) of the Institute of Mechanics and Mechanical Engineering (hereinafter – IMME) of the Faculty of Mechanical Engineering, Transport and Aeronautics (hereinafter – FMETA) of Riga Technical University that implements the study programme has close cooperation with the Association of Mechanical Engineering and Metalworking Industries of Latvia (hereinafter – MASOC) and its representative companies, which ensures continuous improvement of the curriculum according to the international market, industry and scientific novelties.

The curriculum is updated in accordance with the trends of the industry, labour market and scientific development. The study programme is being developed considering the results of student surveys as well as employers' recommendations. The future vision of the professional Bachelor study programme "Industrial Design" is implemented based on the opinion of students, graduates, employers, professional and non-governmental organisations, following the direction set in the development plans of Latvia and is in line with the mission and vision of RTU, goals and tasks.

The competitiveness of the study programme is confirmed by the fact that all graduates are in demand on the labour market and immediately upon completion of the study program are employed within their specialisation. The relevance and sustainability of the study programme are confirmed by the fact that the DID of IMME at RTU is the only institution or one of the few higher education establishments that awards a qualification of Industrial Design Engineer. In line with short-term labour market forecasts based on the recommendations of the Industry Expert Panel and the MASOC survey, the study programme was improved in 2021.

The curriculum is updated in line with industry, labour market and scientific developments. The study programme is being developed considering the results of student surveys as well as the recommendations of employers.

Study Programme Changes

| Year | Minutes | | |
|---|---|---|---|
| | Study Field | Faculty Council | Resolutions |
| 2021 | No 2 as of 22 April 2021 | No 59 as of 6 May 2021 | No 02000-1.1-e/105 as of 27 October 2021 |

Study courses are improved and supplemented when the responsible instructor of the course and the head of the programme see the need for it. After the full implementation of the first study programme in academic year 2020/2021, the general and professional specialisation study courses were replaced by more relevant ones:

- MRA700 Design Research and Creativity 3 CP to MRA717 Design Process 4 CP;
- EAS312 Environmental Engineering (Part 1) 2 CP to VAS038 Environment and Climate Roadmap 1 CP;
- MAT118 Manufacturing Process for Polymer Materials and Necessary Equipment 2 CP to CHPI792 Chemistry and Technology of Polymer Materials 2 CP;
- MKI335 Process Analysis and Management 2 CP to DSP711 Basics of Autonomous and Mobile Robotic Systems 2 CP.

The descriptions of study courses, practical placement and graduation paper have been developed in accordance with the requirements of RTU normative acts. The descriptions of study courses, practical placement and graduation paper are reviewed and updated annually to ensure that their content is up-to-date, mutually complementary, in line with the programme objectives and ensures the achievement of the learning outcomes. Multilateral cooperation and participation ensure that the curriculum is in line with the needs of the sector and scientific trends.

All academic staff involved in the implementation of the study programme, except for those replacing the responsible instructors in case of their long-term absence, carry out research work, which is reflected in their publications and participation in projects.

### 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 professional Bachelor study programme "Industrial Design" complies with Cabinet of Ministers Regulation No 512 of 26 August 2014 "Regulations on the State Standard of the Second Level Professional Higher Education" and RTU normative documentation.

According to the Latvian Classification of Education, the code of the study programme is 42548.

In order to start studies, a general or vocational secondary education or a first level professional higher education in engineering and/or design is required.

To apply for state-funded study positions, applicants have to pass the centralised examinations in mathematics and physics or in a foreign language, as well as pass an entrance examination in drawing, where their skills are assessed with regard to the composition, perspective, construction, proportions, and graphic execution of groups of geometric forms, in accordance with Resolution No 02000-1.1-e/40 of 5 May 2020 "Regulations of RTU Entry Examination in Drawing". The marks of the centralised examinations and the entrance examination score in drawing are the basis for ranking for admission to state-funded study positions. In addition to the state-funded study positions, there are also tuition fee study positions.

Studies at the professional Bachelor study programme "Industrial Design" are commenced by signing a learning agreement. For an annex to the standard learning agreement, see Annex of Section 2.1 "Management of the Study Field".

The volume of the study programme is 160 CP. Successful completion of the study programme shall result in the award of the Professional Bachelor Degree in Industrial Design and the qualification of Industrial Design Engineer in accordance with a sample diploma enclosed in the annex.

The duration of the study programme is 4 years full-time, respectively 8 semesters, where each semester corresponds to 20 CP courses.

The level of qualification obtained corresponds to level 6 of the European Qualifications Framework (EQF) and the Latvian Qualifications Framework (LQF); level 5 of the Latvian Professional Qualifications. It complies with the developed occupational standard "Industrial Design Engineer".

In order to ensure the interrelation of admission requirements, curriculum and learning outcomes, professional competence is acquired by studying theoretical study courses (36 CP) and professional field-specific study courses (56 CP), undertaking practical placement (20 CP), as well as developing and presenting the Bachelor Paper (12 CP). General competences, in turn, are enhanced by studying general study courses (14 CP), compulsory elective study courses (16 CP) of which humanities and social sciences account for 4 CP, and professional field-specific courses (8 CP), as well as free electives (6 CP).

Within the professional Bachelor study programme "Industrial Design", the students' knowledge assessment results are discussed twice a year at the FMETA Council meeting on the issues concerning the study process indicators. In order to meet the labour market requirements related to the formation and development of competences within the framework of the study programme, regular (at least twice a year) meetings with employers are held (within the programme development and methodological council, in cooperation with the FMETA Advisory Board, analysing the students' internship evaluations, etc.). The results of the student survey carried out each semester also serve as a basis for programme development.

The results are collected and evaluated by the programme administration and serve as a basis for further improvement of the study process. The State Examination Committee provides its oral opinion on the quality of Bachelor Papers and their public presentation. The opinion is recorded during the viva voce examination, which promotes better compliance with the requirements of the labour market and improves the content of the graduation papers.

The content, organisation and structure of the professional Bachelor study programme “Industrial Design” allow students to be mobile and, in the event of termination, to transfer to another higher education study programme, acquiring additional study courses, if necessary.

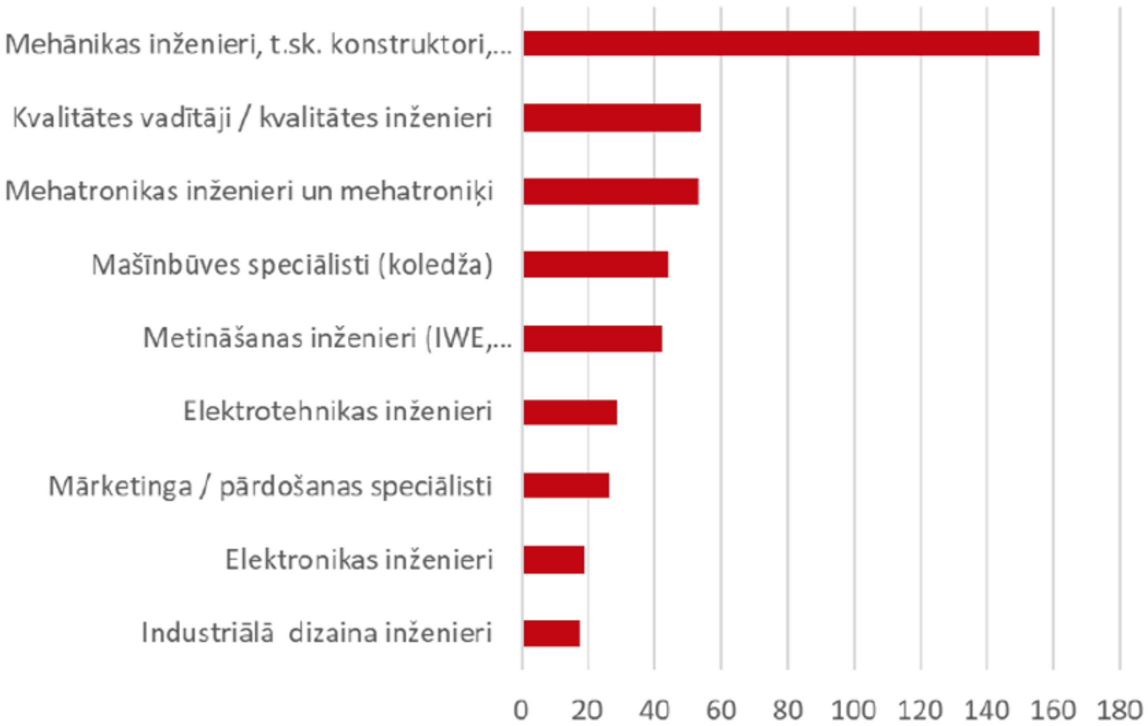
In case of termination of the study programme, students have the possibility to continue their studies at one of the two accredited RTU professional Bachelor study programmes “Mechanical and Instrumental Engineering” and "Material Technology and Design", as well as the cooperation agreement concluded in 2021 with Latvia University of Life Sciences and Technologies (Annex to Section 2.1 "Management of the Study Field") provides the possibility to continue studies at one of the two professional Bachelor study programmes of Latvia University of Life Sciences and Technologies "Machine Design and Production" and "Design and Crafts".

Students of the programme "Industrial Design" shall have all the rights and guarantees of RTU students, if the implementation of the licenced higher education programme is interrupted, the University shall guarantee compensation for the losses according to the concluded learning agreement.

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

The study "MASOC Industry Study 2021" conducted by the Association of the Mechanical Engineering and Metalworking Industries of Latvia in February/March 2021 shows that the sector requires around 470 engineering technicians nationwide, including at least 18 industrial design engineers. Data from MASOC [https://www.masoc.lv/biedri/par-nozari](https://www.masoc.lv/biedri/par-nozari) can be seen in the figure below.

Additionally needed professionals in the sector of Mechanical Engineering and Metalworking




Kopā trūkst ap **470** inženiertehniskie speciālisti jeb aptuveni **16%** no pašlaik strādājošiem šāda līmeņa speciālistiem

Mechanical Engineers, including Constructors

Quality Control Managers/Quality Control Engineers

Engineers of Mechatronics and Mechatronics Technicians

Mechanical Engineering Technicians (College)

Welding Engineers (WE)

Electrical Engineering

Marketing, Sales Engineers

Electronics Engineers

Engineers of Industrial Design

In total, there is a shortage of approximately 470 engineering specialists or about 16% of currently employed specialists of the industry.

In academic year 2020/2021, the first five students completed the study programme "Industrial Design", as a result, two of them were offered a job in the sector at the internship sites: Baltic3d.EU Ltd and AE Partner Ltd. The remaining graduates decided to continue their education at Master study programmes of the Latvian higher education institutions, including Riga Technical University. The professional Bachelor degree in Industrial Design and the qualification of Industrial Design Engineer has enabled one graduate to continue his studies at the Master level at the University of Amsterdam, the Netherlands.

Graduates are not limited to the Latvian market, as industrial design engineers can work for international companies as a full member of the design team.

The large number of MASOC member companies facilitates the transition of students from the implementation of internships to the provision of independent work for graduates (see https://www.masoc.lv/sludinajumi/darba-piedavajumi).

The World Economic Forum's Future of Jobs Report 2020 (see https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf) identifies a growing excess demand (currently 9th place) for commercial and industrial designers. Future occupations will include a set of competences in technology design and programming with shared competences in programming and technology design describing the creation or adaptation of equipment and technology to user needs.

According to data from the United States (see https://www.bls.gov/ooh/arts-and-design/industrial-designers.htm), the projected employment of industrial design professionals in the period of 2020-2030 will make up between 31,500 and 33,300 jobs. Demand for industrial designers is expected to grow as many products increasingly require more intuitive design and sophisticated technology. Employment of industrial designers is projected to grow by 6 percent between 2020 and 2030, roughly as fast as the average for other occupations.

**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.**

On average, 20 state-funded study positions are allocated each year for the study programme "Industrial Design", where the number of state-funded study positions to be allocated is approved at the FMETA Council meeting, in accordance with RTU and FMETA decision-making regulations.

The largest dropout of students from the programme is observed after the 1st and 2nd semesters, which is related to the unsatisfactory grades (academic arrear) in the theoretical courses of the field (area of professional activity) and mathematics, information technology – natural sciences and engineering study courses, which can amount to a maximum of 13 CP in accordance with Senate Decision No. 638 of 30 March 2020 "Approval of Unified Requirements for Study Programmes of Riga Technical University in a New Wording".

Since 2019, the restrictions imposed by the state related to the implementation of face-to-face studies by switching to distance or combined studies have caused the additional dropout of failing students, which is also due to the insufficient provision of the students' personal infrastructure. It should also be mentioned that due to the restrictions and conditions tightened by the state, which are fully applicable to the provision of study process at RTU, the allocated number of state-funded study positions was not covered by this programme, justifying it by students' personal choice without accepting the study provision standards set by the state.

The distribution of students by study years and types of funding (B – state-funded study positions; M – tuition fee study positions) of the professional Bachelor study programme "Industrial Design" is shown in the figure below, where the total number of students has an increasing tendency.

Distribution of students by study year at the professional Bachelor study programme "Industrial Design" on 1 October of each year

| Year | Number of students | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1st year | | | | 2nd year | | | | 3rd year | | | | 4th year | | | | Total | | | |
| | Study | | Acad.leave | | Study | | Acad.leave | | Study | | Acad.leave | | Study | | Acad.leave | | Study | | Acad.leave | |
| | B | M | B | M | B | M | B | M | B | M | B | M | B | M | B | M | B | M | B | M |
| 2017 | 17 | | | | | | | | | | | | | | | | 17 | | | |
| 2018 | 15 | | | | 7 | | 1 | | | | | | | | | | 22 | | 1 | |
| 2019 | 19 | | | | 11 | | 1 | | 5 | | | | | | | | 35 | | 1 | |
| 2020 | 15 | | 2 | | 9 | | 1 | | 11 | | | | 5 | | | | 40 | 2 | 1 | |
| 2021 | 12 | | 1 | | 10 | | | | 5 | | | | 10 | | | | 37 | 1 | | |

There is a positive trend observed in relation to the number of students resuming full-time studies after one or two years; as reasons they mention interest in the programme, the available free time, and employer's support.

Additional statistical data on students enrolled in the professional Bachelor study programme "Industrial Design" during the reporting period are presented in Annex.

### 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 professional Bachelor study programme "Industrial Design" has been developed based on employers' proposals, in line with labour market demand and global trends. The curriculum has been developed and is improved on a regular basis in cooperation with the Association of Mechanical Engineering and Metalworking Industries of Latvia, of which RTU is an active member, as well as in cooperation with the Latvian Designers' Society and independent companies related to the sector. It is a new study programme in Latvia, with the first graduates only in 2021.

The major employers of graduates are product development companies specialising in the design and aesthetics of manufacturing equipment, machinery and apparatus, electronics, lighting products, as well as companies specialising in the execution of individual projects. Graduates of the study programme are oriented towards the development of the Latvian economy already during their studies, promoting their involvement as individual entrepreneurs, which will contribute to the development of new products and the growth of the industry.

Considering employers' expectations, according to a survey conducted by MASOC, 20-30 graduates per year would be needed at the study programme.

The learning outcomes of the study programme fully meet the requirements of the occupational standard, see Annex 6. The title, aim, objectives, learning outcomes and professional qualification of the study programme are closely related (for the relevance of the study programme to the professional qualification, see Annex 7; for the internal coherence of the study programme - relevance of the title, aims and objectives to the learning outcomes, see Annex 8.

The study courses are designed in accordance with the objectives of the study programme and in compliance with the principles set out in the description of the organisation of the study programme. For the study programme plan by academic year and semester, see Annex 9, and for the course (module) descriptions, see Annex 10.

The study programme includes and implements a study module, which provides professional competences in entrepreneurship, technology transfer and product development in accordance with the requirements laid down in the Law on Higher Education Institutions. The module is offered and described as a separate course of study, the content and delivery of which meet the basic requirements of the module. For a description of the module, see Annex 10 as SDD700 Innovative Product Development and Entrepreneurship.

The relevance and appropriateness of the content of the study courses and the module to market needs are maintained by the head of the programme in consultation with industry representatives. Regular meetings with employers' associations and other organisations are also organised at RTU.

Employers participate in the State Examination Committees, where they can verify the quality of students' preparation, as well as a discussion is held after the viva voce examination, where employers share their observations and provide recommendations.

**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).**

Not 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.**

RTU has adopted the Regulation on the Evaluation of Learning Outcomes that is binding on all study programmes.

Various methods are used for the acquisition and assessment of the programme courses and practical skills – case studies, group work, problem-oriented studies, use of information technologies. RTU in general determines the organisation of the study process by the Resolution "On the Organisation of the Study Process", which is regularly updated according to the situation in the country.

The principles of student-centred education are considered in the implementation of the study programme - student representatives have participated in the development of the programme, its discussion and approval. The lecture schedule and examination schedule are designed taking into account the capabilities of students as employed persons. Students are informed about examination methods, criteria, and the procedure for appealing against marks. The learning outcomes and the form of reporting for each course, as well as the prerequisites of a particular course, are communicated to students at the beginning of the course. The course content, learning outcomes, recommended literature and other key information are given in the course description, see Annex 10.

The results of the study process are analysed in discussions with the head of the programme, as well as during meetings of the Department of Industrial Design and the Council of the Institute of Mechanics and Mechanical Engineering. The main issues addressed are the following:

- The implementation of the study programme and the study plan in terms of content and scope;

- The level of assessment of students' knowledge, skills and abilities and their compliance with the requirements for specialist qualifications in professional programmes;
- Learning outcomes of a particular course;
- Financial and economic compliance of the study process to the possibilities and requirements of the Department and the Institute.

The acquisition and quality of students' knowledge, skills and abilities are continuously monitored:

- Operational record of progress - the faculty member conducts operational evaluations of the progress and quality of the study assignments during the semester;
- Examinations and credit tests - examinations are taken in writing or with oral comments, explanations;
- Study project viva voce examination - the project, the content of the work and the performance are assessed,
- Internship evaluation - completion of the individual task of the internship report and description of the results achieved, overall evaluation of the internship performance and the employer's report;
- Bachelor Paper - assessment of the paper - individual practical research work, prototype or model, as well as the assessment of the scientific adviser, the reviewer and the State Examination Committee.

Ten-point grading scale is used to assess knowledge. If the final result of the study course is a credit test, it is marked according to a 10-point grading scale in the same way as an exam. Students' work is assessed mainly by the grades they achieve in the examination session and at the end of the course.

In the study programme, learning outcomes are defined for each study course and for each class in terms of the student's abilities, knowledge and competences to be acquired upon successful completion of the study course. The learning outcomes are assessed for the qualification in general, as well as for each component – study course, practical placement, and graduation paper separately.

Students' knowledge is assessed after the completion of courses twice per academic year, in the winter and spring examination sessions. During this period, students take examinations in the study courses according to their individual study plans. The examination questions are designed according to the topics of the course content, which contribute to the objectives of the study course as described in the description of each study course. If necessary and if pre-determined by the academic staff, students shall demonstrate their proficiency in the study material by means of various types of visual aids, such as posters, a model and/or a prototype, etc. Explanations are given orally or in writing. Examination questions shall be prepared by the lecturer responsible for the study course based on the syllabus of the study course.

The internship shall be provided and supervised by a member of staff specialising in the relevant field(s).

The graduation paper/project is presented orally, with presentation materials and a physical model/prototype.

**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 professional Bachelor study programme "Industrial Design" includes a compulsory internship, the amount of which is 20 CP. On 28 January 2019, RTU Senate (Minutes No 626) approved a new procedure for the organisation of internships, which came into force at the beginning of academic year 2019/2020. Based on the new internship organisation procedure, the Regulation "On the Organisation, Implementation and Presentation of Internships at the Professional Bachelor Study Programme "Industrial Design"" has been developed and approved, see the relevant annex.

Internships at companies are organised during one semester. The head of the study programme, the representative of the internship company and the trainee sign an internship contract. For the successful conduct and management of the internship, a description of the internship is developed, which includes the aim and tasks of the internship, the content of the internship and the content of the internship report. The internships are undertaken at companies with which a cooperation agreement has been concluded. The expected number of trainees per company is 2-3 students per year.

The internship is planned and implemented during the autumn semester of the 4$^{th}$ study year (20 CP). Internship places are provided by the Department of Industrial Design, with which RTU has concluded cooperation agreements. The student is also given the opportunity to find an internship place that meets the aim and tasks of the internship, which should be approved by the head of the programme and the internship supervisor. In case of a positive approval, the head of the programme and the internship supervisor shall ensure the conclusion of a cooperation agreement between the intended internship provider and RTU.

The internship is implemented in accordance with a tripartite internship agreement signed by RTU with the employer for the provision of the internship placement and the student. The internship agreement shall include the aim and tasks of the internship, the planning of the internship, the procedure for evaluating the internship achievements, as well as the duties and responsibilities of the parties. The aim and tasks of the internship shall include the student's familiarisation with the management structure and operating principles of the internship organisation. More detailed information on the provision of the internship is available in the annex.

The aim of the student's internship is to relate and apply the knowledge acquired during the studies in the company of their field, consolidating and deepening their knowledge and skills.

The main task of the student's internship is to obtain information useful for the graduation paper, to consolidate and improve the knowledge acquired during the training, to develop skills necessary for qualification as an industrial design engineer, as well as to develop self-assessment skills, promote professional development and strengthen motivation for work.

During the internship, students get acquainted with the organisational structure of the internship site, the mode of its operation, assess the external environment and perform other activities in accordance with the tasks approved in the internship regulations. At the end of the internship, an internship report is submitted describing the internship site and providing evidence of shortcomings. The internship report is evaluated in a tripartite way by the internship coordinator at the company, the internship supervisor at the University and the internship committee.

To support the student during the internship, the Department of Industrial Design provides an internship supervisor-consultant who coordinates the internship, advises the student, and resolves internship related issues with the company.

In accordance with the decisions of RTU Senate, students are assisted by an internship supervisor at the department. If additional assistance is needed, students can contact the Career Support and Services Unit (see https://ekarjera.rtu.lv/), where a career counsellor and project manager assist students in finding and approaching internship companies, and through various activities promote the development of career management skills that can ensure successful outcomes in the internship process.

In addition to the provision of internships, MASOC is also involved, where detailed information on each company's area of specialisation is available (see https://www.masoc.lv/sludinajumi/darba-piedavajumi)

Representatives of the internship companies participate in the discussion to define the internship aim and tasks, as well as take part in the evaluation of the traineeship. Internship Assessment Committee is established to evaluate the internship. The results of the research obtained during the internship are presented at RTU Students' Scientific Conference and integrated into their Bachelor Paper.

The evaluation questionnaires and feedback provided by employers and internship supervisors show that students understand and can practically apply the knowledge and skills acquired during the study process, are able to identify the problems related to the internship topic in the company, select the most appropriate solutions to problems in the field of industrial design.

The evaluations of the internship are mostly positive - from 7 (good) to 10 (excellent). Employers and internship supervisors at companies have confirmed that the knowledge, practical abilities, and skills acquired by students meet the requirements of the occupational standard.

Table enlists the internship companies and their number in 2020 and 2021.

Student Internship Places by Year

| Year | Enterprises providing internship | No of students at the enterprise |
|---|---|---|
| 2020 | Ltd "Baltic3d.EU" | 1 |
| | Ltd "AE Partner" | 1 |
| | Ltd "Jūrmalas Mežaparki" | 1 |
| | Ltd "KUP Design" | 1 |
| | Ltd "Wood Design Workshop" | 1 |
| 2021 | Ltd "Lucky thirteen" | 1 |
| | Ltd "MK Dizains" | 1 |
| | LTD "AE Partner" | 2 |
| | LTD "Hansa Flex Hidraulika" | 1 |
| | LTD "BIC aluminium" | 1 |
| | LTD "Cits Koks" | 1 |
| | LTD "OCT Composites" | 1 |
| | LTD "Aerones" | 1 |
| | LTD “Pelegrin” | 1 |

Assessment grades of internship reports upon completion of Internship are given in Table.

Internship Assessment

| Academic year | Top grade range | Average grade | Lower grade range |
|---|---|---|---|
| 2020./2021. | 9,5 | 8,6 | 8,0 |

**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.**

The student usually chooses the topic of the Bachelor Paper project from the problem situations identified during the company's internship or it is associated with a project implementing the company, as well as the topic can be chosen individually by the student or from the list of topics offered by the Department of Industrial Design. After choosing the topic, students with the potential supervisor specify the name of the chosen topic and draw up a plan with the tasks to be performed.

In 2021, the students publicly presented the Bachelor Papers covering the following themes:

- Improvement of fire safety device for people with hearing impairments
- Lifting and lowering curtain system
- Turning device for sheet music
- Multi-functional playground for children with movement disorders
- Development of anti-personnel mine moulage for military training purposes

The themes of the Bachelor Papers of the study programme "Industrial Design" cover a wide range of industrial products, addressing various problematic situations identified by the company or by the graduates themselves. The solutions to the problematic situations are based on the identified needs of the consumers, as well as on the conditions and tasks set by the companies.

As an essential and integral part of the Bachelor Paper, a physical model/prototype is developed and demonstrated.

Students acquire research skills by regularly working with literature and internet resources in order to successfully produce various study projects, internship reports and a Bachelor Paper. This also promotes students' research work and work with international scientific databases available at RTU Scientific Library with electronic access from the ORTUS environment.

Participation in RTU scientific conference is compulsory for Bachelor students. For example, in academic year 2020/2021 all 4th year students participated in the 62nd Student Scientific and Technical Conference of RTU.

During the development period of the Bachelor Paper (at least twice a month), interim presentations are organised, where students present the progress of their work. Students' performance is evaluated by a committee comprised of the academic staff and one employer representative. If the committee finds that the student has not met the requirements for the development of the Bachelor Paper at the final assessment stage (pre-defence), the student will not be allowed to present the Bachelor Paper. In this case, with the approval of the head of the programme, the student is given the opportunity to improve the Bachelor Paper and to present it at the end of the following semester.

Two months before the public presentation of the Bachelor Papers, students are given the opportunity to show their improved Bachelor Papers, which are evaluated by the committee and a decision is made on their further assessment by the State Examination Committee. Students who have not developed Bachelor Papers of the required quality will not be allowed to present them.

The State Examination Committee will only award a mark of 10 (excellent) to students who have summarised research further than the programme requirements in their Bachelor Paper or whose work can be fully implemented in production by the company.

Assessment of the Bachelor Papers

| Year | Limit of the highest possible score | Average score | Limit of the lowest possible score |
|---|---|---|---|
| 2020/2021 | 9 | 8.2 | 8 |

## 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 resources available for the implementation of the study programme are sufficient to ensure the achievement of the results specified in the study programme, both now and in the long term. The following material resources are used for the implementation of the programme:

- classrooms (both for lectures and practical classes);
- computer rooms;
- teaching and research laboratories;
- RTU Scientific Library.

The study courses can be acquired using the equipped classrooms, laboratories and computer rooms of the participating faculties, RTU Laboratory House, RTU Design Factory, as well as the resources of RTU Scientific Library and RTU ORTUS portal.

RTU Laboratory House provides modern laboratory equipment for the implementation of the programme in various FMETA institutes, which helps in the design process to learn traditional and modern design technologies by practicing on the work benches and equipment available in the Laboratory House.

For the development of practical skills of the students of the professional Bachelor study programme "Industrial Design", the Department of Industrial Design has a special room with appropriate equipment for drawing, sketching, and painting, as well as a prototyping room with various hand tools for prototyping and mock-ups. In addition, a 3D Mass Portal Pharaoh ED printer with serial No 000145 is available and a Technologie CNC CO2 laser - model 1390WiFi - was purchased in November 2021 as part of the EU project.

RTU Design Factory, within the framework of the programme, provides the possibility to produce models and prototypes. It also ensures the implementation of the study course “Innovative Product Development and Entrepreneurship”, as well as provides the opportunity to work outside the programme content, using its freely available infrastructure, which helps consolidate the acquired knowledge and skills. There is also the opportunity to participate in one of RTU Design Factory projects.

By promoting the sharing of resources, students of the programme also have access to the resources of other faculties.

The study base is available at the electronic study environment ORTUS to the students of the study programme, the academic and general staff. The ORTUS system is designed as a comprehensive single identity and login system. The portal provides an e-learning environment, a careers section, a virtual lesson and session plan system, a research support system, staff information, a regulatory base, and a project management system. Through ORTUS, students and staff have access to extensive information resources, including library resources, which are continuously updated.

Students have access to RTU Scientific Library's subscription databases, which provide research literature sources for the relevant programme area:

- **ProQuest Ebook Central** contains approximately 51 700 full-text e-books published by the world's leading scholarly publishers - Elsevier, Wiley, Springer, Oxford Press, Emerald, and others - in a wide range of disciplines, including the field of industrial design.
- **ScienceDirect** - a database of scientific, technical, and medical articles, published by Elsevier. Over 2500 full-text journals (Freedom Collection) from 2002/2005 and 354 full-text books in various fields of science, including industrial design, are available.
- **Academic Search Complete EBSCOhost** - 8800 full-text periodicals in various disciplines, including industrial design.
- **Wiley Online Library** database of over 1360 full-text journals (Full Collection) from 1997 in various disciplines, also relevant to industrial design.
- **SpringerLink** database contains Springer books (~13,100) published in 2014-2018 in various fields, also relevant to the field of industrial design.

In addition, freely accessible resources such as the Latvian Patent Board database for design samples are offered for the study process.

The study process is fully provided with the latest study literature, which students obtain from RTU Scientific Library or from the textbook subscription and can use throughout the study period. RTU students and academic staff have access to the extensive and modern RTU Scientific Library (5 Paula Valdena Street, Ķīpsala), where they can use all types of educational literature, as well as electronic subscription databases and temporary trial databases. The library reading room is open 24/7 for RTU students, as 24-hour reading room of RTU Scientific Library is a place where students can study even late at night, outside library or faculty opening hours. A variety of teaching aids and books are purchased each year to support the library resources of the study programme. Funding is allocated for this purpose, which varies from year to year, for the acquisition of literature in the field, with part of the funding allocated for the maintenance of digital literature sources - RTU Library's subscription databases.

### 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 programme is funded both from the state budget and from tuition fees paid by individuals. From academic year 2017/2018 to academic year 2020/2021, the programme had 20 state-funded study positions for full-time studies in the Latvian language.

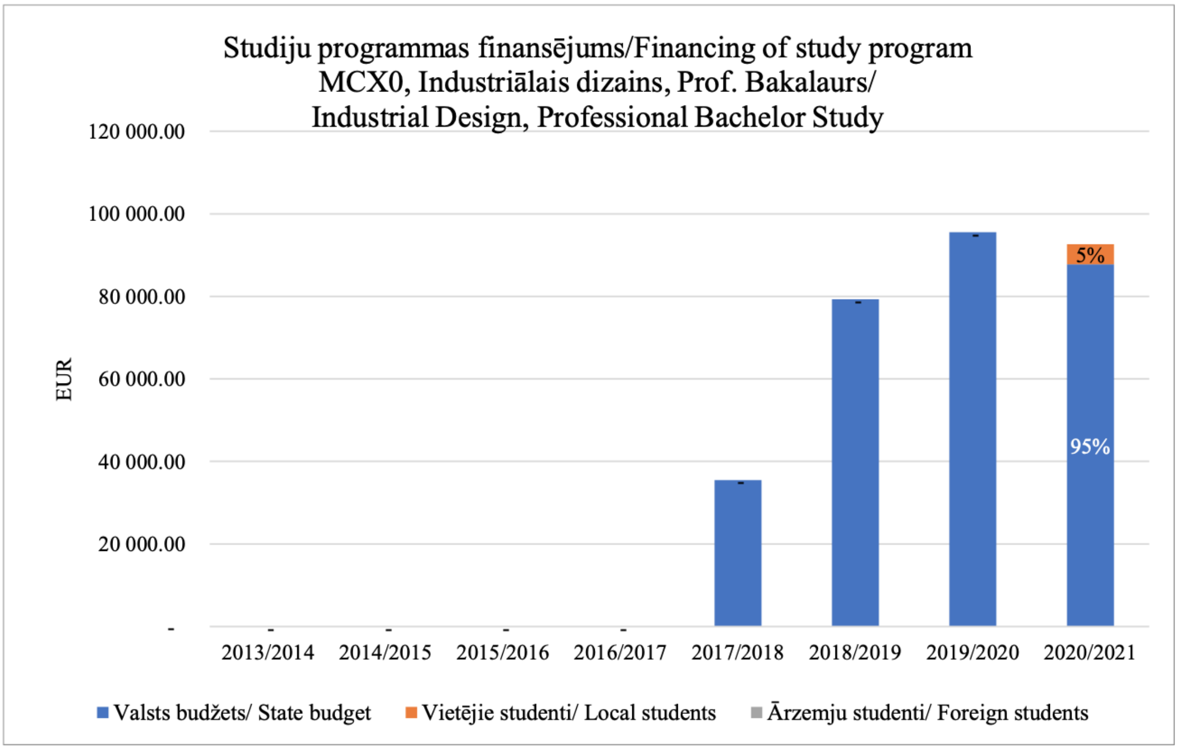
The cost of implementing the programme is variable:

- In academic year 2017/2018, the tuition fee for full-time studies was EUR 1850.00 per year.
- In academic year 2018/2019, the tuition fee for full-time studies was EUR 2700.00 per year.
- In academic year 2019/2020, the tuition fee for full-time studies was EUR 2700.00 per year.
- In academic year 2020/2021, the tuition fee for full-time studies was EUR 2800.00 per year.

The actual costs of the professional Bachelor study programme “Industrial Design”:

| Period | State budget subsidy | Local student tuition fees | Foreign student tuition fees | Total funding | Funding per 1 student, EUR |
|---|---|---|---|---|---|
| 2017/2018 | 35504.66 | - | - | 35504.66 | 4040.66 |
| 2018/2019 | 79269.65 | - | - | 79269.65 | 4229.68 |
| 2019/2020 | 95574.39 | - | - | 95574.39 | 4405.04 |
| 2020/2021 | 87770.28 | 4860.00 | - | 92630.28 | 4462.81 |

Proportional distribution of the funding of the study program “Industrial Design” is given in the figure below.




It must be concluded that in general the resources and provision of the study program are insufficient due to the poor system of distribution of university funding for the needs of the study program. There is a positive trend with the emergence of tuition fee financial indicators, which allows us to conclude that within three years (without a full life cycle, without waiting for the first graduates) this program has already proved its competitiveness and confidence in the program, which has contributed to the tuition fee for local students.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

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

The following faculties are involved in the implementation of the study programme: Faculty of Computer Science and Information Technology, Faculty of Architecture, Faculty of Engineering

Economics and Management, Faculty of Civil Engineering, Faculty of Electrical and Environmental Engineering and Faculty of E-Learning Technologies and Humanities of RTU.

Information on the academic staff involved in the implementation of the programme is summarised in Table in Annex and CVs are enclosed in Annex of Section 2.3 "Resources and Facilities of the Study Field".

The level of qualification of the academic staff is also reflected in the active research activities of the lecturers, as well as in their professional development activities and their mobility to different national universities. Due to national and global impacts on travel restrictions, many planned mobilities were cancelled in the last three years.

The Annex to Section 2.3 “Resources and Facilities of the Study Field” includes the curricula vitae of academic staff, the courses they deliver and scientific publications.

The FMETA has established a long-lasting and sustainable cooperation with foreign lecturers who are involved in the implementation of the study process, providing also access to guest lectures to all students of the study programmes of the Faculty, including the programme "Industrial Design". For the professional Bachelor study programme "Industrial Design" it is also planned to invite guest lecturers from abroad.

Each year, industry experts and company representatives are invited to engage in the study process in order to provide specific knowledge and share experience in the relevant study courses.

The characteristics of the academic staff of the professional Bachelor study programme "Industrial Design" are given in Table.

| No. | Indicator | Number | Ratio |
|---|---|---|---|
| 1. | Academic position | | |
| 1.1. | Professors | 8 | 28% |
| 1.2. | Associate professors | 3 | 10% |
| 1.3. | Assistant professors | 8 | 28% |
| 1.4. | Assistant professors at professional study programs | 2 | 7% |
| 1.5. | Lecturers | 4 | 14% |
| 1.6. | Assistants | 3 | 10% |
| 1.7. | Guest lecturers | 1 | 3% |
| | **Total:** | **29** | **100%** |
| 2. | Scientific degree: | | |
| | PhD | 21 | 72% |

The qualifications of the academic staff meet the necessary requirements for the implementation of the courses of the study programme, as demonstrated by the curricula vitae in the Annex of Section 2.3 "Resources and Facilities of the Study Field". The qualifications of the academic staff are continuously improved, as well as their methodological and scientific achievements.

The quality of the relevant courses of the study programme and the qualification of the academic staff are evidenced by student survey data (Annex of Section 2.2 “Effectiveness of the Internal Quality Assurance System”), as well as by the results of internal RTU supervision of academic staff. The analysis of the data shows that the students' evaluation and the data from the surveys are positive.

### 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 the structure of the academic staff of the Department of Industrial Design is due to the retirement age of the academic staff, the faculty member going on parental leave, and being replaced for a certain period of time, as well as insufficient/unmotivating low salaries.

Apart from the academic activities, the Doctoral degree holding faculty members take part in research projects. The information on scientific activities, publications, participation in projects of the academic staff is provided in the Annex of Section 2.3 “Resources and Facilities of the Study Field”.

Research areas of the academic staff of the Department of Industrial Design:

- **Anita Geriņa-Ancāne**, Dr. sc. ing. The main research area is industrial product development, identifying the main needs with different research methodologies (QFD matrix, Pugh, P-diagram, Concept Scoring, TRIZ, etc.). She is involved in testing of new tools, methodologies upon the recommendation of RTU Faculty of Engineering Economics and Management in the framework of the Erasmus+ project implemented by RTU, University of Rotterdam, South-Easter Finland University of Applied Sciences, and Anglia Ruskin University. Research interests include application of Pareto principle in the evaluation of structures and design of engineering products, improvement of mathematical object analysis, optimisation, and synthesis methodologies by upgrading them with Pareto and Fuzzy control elements.
- **Mārtiņš Irbe**, Dr. sc. ing. and Mg. art. Research interests include object mechanical motion and interaction, CFD calculations of flow and rigid body interaction, physical properties of materials tests and data analysis, mechanical equipment design, CAD strength calculations, CAM motion analysis and industrial product design.
- **Jānis Kaņeps**, Mg. sc. ing. Research interests include production automation, versatile application of robotics, its programming and control capabilities.

Elita Kaņepe, who reached the age of the retirement and used to teach the study courses "Colour and Product Design", "Drawing (special course in industrial design)", "Painting (special course in industrial design)" and "Industrial Sketching", was substituted with a new instructor Elīna Bože-Irbe in 2019. In May 2019, Elīna Bože-Irbe took a parental leave, so in her absence, temporary lecturer Evija Krīgere was appointed. Elīna Bože-Irbe and Evija Krīgere are in the age group of 30-40 years.

Since September 2019, the courses "Design Process", "Design Computer Graphics" and "Product Layout and Prototyping" have been delivered by a new lecturer Arvīds Endziņš holding a Master degree in Functional Design from the Art Academy of Latvia. He provides students with a modern and practically oriented study process, thus developing students’ practical and creative activities. The lecturer is in the age group of 30 - 40 years.

Ernests Jansons, Ph.D, since september, 2020 in the program “Industrial Design” provides courses “Design of Industrial Products” and “Design of Industrial Products (study project)”, the implementation of which has been taken over from the long-term docent (practical) Jānis Kaņeps, ensuring a gradual change of generations.

In addition, he coordinates the internship within the course "Practical Placement for Pre-Graduation Project in Industrial Design". Ernests Jansons' relevance in course delivery is attributed to his practical activities in the period of 2014 - 2019, where he performed the duties of a design engineer at Evestra Limited Ltd. In parallel, he holds the positions of researcher, assistant, and senior expert at RTU and participates in various international projects. Ernests Jansons is in the age group of

30-40 years.

The course "Manufacturing Process for Polymer Materials and Necessary Equipment", which has been delivered within the FMETA, has been changed for curriculum improvement purposes to the study course "Chemistry and Technology of Polymer Materials", which will be delivered by the Faculty of Materials Science and Applied Chemistry (hereinafter - FMSAC), thus ensuring a more relevant and up-to-date quality of studies. The course has been developed in line with the aims, tasks and learning outcomes of the professional Bachelor study programme “Industrial Design”. The course will be taught by Professor Sergejs Gaidukovs.

For the purposes of the professional Bachelor study programme "Industrial Design", the composition of the academic staff and their changes are within the competence of the respective faculties and their organisational units.

**Changes in the content of the academic staff over the years**

| Academic staff | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|
| Professors | 1 | 1 | 1 | 1 | - | - |
| Associated professors | 1 | 1 | 1 | 1 | 1 | 1 |
| Docents | 1 | 1 | 1 | 1 | 2 | 2 |
| Docents (practical) | 1 | 1 | 1 | 1 | 1 | 1 |
| Lecturers | 2 | 2 | 2 | 3 | 2 | 2 |
| Assistants | - | - | - | - | 2 | 2 |

Changes in the content of the academic staff of the specialized study programs of the Department of Industrial Design over the years indicate a positive trend in attracting directly new academic staff, thus positively reducing the average age of academic staff that actively took place in the period from 2016 to 2019 (see the Table above). In the last two years, there has been stability in the changes of the academic staff, and two of the academic staff have obtained a doctoral degree.

**Percentage distribution by academic qualification and scientific degrees in the year 2021**

| Parameters | Quantity | Percentage |
|---|---|---|
| *Academic positions:* | | |
| Associated professors | 1 | 20% |
| Docents | 2 | 40% |
| Lecturers | 2 | 40% |
| Total: | 5 | 100% |
| *Scientific degrees:* | | |
| Doctor of sciences | 4 | 80% |

The percentage of current academic staff according to academic qualification in the year 2021 indicates that academic staff of study program “Industrial design” is with high scientific qualification and work experience, further, the proportion of doctors of science has a very high indicator (see the Table above).

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

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

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

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

The implementation of the study programme "Industrial Design" is mainly ensured by the Institute of Mechanics and Mechanical Engineering and the Department of Industrial Design of FMETA, its general and academic staff. The main part of studies take place at 6B Ķīpsalas Street. In addition, other faculties of RTU and their units are involved in the implementation of the professional Bachelor study programme “Industrial Design”:

**Faculty of Mechanical Engineering, Transport and Aeronautics**

- Institute of Mechanics and Mechanical Engineering, Department of Theoretical Mechanics and Resistance of Materials
- Department of Mechanical Engineering and Mechatronics, Institute of Mechanics and Mechanical Engineering
- Scientific Laboratory of Experimental Mechanics of Materials

**Faculty of Materials Science and Applied Chemistry**

- Institute of Technical Physics
- Institute of Design Technology
- Institute of Polymer Materials

**Faculty of Computer Science and Information Technology**

- Institute of Applied Mathematics
- Institute of Applied Computer Systems

**Faculty of Architecture**

- Department of Architectural Design

**Faculty of Engineering Economics and Management**

- Institute of Business Engineering and Management
- Institute of Labour Protection and Civil Defence

**Faculty of Electrical and Environmental Engineering**

- Institute of Environmental Protection and Heating Systems

**Faculty of E-Learning Technologies and Humanities**

- Institute of Humanities
- Institute of Applied Linguistics

The Institutes and their Departments provide teaching and methodological work: establish and update study courses of the programme, ensure teaching of the relevant study courses, advise in the process of elaboration of the Bachelor Papers, if necessary, carry out other activities related to academic, methodological and scientific work.

The study programme has a mechanism for cooperation among academic staff, which promotes the development and interconnection of courses. The following measures are used to exchange experience and information related to the academic work:

- Meetings of academic staff (at least once a semester);
- Unit (department, institute) meetings (at least once a month);
- Academic conference (once a year);
- Seminars, conferences, workshops, etc.

The achievement of the aims, tasks and learning outcomes of the study courses within the framework of the programme shall be implemented through regular seminars and discussions of the academic staff on the learning outcomes and the basic principles of quality assurance. Thus, it can be stated that a mechanism for cooperation among the academic staff has been established, which contributes to the development and interconnection of study courses.

The development of study courses is carried out on regular basis, based both on suggestions made by students and on developments in the field. The content of study courses where study projects are developed is mutually agreed among the lecturers. During the implementation of the study courses, regular meetings of the academic staff are held to exchange experience on the topics of the study courses, and the content of the study courses is developed and improved through discussions, mutual agreement on topics, responsibilities, and compliance with regulatory requirements.

During the process of study course coordination, it requires all faculty members to be involved in the specific study course, thus ensuring that the topics covered in the study programme are continuously developed and updated in cooperation with the professionals engaged.

On average, 30 members of the academic staff participate in the implementation of the study programme yearly, apart from the guest lecturers. In terms of the number of the elected academic staff working on a permanent basis at RTU, the student-academic staff ratio is 1 academic staff member per student. The ratio of academic staff for the specialised courses within the programme is 1 academic staff member to 7 students.

However, taking into account that the study programme employs academic staff from different RTU organizational units, as well as being aware of the fact that some courses are also delivered to students from other programmes, the student-academic staff ratio should be considered in the context of the study field and the faculty.

# 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 | MCX0 _diploms_dipl_pielik_dipl_supple.zip | MCX0 _diploms_dipl_pielik_dipl_supple.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) | | |
| 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 | MCX0_stud_statist.pdf | MCX0_stud_statist.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 | MCX0_StEdSt_6_annex.pdf | MCX0_ValzSt_6_pielik.pdf |
| 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) | MCX0_ProfSt_7_annex.pdf | MCX0_ProfSt_7_pielik.pdf |
| 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 | MCX0_CoursMapp_8_annex.pdf | MCX0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MCX0_CurricStProgr_9_annex.pdf | MCX0_StudProgrPL_9_pielik.pdf |
| Descriptions of the study courses/ modules | MCX0_DescriptStud_cour.zip | MCX0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | MCX0_Descr_org_internsh.pdf | MCX0_prakse_Apr.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Transport (51525)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Transport* |
| Education classification code | *51525* |
| Type of the study programme | *Doctoral study programme* |
| Name of the study programme director | *Ilmārs* |
| Surname of the study programme director | *Blumbergs* |
| E-mail of the study programme director | *ilmars.blumbergs@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., asociētais profesors* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study programme is to prepare highly qualified scientists in the field of transport and traffic, specialists for pedagogical and scientific work, who have systemic, analytical, critical and creative thinking and are able to solve the tasks of scientific innovation.* |
| Tasks of the study programme | *1. To provide in-depth theoretical knowledge in the fundamental directions of transport and communication industry;*<br>*2. To provide the ability to carry out scientific-research;*<br>*3. To provide the ability to formulate and independently solve scientific problems;*<br>*4. To provide skills for scientific discussions about the work topics and acquire the ability to enter discussions on other scientific topics of the field;*<br>*5. To provide knowledge about innovative technical methods (training, studying, experience, science, techniques, technology, manufacturing);*<br>*6. To provide knowledge and skills to perform pedagogical work;*<br>*7. To foster scientific research of international significance and performances at international conferences and seminars.* |

| | |
|---|---|
| Results of the study programme | *Knowledge (knowledge and understanding)<br>Students can prove that they know and understand the most topical scientific theories and facts related to mechanics, engineering and transport and communication, know modern scientific research methodology and methods in the professional field and in relation to other fields of science.<br>Skills (ability to use knowledge, communication, general skills)<br>Students can independently evaluate and select the methods that are appropriate to scientific research in transport and communication or mechanics and engineering.<br>The achieved results give a new understanding of existing knowledge and its practical application, and help to implement voluminous original research a part of which reach the level of internationally quoted publications.<br>Students can communicate, both orally and in written form, with scientific circles and society in general about their own field of scientific activity, computer simulation and optimization of transport systems functioning, automated methods of designed products optimization, technological methods of vehicle safety improvement, calculation and design methods for vehicle precision modular systems.<br>Students can independently upgrade their scientific qualification and carry out scientific projects in the field of transport and engineering with achievements that correspond to the international criteria of the research field.<br>Students can manage research or development tasks at transport systems enterprises, institutions and organizations where wide research knowledge and skills are required.<br>Competence (analysis, synthesis and evaluation)<br>By applying independent critical analysis, synthesis and evaluation, students can solve important research or innovation problems in the field of transport systems.<br>Students can independently propose a research idea, structure and manage large-scale scientific projects including those on an international scale.* |
| Final examination upon the completion of the study programme | *Research Work* |

# 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 degree in transport or mechanics and mechanical engineering, or comparable education; master degree in engineering science of transport and traffic or mechanical 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 Civil and Transport 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 - 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 degree in transport or mechanics and mechanical engineering, or comparable education. Master degree in engineering science of transport and traffic or mechanical 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 Civil and Transport 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.**

In 2020, Ilmārs Blumbergs became the head of the study program after Mareks Mezītis had resigned.

Taking into consideration the requirements on learning competencies, the study program tasks have been defined and elaborated.

Considering the requirements on learning competencies, the learning outcomes of the study program have been elaborated.

The content of the study program has been renewed and complemented; however, no major changes have been made in the list of the study courses.

**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.**

PhD study program “Transport” corresponds to Level 8 of EQF (European Qualification Framework) and LQF (Latvian Qualification Framework) and hence is developed to educate PHD graduates in the field of transport and communication engineering. The name of the program is entwined with the main aim of the study program – that is, to train highly qualified scientists in the field of transport and communication engineering, i.e., specialists, who are able to perform both pedagogical and scientific work, and to solve varied problems related to scientific innovations. The program is aimed at providing the renovation of the transport branch infrastructure as well as at educating potential employees for higher education institutions and scientific research institutions. To reach the aforementioned aim, the tasks of the study program (developed to achieve specific learning outcomes) were redefined and elaborated accordingly (see Section 3.1). The aim of the study program is met if all the students involved in the study process attain the above-mentioned tasks. Content wise, the program has been developed so that the goals of the study courses would contribute to overall learning outcomes and facilitate the achievement of the aims. A PhD degree (doctoral scientific degree) in transport and communication engineering is awarded if a student has completed the theoretical courses of the study program and has taken the viva voce examination successfully. Analyzing the interconnection between the name of the study program, its aim and tasks, the obtained degree, learning outcomes as well as entrance requirements, it can be stated that all the program aspects are mutually interconnected and well-balanced.

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

The study program trains and educates highly skilled scientists in the field of transport and communication engineering, i.e., specialists able to perform both pedagogical and scientific work, and to solve problems related to scientific innovations. The program is aimed at providing the renovation of the transport branch infrastructure as well as at educating potential employees for higher education institutions and scientific research institutions. The content and implementation of the study program is based on normative documents of the Republic of Latvia, the PhD education basic principles recommended by the EUA (European University Association), EQUAL guidelines for Doctoral programs in business and management, May 2016; taking into consideration the following aspects: the strategic development of both RTU and the Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA); in particular, the development of the AERTI and the Institute of Transport; as well as Sustainable Development Goals in higher education defined by the United Nations. The distinguishing characteristic of the program initiated by RTU, and the FMETA is the ongoing interdisciplinary research in the fields of engineering sciences, economics, and entrepreneurship – conducted from the perspective of current transport related problems. Annually, 3-4 students obtain a PhD degree. There are study programs with a similar name at other higher education institutions across the Baltic region; however, they do not specialize in solving interdisciplinary problems related to the creation and maintenance of different complex systems, the analysis of their economic justification as well as the development of new technologies, products, and services. The study program is aimed at interdisciplinary research in the field of engineering sciences, economics, and entrepreneurship, enhanced by the development of innovations both in Latvia and in the European Union. Within the framework of the study program, research is conducted in the scientific fields, where transportation problems are analyzed from the interdisciplinary perspective (incl. the creation and maintenance of different complex systems, the analysis of their economic justification as well as the development of new technologies, products, and services). Research is conducted in the specialization fields related to entrepreneurship, business development and innovation, quality process, product, and system maintenance in transport systems. Such an interdisciplinary approach counts in favor of the unicity of the program; therefore, it is not possible to integrate it directly into other study programs, implemented by RTU or other educational institutions. Within the framework of PhD studies, the intellectual potential has been formed and is vital for economic development of the country. In Latvia, the intellectual potential is entwined with transport communication as a bridge between East and West. According to the provisions of the Sustainable Development Strategy of Latvia until 2030, there is a current need for long-term investment in human capital to foster the renewal of human resources; for this reason, there is a high demand for specialists with a PhD degree in the Latvian labor market and in engineering sciences. The high employment rate among the program graduates is a vivid marker of this demand. Primarily, they work at higher education institutions, in the private sector or at different public entities both in Latvia and in the European Union.

### 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.**

Statistics about students enrolled in the study program “Transport” is available in Annex. According to the graph, the number of students enrolled in the program is average, i.e., sufficient to ensure high quality education and training. Taking into account the poor funding of scientific sector in Latvia, the range of people willing to study diminishes gradually. Over the past few years, we have managed to fill all state-funded study positions as well as encourage former PhD graduates (having completed the program) to publicly present their PhD Theses in academic year 2021/2022. The comparatively large number of dropouts (2019-2021) could be explained by the fact that the program “Transport” was open for students of the Latvian Maritime Academy up until the moment the Academy established its own PhD program. In academic year 2018/2019, there was a successful campaign aimed at attracting foreign students, but over the last two years (student admissions 2020/2021) due to Covid 19, the initiatives meant to attract them were not effective.

**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.**

Aviation-related companies, research centers and higher education institutions are the main employers for the program graduates. Considering employers’ forecasts, there should be at least 3-7 graduates enrolled in the program annually.

Study courses are developed in accordance with the aim of the study program, obeying its main principles elaborated in the program description. Find the description of the study courses in Annex.

The topicality of the study courses and their relevance to the actual demands of the labor market are obtained through the consultations with the companies working in the sector (normally initiated by the head of the study program). Students’ meetings with different employer associations are organized on a regular basis. Scientific tendencies are taken into account with regard to thematic areas and appeals associated with a particular project, as well as by consulting the academic staff of the program, considering the scientific areas of their competencies. The academic staff take part in international conferences on a regular basis that helps keep their professional competence up to date. The organizational units of the FMETA regularly implement contracts by different companies to strengthen the link with the industry representatives, who sometimes participate in RTU initiated discussion about developmental tendencies and the topicality of the field of the research.

#### 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 content of the study program as well as its implementation is based on the corresponding regulations and standards of the Republic of Latvia; RTU regulations; PhD learning principles and provisions recommended by the EUA (European University Association); EQUAL guidelines for Doctoral programs in business and management; taking into consideration the strategic development of RTU and the FMETA as well as Sustainable Development Goals (SDGs) for higher education defined by the United Nations. The European University Association has developed a shared understanding of the underlying principles of the PhD study process and the process of obtaining a PhD degree. Thus, the study program is based upon the following principles:

- The main prerequisites for successful PhD studies are as follows: continuous mastering and improvement of professional knowledge, conducting original research projects that meet current needs of the national economy and facilitate the development of higher education and research work;
- All PhD students are early-stage researchers, who contribute to the advancement of scientific knowledge in cooperation with senior researchers;
- PhD supervision and regular assessment of students' achievements and professional competence play a major part in the development of Doctoral studies and in the education and training of new highly skilled scientists;
- The PhD program envisages interdisciplinary research, cross-sector research as well as geographically wide-ranging research by providing collaboration with different partners throughout Europe as well as students' mobility.

One of the change-making objectives of the EC's Joint Research Centre is the integration of SDGs in the study process; for this reason, study courses and research projects of the program are oriented towards the accomplishment of SDG forementioned objectives.

The study program is aimed at interdisciplinary research in the field of engineering sciences, economics, and entrepreneurship, fostered by the development of innovations both in Latvia and in the European Union. Within the framework of the study program, research is conducted in the scientific fields, where transportation problems are analyzed from an interdisciplinary perspective – e.g., the creation and maintenance of different complex systems, the analysis of their economic justification as well as the development of new technologies, products, and services. Research is conducted in specialist fields, such as entrepreneurship, business development and innovation, quality processes, and product and system maintenance in transport systems. All the above-mentioned fields count in favor of the unicity of the program; for this reason, it is not possible to integrate it directly into other study programs, implemented by RTU or other educational institutions.

In accordance with the current worldwide tendency to support green technology and the ongoing digitalization, priority should be given to that type of technology. The scientific ambition of RTU AERTI is to become the leader of space research in Latvia.

In the organizational units, which implement the program, the main research areas are as follows:

- energy efficient road and rail transport;
- safe and cost-effective air transport;
- efficient transport infrastructure;
- reliable and safe diagnostic methods of vehicle and transport infrastructure;
- aerospace materials;
- effective aerodynamic solutions;
- efficient and innovative heat engines;
- remote control and autonomous control transport solutions.

The award of the degree is based on the achievements and findings of the relevant field of science or artistic creativity, which is confirmed by the scientific projects, articles and patents carried out in the structural unit implementing the program, the topics of which are reflected in the study courses.

**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 following methods and forms of study have been applied to facilitate an understanding of the study course: lecture, scientific seminar, case studies and analysis, colloquia. To help students acquire professional skills, assistant professors organize discussions, debates, group work, case studies, independent work (e.g., report writing) and simulations. PhD students master their competencies using such methods as self-confrontation, situation modelling and simulation (being involved in situations which bring them valuable experience enhancing further research and findings).

RTU grading system has been developed in accordance with a student-centered approach adapted by higher education institutions in Latvia; it implies the following principles of student-centered learning and teaching:

1. Assessors are familiar with testing and examination methods and receive support in mastering their professional competencies;
2. Assessment criteria and methods as well as the description of a ten-point grading system are available and published;
3. Assessment allows students to demonstrate their progress in achieving learning outcomes;

4. Students receive timely feedback that, if necessary, implies the supervisor's suggestions on how to improve the study process;
5. Preferably, the study progress of the student is assessed by more than one examinator;
6. Knowledge assessment might be adjusted to any mitigating circumstances the student might have;
7. Knowledge assessment is consistent, fair, applicable to all students and implemented in accordance with approved procedures.

The program grading system (along with the implemented methods) can be assessed as flexible, successive, mutually integrated, which ensures the acquisition of the study program courses and the advancement of the students' knowledge and skills.

As a learning outcome, PhD students shall demonstrate an in-depth understanding of scientific theories and research methodologies, as well as apply modern research methods in their work. PhD students shall obtain information independently, identify the problems and solve them by evaluating and choosing the most appropriate scientific research methods in engineering. Students shall publish the results of original research that expands the boundaries of knowledge or presents current knowledge from a new practical perspective. PhD students shall communicate (both orally and in writing) with the wide scientific community involved in the corresponding research field (incl. participation in international conferences) and regularly raise professional qualification. PhD students acquire competencies to perform independent critical analysis, synthesis, and evaluation, and to solve significant research and innovation problems in the field of engineering sciences at universities or other organizations and institutions; to propose new research ideas and areas as well as to plan, structure and manage large-scale scientific projects and initiatives (incl. managing study processes in an international context).

The implementation of the study program implies student-centered teaching principles – students (students' representatives) take part in the development of the program and participate in all program-related discussions. Study schedules (incl. examinations and credit tests) have been developed considering students' workload. Students are informed about examination methods, criteria as well as assessment appeal procedures. Students are informed about the intended learning outcomes, report writing guidelines as well as examination requirements at the beginning of each study course. The course content, expected learning outcomes, course literature and other important information are available in the course description (see Annex).

At the end of the academic year (May-June), the Research Committee of the faculty arranges an annual attestation of PhD students. The attestation timetable is developed by Vice Dean for Research of each individual faculty, thereby all the PhD students of that faculty shall participate. During the attestation, student's implementation of the individual study plan is assessed with regard to the minimum publication and thesis requirements according to RTU Regulation on Doctoral Studies.

The assessment of PhD students is based upon the decision of the Research Committee of the faculty. PhD students who fail to fulfil the minimum requirements for PhD annual attestation are exmatriculated.

At the end of the fourth academic year, PhD students are attested and exmatriculated as graduates if by the end of the study period they have successfully submitted a PhD Thesis to the Promotion Council or there has been a pre-defense of the Thesis at a meeting of the Promotion Council or at an organizational unit meeting – with the chairperson of the Promotion Council (or the expert in a field empowered by the chairperson of the Promotion Council) present, and there is a recommendation to submit the Thesis to the Promotion Council. Otherwise, at the end of the fourth academic year, the PhD student is exmatriculated for not fulfilling the requirements.

Learning outcomes are analyzed during the discussions with the head of the program, the heads of the organizational units and other invited participants.

A ten-point grading system is used for knowledge assessment. If the credit test is the form of the final course assessment, a ten-point grading system is used anyway. Academic progress of the student is evaluated according to the learning outcomes they have demonstrated during the examination period and upon completion of the study course.

At all the stages, students are involved in the study process, thus ensuring knowledge transfer and research integrity at all academic levels. The results of research conducted during doctoral studies are integrated into master's and bachelor's study programs in the respective fields of science, which ensures the integrity of knowledge transfer and research at all study levels.

### 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 for a scientific PhD degree at Riga Technical University (hereinafter - RTU) takes place in conformity with Regulations No. 1001 – Regulations of the Cabinet of Ministers of the Republic of Latvia No. 1001 of 27 December 2005 “Procedure and Criteria of Conferring the Doctoral Degree (Promotion)”, RTU Regulation on Doctoral Studies (approved with amendments at RTU Senate meeting on 26 September 2016), Regulation on Promotion Councils and Promotion (approved on 29 October 2007 by RTU Senate, Minutes No. 517) and others relevant external and internal regulatory documents.

Promotion is the process of public presentation of a scientific work as a result of which the PhD degree is conferred. The Promotion Councils confer the PhD degree for an independently developed and publicly presented PhD Thesis under the supervision of an experienced scientist (a professor, an associate professor, an assistant professor and/or the leading researcher, who is approved in accordance with the procedure determined at RTU). The scientific research may take the form of a PhD Thesis, or a thematically united series of scientific publications, or a monograph – a peer-reviewed scientific book, which is dedicated to one subject. For a PhD student, qualitative Doctoral studies are completed with passing of all examinations and credit tests anticipated by the study plan of the program, submitting the PhD Thesis for promotion to a scientific PhD degree to the Promotion Council of the corresponding industry, presenting in public the PhD Thesis and obtaining the PhD degree.

**The first stage** on the way to obtaining the PhD degree is completed when a PhD student successfully passes all examinations and credit tests anticipated by the study plan of the program, as well as develops the PhD Thesis.

**The second stage** is submission of the PhD Thesis to the Promotion Council of the corresponding industry for public presentation. An organizational unit of RTU, where the PhD Thesis is developed, makes a decision at a meeting whether the PhD Thesis has been developed and can be submitted to the Promotion Council of the corresponding industry. A candidate for the acquisition of the Doctor of Science degree submits an excerpt from the Minutes together with other required documents (in accordance with the Regulations on Promotion Councils and Promotion at RTU) to the Promotion Council of the corresponding industry.

**At the third stage,** the Promotion Council accepts the PhD Thesis, when its author substantiates the choice of the subject, defines the goal and objectives of the research, characterizes scientific achievements during the research and the used methods, reports on and discusses the results obtained and conclusions. If PhD Thesis meets all the requirements, the date for public presentation of the PhD Thesis is set.

Not later than two weeks prior to the public presentation of the PhD Thesis determined by the Promotion Council, the PhD candidate:

- who has been already dismissed from the PhD studies due to completion of the theoretical courses, submits an application, which is addressed to RTU Vice-Rector for Research for the PhD candidate’s reinstatement at the PhD studies, to the Doctoral Study Department;
- uploads the PhD Thesis, its summary (in Latvian and English) and the PhD Thesis appendices in the electronic form on the ORTUS portal;
- submits one copy of the PhD Thesis and its summary (in Latvian and English) to RTU Scientific Library;
- submits two copies of the PhD Thesis and seven copies of its summary (in Latvian and English) to the National Library of Latvia;
- submits notices on submission of the PhD Thesis and its summary to the libraries to the Promotion Council Secretary prior to the public presentation of the PhD Thesis.

**The fourth stage** is public presentation of the PhD Thesis. The Regulations on Promotion Councils and Promotion at RTU provide information regarding the process of public presentation of the PhD Thesis and conferring the scientific degree.

The PhD degree is conferred to the candidate pursuant to the resolution of the Promotion Council, with the order of RTU Rector.

### 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.

The unicity of the program developed by RTU AERTI (the Faculty of Mechanical Engineering, Transport and Aeronautics) is stipulated by the interdisciplinary research in engineering sciences, economics and entrepreneurship.

The theme of the PhD Thesis (i.e., the field of research) shall be chosen upon the student’s application for studies; herein, potential scientific adviser and consultants are appointed by the head of the study program. At the beginning of Doctoral studies, according to the order issued by RTU Vice-Rector for Research, the scientific adviser (approved by RTU Doctoral Study Department) is appointed. The theme of the PhD Thesis is clarified prior to viva voce examination.

**List of Publicly Presented PhD Theses from 2013 to 2021**

| | |
|---|---|
| 2013 | • Assessment of Remaining Resource of Tank Wagons with Expired Life Time<br>• The Aircraft Vehicle's Fatigue Cracks Early Detection and Inspection Methods Outlook During Bench Tests<br>• Optimization Methods and Models Creation for Logistic Company Successful Development<br>• Optimization Of Parameters of The Aerodynamic Stand Meant for Free Flight of Humans |
| 2014 | • Development of Metal-Ceramic Nanostructured Coatings for the Host Section Parts of a Gas Turbine Engine |
| 2015 | • Airframe Inspection Planning |
| 2016 | • Helicopter Structure Fatigue Defect Acoustic Diagnostics with Defect Localization<br>• Air Traffic Control System Establishment for Remotely Piloted Aircraft Systems Operation in Riga Flight Information Region<br>• Reliability of Fleet of Aircraft and Aircraft Replacement Problem<br>• Development of the Acoustic Diagnostic Methodology for Marine Diesel Engine Technical Condition<br>• Improving the Safety and Regularity of Airline Flights on Base of Improving Technical Operations Processes of Aircraft |
| 2017 | • Assessment of technical Condition of the land Transport Structures and Objects Using Acoustic Emission Method<br>• Evaluation of Professionally Important Qualities of Aircraft Maintenance Personnel |
| 2019 | • Development of the Model of the Relationship Between Flight Safety Level and Production Factors in the Airline<br>• Development of Cartographic Information Collection System with Remotely Piloted Aerial Vehicles Complex for Safe Maritime Vessels' Navigation<br>• Use of Remotely Piloted Aircrafts for Solving the Tasks of Ecological Monitoring of Sea Aquatorium |
| 2020 | • Probability Approach a Survive of Passengers Estimation in an Aviation Incident Situation in an Airport Responsibility District<br>• Production Technology of Metal Powder Antifriction Parts for Rolling Stock and Improvement of Their Tribological Properties |
| 2021 | • Development of Electric Propulsion Thrusters Cooling Systems for Perspective Spacecrafts<br>• Analysis of the Impact of Rail Grinding on Their Condition |

The publicly presented PhD Theses have been developed in compliance with the corresponding field of research of organizational units implementing postgraduate programs. The range of topics is wide and varied, relevant to the topicality of the field. With the election of a new head of RTU Transport Institute in 2021, interest in road and rail transport study fields has increased.

## 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.**

RTU Ķīpsala Campus currently has 54 study rooms, 187 laboratories, 19 special training rooms, 10 computer classrooms, 12 workshops and several research centers of national importance. There is also a student dormitory with 950 beds and a special block designed for people with special needs to ensure enjoyable and comfortable living.

For the implementation of the study program, the premises of the Institute of Aeronautics of Riga Technical University (hereinafter - RTU) (at Ķīpsalas Street 6B and Lauvas Street 8 in Riga), 23 study rooms and specialized study rooms, training laboratories, workshops and simulation facilities are equipped with computers, projectors, webcams, audio systems, and other technical aids. The average number of work stations in the study rooms is 18. Lecturers have their own work rooms in each of the buildings, which are equipped with computers with Internet connection and printers.

The Institute has 2 computer classrooms with total of 60 work stations. RTU centralized computer classrooms, laboratories and library are also available for the implementation of the program. RTU HPC Centre provides high-performance computer resources and software for the study process and research. RTU organizational units may use software free of charge. The following software packages are available:

| Nr.p.k. | Programmatūra | Pētniecībai | Mācību klasēm | Studentiem uz personīgā datora |
|---|---|---|---|---|
| 1. | Adams | √ | | |
| 2. | *Altium Designer* | √ | √ | √ |
| 3. | *Ansys* | √ | √ | √ |
| 4. | *ArcGIS* | √ | √ | √ |
| 5. | AutoCAD (Autodesk) | √ | √ | √ |
| 6. | *COMSOL* | √ | √ | √ |
| 7. | *BM SPSS Statistics* | √ | | |
| 8. | *Intel Parallel Studio* | √ | | |
| 9. | *Mathcad* | | √ | |
| 10. | *Mathworks MATLAB* | √ | √ | |
| 11. | *OriginPro* | √ | | |
| 12. | *RETScreen* | √ | √ | √ |
| 13. | *SolidWorks* | √ | √ | √ |

In addition to the centrally purchased scientific software, the AERTI has purchased the following computer programs to improve research activities: ANSYS Academic Research (1 task) - TEC Technical Support, ANSYS Academic Research (1 task) - TEC Technical Support period.

The computer programs required for planning the curriculum, accounting, record keeping, personnel management and executing other administrative functions are provided centrally and are interconnected in a unified RTU system.

Database subscription agreements are signed both directly with the supplier and through the state agency Cultural Information Systems Centre, which is the national representative of Latvia in the international non-profit organization EIFL (Electronic information for Libraries, http://www.eifl.net/). The EIFL licensing program offers national libraries a subscription to internationally recognized databases at a significantly reduced subscription fee than is offered to individual subscribers, reducing the Library's expenditures. RTU Scientific Library has subscription to the following databases (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazeseresursi/abonetas-datubazes):

- ProQuest Ebook Central, Academic Search Complete EBSCOhost, Applied Science & Technology Source EBSCOhost, Business Source Ultimate EBSCOhost, EBSCOhost eBook Academic Collection, Wiley Online Library, SpringerLink, The International Monetary Fund;
- Subscriptions funded by the Ministry of Education and Science (ScienceDirect, SCOPUS (Elsevier), Web of Science);
- Latvian databases LETA, Letonika, Latvian Standards Database (available only on-site in the library).

The intensity of database use in RTU Scientific Library has been growing since 2016. The issuance of electronic resources has increased from 75,391 to 525,194 units. The new premises of the Library have allowed expanding the range of services for users. Since the opening of the new premises, the number of visits to the Library increased from 103,825 to 235,600 in 2018. RTU Scientific Library is available to anyone interested. It is open to users from Monday to Saturday. There is a 24-hour reading room. In summer, the Library is open every weekday and works part-time. (https://www.rtu.lv/lv/studijas/biblioteka/pakalpojumi-3) Information sources of the Library are organized in an open access collection.

A librarian helps navigate the collection. Bibliographers (information specialists) provide more detailed information and advice. A field-specific librarian service has been established in the Library (https://www.rtu.lv/lv/studijas/biblioteka/nozaru-informacija). Library resources can be found using the search tool Primo Discovery (https://www.rtu.lv/lv/studijas/biblioteka/vienota-informacijas-meklesana). It gives an opportunity to search for information in the library catalogue (https://kopkatalogs.lv/F/?func=find-b-0&local_base=rtu01), in the subscribed databases, as well as in the databases created by RTU Scientific Library (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazeseresursi/bibliotekas-veidotas-datubazes) within one interface.

By searching for information in the electronic joint catalogue (https://kopkatalogs.lv/F), you can simultaneously obtain information about the available resources in 12 Latvian libraries. Both the electronic catalogue and RTU portal ORTUS have an option to reserve library resources remotely, remote access to databases is also provided. Since the introduction of RFID technology, users have been able to use five self-service book machines to take out books and return them at any time of the day. The Library provides students, academic staff and other interested parties with various levels of individual consultations and group training sessions on information literacy (https://www.rtu.lv/lv/studijas/biblioteka/lietotajuapmacibas).

The AERTI laboratories, workshops and other equipment are not strictly segregated for individual programs; thereby, the sharing of facilities is encouraged. Scientific equipment is used in the study process of both Master and PhD programs (under the strict supervision of the laboratory manager). Within the framework of the study program, students have an opportunity to use, strengthen and improve their knowledge, skills and competencies in practical, specialized study rooms, laboratories, workshops or simulation cabins and aircraft:

| No. | Name |
|---|---|
| 1. | Computer Simulation Aeronautics Laboratory |
| 2. | Metalworking Workshop with CNC Milling Cutters and CNC Laser Cutters and Other Equipment |
| 3. | Experimental Materials Laboratory |
| 4. | Module Manufacturing Laboratory/Workshop |
| 5. | Aircraft Navigation and Instrumentation System Laboratory |
| 6. | Fundamentals of Electronics and Electrical Engineering Training Laboratory |
| 7. | Aircraft Maintenance and Repair Training Laboratory |
| 8. | Aircraft Systems Training Laboratory |
| 9. | Propeller Training Laboratory |
| 10. | Aerodynamics Laboratory |
| 11. | Digital and Electronic Equipment Laboratory |
| 12. | JAK-42 Simulation Cabin |
| 13. | A-24 Simulation Cabin |
| 14. | AN-2 Simulation Cabin |
| 15. | Non-Destructive Testing Laboratory |
| 16. | Trainer Plane Socata Rallye |
| 17. | Trainer Plane VEF I-16 |
| 18. | Trainer Helicopter Mi-2 |
| 19. | Aircraft Engine Training Laboratory |
| 20. | Composite Material Manufacturing Workshop |
| 21. | Nanocoating Laboratory |

Every year, in addition to the centrally procured books, the AERTI purchases study literature corresponding to the study programs worth more than 1,000 EUR; these resources are included in the collection of RTU Scientific Library (see https://kopkatalogs.lv/F) .

Provided resources are sufficient for the successful implementation of the study program.

### 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 study materials for the PhD students, as well as for the academic staff and RTU employees are available on the ORTUS e-learning portal. It is a comprehensive system based on a single sign-on authentication. The portal provides an e-learning environment, a career section, a virtual study schedule, a research support system, information for staff, a regulatory framework, and a project management system. ORTUS provides extensive information resources to students and academic staff, incl. library resources that are constantly updated. Each PhD student is employed by the Faculty and given free access to scientific resources.

The scientific database consists of laboratories at the disposal of the Faculty, databases, diverse software, as well as extensive scientific resources provided by RTU. Up-to-date equipment and laboratories are available and can be used for different research purposes. The Faculty is well-equipped, providing individual working places for all researchers, PhD students and postdoctoral students. Several organizational units of the Faculty participate in the implementation of the program with their own equipment, but if necessary the entire range of RTU scientific equipment is available for the implementation of the study program or research.

The organizational units implementing the program do not strictly separate the scientific equipment from the teaching equipment; therefore, the list of laboratories (mentioned in Section 3.3.1) is also applicable to scientific database. For scientific research, the following laboratories have a greater demand:

| No. | Name |
|---|---|
| 1. | Computer Simulation Aeronautics Laboratory |
| 2. | Experimental Materials Laboratory |
| 3. | Aircraft Navigation and Instrumentation System Laboratory |
| 4. | Non-Destructive Testing Laboratory |
| 5. | Aircraft Engine Training Laboratory |
| 6. | Nanocoating Laboratory |

RTU manages and administrates UseScience, a research equipment and services database, for research institutions, students, entrepreneurs, and other interested parties, as well as partner institutions and industrial companies both in Latvia and abroad. The portal provides an opportunity to reach the person responsible for certain equipment to agree on the use of a particular service or piece of equipment. RTU has concluded cooperation agreements with other research institutions on the use of research equipment, incl. commercial companies if allowed by funding conditions.

The RTU Research Department manages the Research Support Fund, which provides support for research activities, ensures the maintenance and availability of research infrastructure, as well as provides financial support for open access publications of Open Access Journals and RTU scientific journals.

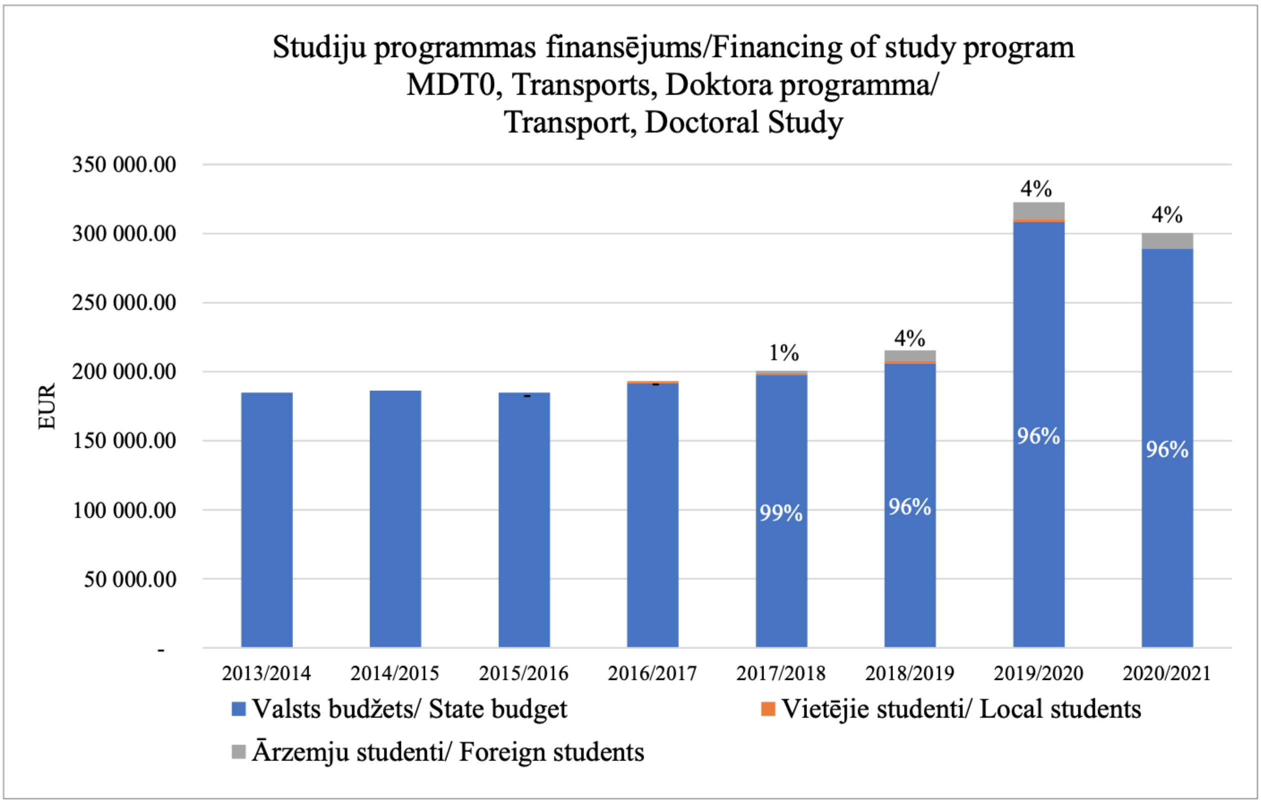
The AERTI closely collaborates with Aviatest, Latvia's leading research company in the field of aeronautics, cooperating in the use of the scientific base, as well as in research performance.

International cooperation with foreign universities and research organisations can be well characterized by cooperation agreements concluded within the framework of Erasmus+ (https://www.rtu.lv/en/internationalization/mobility/erasmus-plus/erasmus-outgoing-mobility/partners), as well as with a team of authors of published scientific articles, which can be seen in the attached CVs of the academic personal.

**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).**

RTU funding from the state basic budget consists of study base funding, which corresponds to the list of study programs and the number of students. This funding comprises finances for utility payments, taxes, infrastructure maintenance (including providing data for the Register of Students and Alumni), purchase of inventory and equipment and staff salaries, as well as funding for research. The number of study positions is allocated after negotiations with the Ministry of Education and Science.  Study base funding from the state budget is intended to be used for full-time studies. It is calculated based on the number of study positions determined by the state at RTU, as well as the costs of the study position determined by the state and the study cost coefficients in the thematic spheres of education. RTU funding from the state basic budget for the study positions in the respective academic year is distributed in accordance with RTU Senate decision "On the Methodology for Distribution and Use of Basic Budget, Performance Financing and Student Tuition Fees between RTU Organizational Units" from the respective academic year. This Methodology is annually reviewed and approved considering the necessary changes. RTU has a decentralized budget and a separate budget is planned for each organizational unit. A budget essentially is a plan of revenue and expenditure for a specific period, work, event, or function. RTU revenues and expenditures are managed according to the principles approved by the Senate or determined by an authorized Vice-Rector for Finance.

According to the Methodology, funding for organizational units is allocated either according to the financial or budget year or immediately upon receipt of funding. The financial or budget year of RTU organizational units is from October to September of the following year, for this period the funding is calculated and distributed: the subsidies or the basic budget funding (education and training of state-funded students) is allocated in a form of a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month; financing for students, who pay tuition fees (education and training of students who pay tuition fees, including debtors' finances) is distributed twice a year (in October and April) as a monthly limit – each organizational unit receives 1/6 of the calculated funding for the semester per month; performance funding (research support funding) is allocated as a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month; research base funding (research support funding) is allocated as a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month. Analysis of the general procedure for financing study programs at RTU reveals that the basic budget and tuition fee funding from local students who pay tuition fees are determined following the basic principles set by the state. In the process of determining the amount of funding, the study cost coefficients of the thematic spheres and the values of the study cost coefficients according to the level of the study program, as well as the number of students at the study program and the corresponding study courses are considered. As mentioned above, by using the study cost coefficients of the thematic spheres of education, it is possible to determine the amount of funding required for the implementation of a specific study program and study course. RTU Senate has decided that in the future the study cost coefficients of the thematic spheres of education will be applied individually to each study course included in the study program, thus ensuring even more appropriate funding for the implementation of the study courses. To implement this system, an expert commission was established by the order of the Vice-Rector for Academic Affairs, which determined the thematic area of each study course.




The financial resources of the study program "Transport" are shown in Figure and are sufficient to implement the study program. The use of financial means is regularly monitored by RTU administration and RTU Vice-Rector for Finance. In 2019/2020, there was a financial spike caused by the admission of PhD students from the Latvian Maritime Academy (until the PhD program was developed and licensed by the Academy). Thus, six PhD students of the Maritime Academy were admitted to RTU program "Transport" for two academic years, but in academic year 2020/2021 they moved to the newly licensed Doctoral study program at the Maritime Academy.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

The costs per student within the study program are calculated by the Office of the Vice-Rector for Finance. The average cost per student in 2013-2020 was 12 225,84 EUR. The number of study places is allocated after negotiations with the Ministry of Education and Science. The amount of study funding is determined on the basis of the number of study places determined by the state at RTU, as well as the base costs of the study place determined by the state and the study cost coefficients of the thematic areas of education.

## 3.4. Teaching Staff

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

The academic staff involved in the implementation of the study program are highly qualified and competent to ensure the acquisition of the necessary research skills, theoretical knowledge, practical skills and competencies. The qualification of the academic staff meets the criteria specified in Articles 28, 30, 32, and 40 of the Law on Higher Education Institutions, see the Self-Assessment Report (Biographies of academic staff in the form of Europass Curriculum Vitae).

Actively engaged in scientific research, the academic staff publish research results, participate in international scientific conferences, seminars, exhibitions, etc., undertake internship at companies, and constantly raise competencies and professional qualifications, thus ensuring the achievement of aims and learning outcomes of the corresponding study course and the study program.

The academic staff have extensive experience in organizing and implementing research projects, which helps young researchers develop their creative competencies, i.e., the ability to generate new research ideas as well as to plan, structure and manage large-scale research projects in business and economics (incl. international projects).

Considering that the study program and study courses are student-centered (respecting the difference in the students' prior knowledge, skills, experience, and the variety of students' actual needs), the performance appraisal method is used; thereby, assessment results provide students with an insight into the extent to which they have achieved the intended learning outcomes. In this case, the feedback of the scientific adviser and their in-depth involvement in the development of the PhD Thesis provide an opportunity to achieve the learning outcomes.

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

Since academic year 2013/2014, there has been a change in the academic staff of the program, featuring positive dynamics. The total increase is +153%, which can be explained by the consistent implementation of the staff policy as well as the continuous recruiting of academic staff.

| Academic year | Professors | Associate professors | Assistant professors | Total |
|---|---|---|---|---|
| 2013/2014 | 6 | 2 | 7 | 15 |
| 2014/2015 | 6 | 2 | 7 | 15 |
| 2015/2016 | 9 | 3 | 7 | 19 |
| 2016/2017 | 9 | 3 | 8 | 20 |
| 2017/2018 | 9 | 3 | 7 | 19 |
| 2018/2019 | 9 | 4 | 8 | 21 |
| 2019/2020 | 9 | 4 | 8 | 21 |
| 2020/2021 | 9 | 6 | 7 | 22 |
| 2021/2022 | 10 | 6 | 7 | 23 |

The study process in academic year 2013/2014 was carried out by 15 members of academic staff, including 6 professors, 2 associate professor and 7 assistant professors. Based on the results of the analysis, it can be concluded that during the reporting period, in accordance with the strategic aims of the study field and study program development, the qualitative value of academic staff has increased, with particular emphasis on the increase in the number of assistant and associate professors, as seen in Table. As a result, in academic year 2021/2022 the study process is mainly provided by 10 professors, 6 associate professors and 7 assistant professors. Consequently, it can be concluded that the academic staff has improved both qualitatively and quantitively.

**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).**

In compliance with the study field and the strategic aims of the program development, academic staff are expected to perform scientific research to keep the study program (and study courses) compatible with the technological advancement and the novelties of the industry. The academic staff of the study program participate in Latvian and international scientific conferences, using gathered information and experience for updating the content of the study courses, thus contributing to the scientific research and its integration into the study process. The prevalent publications in conference proceedings indexed by the Web of Science and / or SCOPUS are as follows (see Annex for the full list of publications):

- Arnautov, A., Nasibullins, A., Gribniak, V., Blumbergs, I., Hauka, M., Experimental characterization of the properties of double-lap needled and hybrid joints of carbon/epoxy omposites, Materials, 2015, 8(11), pp. 7578–7586.
- Sokolovs, A., Grigans, L., Kamolins, E., Voitkans, J., An induction motor based wind turbine emulator,Latvian Journal of Physics and Technical Sciences, 2014, 51(2), pp. 11–21.
- Lavrinovicha, L., Dirba, J., Sejejs, K., Kamolins, E., Synthesis of Electronically Commutated Synchronous Motors with Predefined Characteristics, Latvian Journal of Physics and Technical Sciences, 2019, 56(2), pp. 3–11
- Makarchuk, D., Kreicbergs, J., Grislis, A., Gailis, M., Analysis of energies and speed profiles of driving cycles for fuel consumption measurements, Engineering for Rural Development, 2015, 14(Janury), pp. 265–271
- Malnaca, K., Gorobetz, M., Yatskiv (Jackiva), I., Korneyev, A., Decision-making process for choosing technology of diesel bus conversion into electric bus, Lecture Notes in Networks and Systems, 2019, 68, pp. 91–102
- Gorobetz, M., Strupka, G., Levchenkov, A., Algorithm for optimal energy consumption of UAV in maritime anti-collision tasks, 2015 56th International Scientific Conference on Power and Electrical Engineering of Riga Technical University, RTUCON 2015
- Zaripov, R., Gavrilovs, P., Research Opportunities to Improve Technical and Economic Performance of Freight Car through the Introduction of Lightweight Materials in their Construction, Procedia Engineering, 2017, 187, pp. 22–29
- Auzins, J., Chate, A., Rikards, R., Skukis, E., Metamodeling and robust minimization approach for the identification of elastic properties of composites by vibration method, ZAMM Zeitschrift fur Angewandte Mathematik und Mechanik, 2015, 95(10), pp. 1012–1026
- Auzins, J., Janushevskis, A., Janushevskis, J., Skukis, E., Software EDAOpt for experimental design, analysis and multiobjective robust optimization, OPT-i 2014 - 1st International Conference on Engineering and Applied Sciences Optimization, Proceedings, 2014, pp. 1055–1077
- Pavelko, I., Pavelko, V., Kuznetsov, S., Ozolinsh, I., Bolt-joint structural health monitoring by the method of electromechanical impedance, Aircraft Engineering and Aerospace Technology, 2014, 86(3), pp. 207–214, 17112012
- Paramonov, Y., Cimanis, V., Varickis, S., Kleinhofs, M., Modeling the Residual Strength of a Fibrous Composite Using the Residual Daniels Function, Mechanics of Composite Materials, 2016, 52(4), pp. 497–506
- Zabasta, A., Kunicina, N., Kondratjevs, K., ...Ribickis, L., Delsing, J., MQTT Service Broker for Enabling the Interoperability of Smart City Systems, Energy and Sustainability in Small Developing Economies, ES2DE 2018 - Proceedings, 2018, pp. 81–87, 8494341
- Patlins, A., Hnatov, A., Kunicina, N., ...Zabasta, A., Ribickis, L., Sustainable pavement enable to produce electricity for road lighting using green energy, Energy and Sustainability in Small Developing Economies, ES2DE 2018 - Proceedings, 2018, pp. 21–26, 8494236
- Zakis, J., Rankis, I., Liivik, L., Chub, A., Analysis of buck mode realization possibilities in quasi-Z-source DC-DC converters with voltage doubler rectifier, International Conference on Power Engineering, Energy and Electrical Drives, 2015, 2015-September, pp. 570–575, 7266379
- Arshad A, Li Q, Li S, Pan T. Effects of inlet radial distortion on the type of stall precursor in low-speed axial compressor. Proc Inst Mech Eng Part G J Aerosp Eng 2018;232(1):55-67.

The following persons with a doctoral degree are involved in the implementation of the doctoral study program “Transport” (Classification Code 51525), including experts approved by the Latvian Science Council:

- Engineering Sciences and Technologies-Electrical Engineering, Electronics, Information and Communication Technologies - 2 persons;
- Engineering Sciences and Technologies-Mechanical Engineering and Mechanics - 2 persons;
- Engineering and Technology-Construction and Transport Engineering - 4 people

| Name, surname of the lecturer | LZP expert rights | Field | End date of election |
|---|---|---|---|
| Edmunds Kamoliņš | yes | Engineering Sciences and Technologies-Electrical Engineering, Electronics, Information and Communication Technologies | 17.06.2023. |
| Aivis Grīslis | no | | |
| Māris  Hauka | no | | |
| Mihails Gorobecs | yes | Engineering Sciences and Technologies-Electrical Engineering, Electronics, Information and Communication Technologies | 06.10.2024. |
| Pāvels Gavrilovs | yes | Engineering and Technology-Construction and Transport Engineering | 25.05.2023. |
| Jānis Eiduks | no | | |
| Aleksandrs Januševskis | no | | |
| Ēriks Geriņš | yes | Engineering Sciences and Technologies-Mechanical Engineering and Mechanics | 31.03.2024. |
| Irīna Boiko | yes | Engineering Sciences and Technologies-Mechanical Engineering and Mechanics | 25.05.2023. |
| Mārtiņš Kleinhofs | no | | |
| Vitālijs Pavelko | yes | Engineering and Technology-Construction and Transport Engineering | 01.09.2024. |
| Ali Arshad | yes | Engineering and Technology-Construction and Transport Engineering | 05.05.2024. |
| Vladimirs Šestakovs | yes | Engineering and Technology-Construction and Transport Engineering | 21.08.2022. |
| Ilmārs Blumbergs | no | | |
| Ēriks Ozoliņš | no | | |
| Sergejs Kuzņecovs | no | | |
| Sergejs Bratarčuks | no | | |
| Viktors Feofanovs | no | | |

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

During the reporting period, the organizational units responsible for the PhD study program have implemented or are implementing the following research and contract projects:

1. Mobile Space Environment Testing Equipment Development of "Metamorphosis" Prototype for Transportation Intermodal Traffic, short title: "Metamorphosis", ERAF 1.1.1.1/18/A/133, 01.05.2019- 30.04.2022
2. Supporting the Smart Specialization Approach in the Silver Economy to Increase Regional Innovation Capacity and Sustainable Growth, short title: OSIRIS; #R080 Interreg Baltic Sea region; 01.01.2019- 30.06.2021.
3. Design and Modelling of Aerospace System for Launching pico- and nano-Satellites to Low Earth Orbit; LZP-2018/2- 0344; 01.05.2020- 30.04.2023.
4. Contractual work on the production and testing of the most promising samples of magnesium coating technologies within the framework of project No. 1.1.1.1/19/A/148 “Innovative and Efficient Coating Development for Magnesium Components”, L8900.
5. Contractual work on the study of MgO-free (oxide-free) coating of magnesium products using a plasma electrolytic oxidation (PEO) and a physical vapor deposition (PVD) approach within the framework of project No. 1.1.1.1/19/A/148 “Innovative and Efficient Coating Development for Magnesium Components”, L8901.
6. Contractual work on the study of MgO-free (oxide-free) coating of magnesium products using a plasma electrolytic oxidation (PEO) approach within the framework of project No. 1.1.1.1/19/A/148 “Innovative and Efficient Coating Development for Magnesium Components”, L8902.
7. Development, Manufacture and Testing of a Single-Axle Single-Seat Helicopter Pilot Plant; LIAA voucher project (active 1.2.1.2/16/I/001); LV8881.
8. Development of a New Generation of Advanced Metal Alloys; LIAA voucher project (activity 1.2.1.2/16/I/001); LV8881.
9. The Development of an Unmanned Aerial Vehicle Platform Using Biodegradable Materials, the projects of RTU research platforms; ZI- 2021/7.2.
10. Contract work on the feasibility study on the conversion of a minibus from diesel to hydrogen, LIAA voucher project (activity 1.2.1.2/16/I/001); LV8906.
11. Development of Innovative Metal-Ceramic Nanostructured Coatings (McBLADE) for the Hot Section Parts of Gas Turbine Engines, 1.1.1.2/VIAA/1/16/126; 01.03.2018- 28.02.2021.
12. Multifunctional Nanostructured Coatings for Aircraft Structures (NANOCOAIRS), 1.1.1.2/VIAA/1/16/176; 01.02.2018-31.01.2021.
13. Development of Aircraft Structural Health Inflight Monitoring System (FLY-SAFE), 1.1.1.2/VIAA/1/16/104; 01.02.2018-15.10.2020.
14. Development of an Innovative High-speed Wind Tunnel Testing Facility for the Research of the Characteristics of Novel Aerospace Objects, 1.1.1.2/VIAA/2/18/321; 01.12.2018-30.11.2021
15. Development of an Integrated Sensor System for Material and Structure Monitoring, 1.1.1.2/VIAA/2/18/326, 01.11.2018-31.10.2021
16. Developing a Remotely Piloted Aircraft System for Solving Environmental Monitoring Problems in the Baltic Sea Area, 1.1.1.2/VIAA/4/20/650; 01.01.2021-30.06.2023
17. High Performance Erosion Resistant Multifunctional Coatings for Aircraft Composite Structures, (PEROMACS); 1.1.1.1/16/A/073; 01.03.2017–29.02.2020
18. A Novel Concept of an Extremely Short Take-Off and Landing All-Surface (ESTOLAS) Hybrid Aircraft: From a Light Passenger Aircraft to a Very High Payload Cargo/Passenger Version; FP7-AAT-2012-RTD-L0; 01.05.2012-30.04.2014

19. Development of a System for Unmanned Aircraft and the Creation of Industrial Prototypes for Unmanned Aerial Vehicles to Perform the Tasks of the Latvian National Economy No. 2010/0256/2DP/2.1.1.1.0/10/APIA/VIAA/070, 2011-2014.

Prior to the accreditation period, the following projects have been implemented, e.g.,: “A Novel Concept of an Extremely Short Take-Off and Landing All-Surface Hybrid Aircraft: From a Light Passenger Aircraft to a Very High Payload Cargo/Passenger Version ” (ESTOLAS); “Aircraft Integrated Structural Health Assessment” AISHA II; “Development of Technology for the Creation of Multicomponent Nanostructured Protective Coatings for Industrial Products”; “Optimization of Technical Systems Based on CAD-Integrated Safety Analysis”, “Statistical Evaluation and Verification of Information Process Models Using the Resampling Approach”, “Investigation of Material Surfaces and Macrostructural Properties”; “Structural Safety of Aircrafts under Fatigue”; “Testing of Structural Elements and their Joints Using Lambda Wave Method”; “Development of an Unmanned Aircraft System and the Creation of Industrial Prototypes for Unmanned Aerial Vehicles to Boost Latvian National Economy”, “Development of an Industrial Technology Prototype for Obtaining Multicomponent Nanostructured Ion-Plasma Wear-Resistant Coatings”; “Modelling and Research of Efficient Gas Processes for Small Heat Generating Engines”; “Development of an Industrial Prototype of Innovative Wind Energy Equipment with a Vertical Axis of Rotation to Increase the Latvian National Economy”; ‘Creation of Technology-Intensive Modules and Modernization of Material and Technical Base for the Study Program ‘Transport Systems Engineering’”; “ESF Project for the Improvement of the Study Program ‘Transport Systems Engineering’”; “Multipurpose Unmanned Aerial Vehicle Design”; “The Creation of Functional Composite Coatings of Industrial Products by Ion-Plasma Spraying”; “The Creation of Mathematical Models, Algorithms and Computer Programs for Analysis of the Latvian Transport System for Development Prognosis and Optimization”; “The development of Ion-Plasma Coatings for Protection and Restoration of the Components of a Vehicle Power Plant”; “Design of Eco-Efficient Vehicles for Individual Use”; “Development of a Method for Early Detection and Control of Fatigue Cracks in Aircraft Structures in Bench Tests”; “Multipurpose Unmanned Aerial Vehicle Design”.

See Annex for the list of students and Faculty staff involved in the forementioned projects.

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

The implementation of the study program “Transport” ensures the proportionality of the teaching staff of the professional and academic environment, thus creating a balanced team that helps to achieve the goal and results of the study program.

The cooperation of the teaching staff is formed in scientific-methodological seminars, as well as in individual talks with the director of the study program, communication of the teaching staff, as well as in joint meetings of AERTI and Transport Institute academic staff, discussing various issues of AERTI and Transport Institute. The academic staff of the study program cooperates in the implementation and updating of the content of the study courses, coordinates the topics in order to avoid duplication of the content. The academic staff also cooperates in research groups within the institutes, promoting cooperation in teams in the implementation of joint research projects and contract work, which involves employees of various RTU structural units, as well as foreign partners, as evidenced by the lecturers' CVs and publications.

The ratio of the total number of students and lecturers within the study program is on average one lecturer per two students. When analyzing this relationship, it should be taken into account that the doctoral program is implemented in a widely represented field of study and the lecturers involved in the doctoral program also teach in other programs of the field. Thus, it is possible to maintain highly qualified teaching resources despite the relatively small number of students. The wide range of academic staff is objectively necessary to ensure different specializations in the field of transport. Each specialization has its own distinct differences, as well as graduates of these specializations are in demand in the labor market. A wide range of lecturers is also needed to provide new scientists with different scientific directions in the field of study and at the faculty, which in turn is essential for the continuation and development of the implemented research directions, as well as for the subsequent renewal of academic and research staff in general.

The scientific commission of the faculty supervises the implementation of the doctoral program, whose responsibilities also include the annual evaluation of the doctoral students' study progress and the decision on the transfer of the student to the next study course.

# 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 | MDT0_diploms.pdf | MDT0_diploms.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) | MDT0_CHE_opinion.pdf | MDT0_AIP_atzin.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 | MDT0_stud_statist.pdf | MDT0_stud_statist.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 | MDT0_CoursMapp_8_annex.pdf | MDT0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MDT_CurricStPogr_9_annex.zip | MDT_StudProgrPL_9_pielik.zip |
| Descriptions of the study courses/ modules | MDT_DescriptStud_cour.zip | MDT_Studkurs_Apr.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.zip | Apliecinājums - LZP eksperti doktora programmā.zip |
| 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 |

# Aviation Transport (45525)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Aviation Transport* |
| Education classification code | *45525* |
| Type of the study programme | *Academic master study programme* |
| Name of the study programme director | *Ilmārs* |
| Surname of the study programme director | *Blumbergs* |
| E-mail of the study programme director | *ilmars.blumbergs@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing.* |
| Phone of the study programme director | *29596694* |
| Goal of the study programme | *TThe aim of the master’s degree study program is to prepare demanded and high-quality specialists in the aviation industry with in-depth knowledge of the field, who have systemic and analytical thinking and independent work skills, as well as to prepare students for further doctoral studies.* |
| Tasks of the study programme | *1. To develop competencies in the operation, construction, and maintenance of aircraft equipment<br>2. To ensure continuous improvement of the quality of aviation transport education by training highly educated specialists for the private and public sectors in the field of aviation<br>3. To stimulate the interest of students and graduates in studies in higher level study programs<br>4. To develop the ability to independently organize one's own and team work.* |

| | |
|---|---|
| Results of the study programme | *Knowledge (knowledge and understanding)<br>Students can demonstrate in-depth, extended knowledge and understanding in the field of air transport. Students acquire information on the latest discoveries in aviation science. The knowledge acquired through the study program "Aviation Transport" provides the basis for creative thinking and involvement in scientific research activity.<br>Skills (ability to use knowledge, communication, general skills)<br>Students can independently use theoretical methods and problem-solving skills to carry out scientific research in the field of air transport and perform highly skilled, professional functions.<br>Students can reasonably explain and discuss complex or systematic, scientific or professional aspects of aircraft maintenance both with professionals and non-professionals.<br>Students can independently direct the development and specialization of their competences and assume responsibility for the results and analysis of personnel's team work.<br>Students can conduct business activity, introduce innovations in the field of air transport systems, conduct a study or learn in difficult and unpredictable conditions and, if necessary, change these conditions by applying new approaches.<br>Competence (analysis, synthesis and evaluation)<br>Students can independently:<br>- formulate and critically analyse complex scientific and professional problems related to the branch of air transport.<br>- substantiate decisions and, if necessary, carry out additional analysis.<br>Students can integrate knowledge from different fields and make contribution to the creation of new knowledge.<br>They can promote the development of scientific research methods in the field of air transport systems, demonstrate understanding of and responsibility for the possible effect of scientific results or professional activity on the environment and society.* |
| Final examination upon the completion of the study programme | *Master's Thesis* |

# Study programme forms

### Full time studies - 2 years - latvian

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *2* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *80* |
| Admission requirements (in English) | *Bachelor degree in mechanical engineering or comparable education* |

| | |
|---|---|
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Master degree in mechanical 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 - 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 mechanical 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 in Mechanical 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.

The main changes introduced to the program, with the regular accreditation, are the transition to the academic Master program. Due to the transition to the academic program, the qualification of Aircraft Technical Operations Engineer and Aircraft Technical Operations Avionics Engineer will no longer be awarded. It is planned to implement the program only in one volume – 80 CP in two years. Because of the transition from the professional master's program to the academic one, as well as in connection with the updating of the program, a number of changes have been made to the curriculum and courses.

Due to the death of Alexander Urbahs, the previous director of the program, Ilmārs Blumbergs has been the director of the program since 2020.

### 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 academic Master study program “Aviation Transport” complies with the the $7^{th}$ level of the EQF and the LQF; thus, it is oriented towards graduates with a Bachelor degree in the field of aviation transport or comparable education. Its name indicates the aim of the study program, which is to provide students with the opportunity to acquire practical skills and theoretical knowledge in the field of aviation transport in accordance with the state standard of academic education for an academic Master degree as well as to develop students’ research skills and educate and train the analysts in aviation transport maintenance and related processes and industry specialists for solution of various problems and decision-making in the modern changining economic environment. To achieve the set aim, the tasks of the study program have been developed and they are designed to achieve specific learning outcomes. The aim of the program is reached if during the study process the students obtain these learning outcomes. Regarding its content, the program is designed in such a way that the aims and learning outcomes of the included study courses align with and ensure the achievement of the overall aim and learning outcomes specified in the program. The Master degree in Aviation Transport is awarded after the completion of the theoretical study courses of the program and the public presentation of the Master Thesis in front of the State Examination Committee. Analyzing the name of the study program, the degree to be obtained, the aim and tasks, learning outcomes, as well as the admission requirements, it can be concluded that all these aspects are correlating.

Comparison of program changes:

| | Parameters of the program submitted in the previous accreditation | Parameters of the program submitted in the current accreditation |
|---|---|---|
| Code of the study program according to the Latvian education classification | 47525 | 45525 |
| Type and level of the study program | Professional master studies | Academic master's studies |
| Volume of the study program (CP, recommend also ECTS) | 80 or 121 CP | 80.0 CP |
| Duration of studies | 2 or 3 years full-time | 2 years full-time |
| Language of implementation | Latvian Language | In Latvian or English |
| Director of the study program | Alexander Urbaha - doctor, professor | Ilmārs Blumbergs - Doctor, Associate Professor |
| Degree to be awarded, professional qualification or degree and professional qualification | Professional master's degree in aviation transport and qualification of mechanical engineering engineer | Academic master's degree in transport systems engineering |

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

Since the last accreditation, the content of the study program has been updated and improved to meet the aim of the program and ensure the achievement of learning outcomes, as well as to fit within the field of aeronautic transport and the latest scientific trends and innovative solutions.

While elaborating RTU Development Strategy, recognizing the role of the university in the economic growth of the Baltic region and shaping the future of Latvia, the priorities of the European Union, as well as the guidelines of national and regional level education and innovation policy planning documents have been observed. Successful implementation of RTU Development Strategy is the basis for building a knowledge-based Latvian society and RTU is one of the most important partners in achieving strategic goal No 244 set in the National Development Plan of Latvia – education and knowledge for economic growth and technological excellence.

RTU mission is to provide the Latvian economy and society with internationally competitive high-quality scientific research, higher education, technology transfer and innovation.

The aim of the academic Mster study program “Aviation Transport” corresponds with the mission of RTU and focuses on the education and training of new specialists.

The content and implementation of the study program focus on the development of such competencies as adaptability and responsiveness to changes in students, following and even getting ahead of the labor market demand. RTU is one of the cornerstones of Latvia’s development, which ensures the training of specialists necessary for the Latvian economy, as well as the creation of new products and services, serving as a basis for Latvia’s sustainable growth. RTU Strategy includes the most important guidelines for the development of RTU in the period up to 2020, as well as determines the tasks and delegates responsibilities for the completion of these tasks.

Graduates of the study program easily find a job in their specialty. In fact, upon admission to the study program many students already work in the respective field or find a job during their studies. AERTI on its part develops a schedule that is as suitable as possible to be combined with work.

The Latvian Aviation Association, which consists of the absolute majority of representatives of the aviation industry, confirms the necessity of the program and the demand for its graduates. Since Riga International Airport is planning to expand because of the forecast increase of traffic, and other Latvian airports are also developing, the demand for the graduates of the program will be even higher. As the transport sector continues to grow rapidly, the importance of proper maintenance of the transport system and smart, science-based management of transport operations increases. Given the situation in the world, it is difficult to predict the potential demand for students, but it is clearly growing over time and at least 20 new specialists per year would be necessary to satisfy the needs of the Latvian economy.

### 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 number of students at the Master program with specific specialization may be assessed as moderate and fully sufficient to provide qualitative training. Despite the demand from employers and the labor market for aviation transport specialists, the number of people willing to study and consequently the number of students was decreasing. Of course, the decline in the number of enrolled students could be observed in almost all Latvian universities. However, in this case one of the reasons is that already in the junior courses, the students of the Bachelor program tend to find well-paid jobs in the aviation industry and many lose motivation to continue studies to aim for even higher career development. The passivity of the previous head of the study program must be acknowledged as well. Since the spring of 2020, the head of the program has been replaced and a lot of work has been put into developing scenarios for the development of the program. As a result, it has been decided to make the transition to an academic Master program, which will allow in a relatively short period of time to educate and train the leading specialists with a wider knowledge meeting a wider industry demand for solution of work-related tasks.

The proportion of students enrolled, students expelled and graduates remains at about the same optimal level, which is good. Some students who were on academic leave have resumed and completed their studies and some students have re-enrolled, which to a certain extent indicates a positive attitude towards the new program head and his actions. The increase in the number of enrolled students in academic year 2019/2020 is yet another positive aspect.

Due to Covid-19, the number of foreign students admitted has slightly decreased in the last two years, but overall, the number of foreign students in the program is on average about 30% and the number of foreign students in the program increased by the time of the Covid-19 restrictions.

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

## 3.2. The Content of Studies and Implementation Thereof

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

The study program “Aviation Transport” has been developed considering suggestions from employers regarding the demand of the labor market. Order stipulating the transition of the program status from professional to academic Master study program, was adopted considering the situation in the country concerning the formulation of occupational standards as well as the recommendations of employers. This transition will allow academic staff to educate and train students for a wider labor market demand. In Latvia, most companies are classified as micro or small companies; occupational standards are not formulated for specialists working in such companies, because their number is too small. Nor are professional standards formulated for future professions, such as those in the space industry. However, to ensure the training of specialists necessary for the Latvian economy, the study program was adjusted in cooperation with employers to comply with both the regulations of Cabinet Regulation No. 512 of 26 August 2014 "Regulations on the State Standard of the Second Level Professional Higher Education" and the interests of companies.

Typically graduates of the program are employed by aviation-related companies such as airports, maintenance organizations, airlines, designers and manufacturers of aviation products, etc.

Considering the forecasts of employers, 20-30 graduates should complete the program per year.

The study courses are designed in accordance with the aim of the study program and observing the principles included in the description of the study program implementation.

The study program is implemented on the module principle. The modules are created as described in the Law on Higher Education Institutions, which stipulates that a study module is part of a study program created by combining study courses or their parts, which have common aims and learning outcomes.

Program modules are divided according to the aims, comprising the study courses that provide information on the latest theoretical and practical achievements in the field, while the second module comprises research, creative work, design and management study courses. These modules are not separately highlighted in the program.

The topicality and compliance of the content of study courses and modules with the needs of the labor market are maintained as the head of the program consults with the companies of the field, as well as RTU organizes regular meetings with employers’ associations and other organizations. Employers participate in the commissions evaluating the public presentations of graduation papers, where they can ascertain that student are educated and trained well. After the public presentation, the representatives of employers can express their observations and recommendations. Scientific trends are considered by following the trends in the themes of projects, as well as by consulting with the instructors of the program (considering their competencies in a particular research field). The instructors of the program regularly participate in international conferences, which ensures their competence in the represented fields.

The compliance of the program with the needs of the labor market of the sector is confirmed by a positive feedback on the program from the leading association of the sector - the Latvian Aviation Association, which includes the absolute majority of companies in the sector.

**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 evaluation of the information included in the study courses/modules, the learning outcomes, the set aims, and other indicators, as well as the correlation of the study course/module aims with the aims of the study program and the learning outcomes is provided by the head of the program, who is responsible for the coordination of course content and aims. The interrelation of the learning outcomes of different courses is reflected in the order in which these courses appear in the curriculum.

The academic staff are involved in various scientific projects and regularly participate in scientific conferences and publish their articles, including those included in Scopus and other databases. The involvement of the staff in current research, as well as the execution of contract work in the industry and regular cooperation of the head of the program with this industry form the basis for concluding that the degree awarded upon completion of this program is based on scientific achievements in the industry.

**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.**

RTU has adopted the Regulation on the Assessment of Learning Outcomes that is binding on all study programs.

Various methods are used to assess student's performance and ensure mastering the program courses and acquiring practical skills – case studies, group work, problem-oriented studies, use of information technology. RTU determines the organization of the study process by Order , which is regularly updated based on the situation in the country.

The principles of student-centered education have been taken into account in the implementation of the study program – student representatives have participated in the development of the program, its discussion and approval. The classes and the examinations are scheduled considering the possibilities of students as they combine studies with work. Students are informed about the examination methods, criteria and the procedure for appealing the assessment. Students are introduced to the expected learning outcomes of each course and the report form, as well as expected tests at the beginning of the study course. The content of the course, expected learning outcomes, recommended literature and other important information are provided in the description of each course.

The results of the study process are analyzed in discussions with the head of the study program, as well as during the meetings of the AERTI Council. The main issues addressed are the following:

- Execution of the study program and study plan in terms of content and volume;
- The level of students' knowledge, skills and abilities and its compliance with the requirements of a specialist qualification in professional programs;
- Performance of students in the course;
- Financial compliance of the study process with the possibilities and requirements of the Institute.

The quality of students' knowledge, abilities and skills is constantly monitored by:

- Operational accounting of records – the instructor performs operational evaluations of the progress and quality of the completion of study tasks during the semester;
- Credit test and exams – exams are written or supplemented by oral additions, explanations;
- Public presentation of the study project – the content of the project or research and the public presentation are evaluated;
- Internship evaluation – fulfilment of individual task, evaluation of internship log entries;
- Evaluation of the graduation paper – the Master Thesis – creative practical research and results.

Students' knowledge is assessed according to a 10-point grading scale. If the final form of assessment of a study course is a credit test, then, similarly to an exam, it is evaluated by a mark in a 10-point grading scale. Students' performance is mainly evaluated according to the results during the examination session and upon the completion of a course.

Learning outcomes are determined for each study course and lesson within the program – what the student knows, what skills and competences they have acquired, and what they are able to do after successful completion of the course. Learning outcomes of both the whole qualification, and each component separately – the course and the internship – are assessed.

Students' knowledge is assessed twice a year upon completion of courses during winter and spring examination sessions when students take exams in study courses in accordance with the developed individual study plans. Examination questions are designed to ensure that the student preparing for the exam achieves the aim of the study course described in the description of each course. If necessary, students demonstrate their knowledge of the study course on stands, using posters and mock-ups. Explanations shall be given orally. Examination questions, based on the course program, are developed by the instructor, who is responsible for the respective study course.

The viva voce examination of the Bachelor and Master Theses takes place orally, demonstrating presentation materials. Internship places in the respective field are provided in collaboration with the technical staff of internship companies.

### 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 at RTU is organized in accordance with the “Procedure for Organizing the Internship at the Riga Technical University” approved by the RTU Senate.

Internships undertaken at companies are organized by dividing the total volume of internship by semesters. The head of the study program, a representative of the internship company and the intern sign an internship agreement. To ensure successful execution and management of the internship, a description of the internship has been developed, comprising the aim and tasks of the internship, the content of the internship and a report. Internships are intended to be undertaken at the companies, which have signed a cooperation agreement. The number of interns at small companies is usually 1-2 students per year; however, larger companies such as AirBaltic and Aviatest shall admit up to 15 students each. Number of cooperating companies with which traineeship agreements are concluded are attached.

Internship tasks are related to achieving the following learning outcomes:

- acquiring the competence to operate a company’s technical maintenance control system, ability to understand and analyses the elements of schemes, functional, principal and assembly schemes, and perform calculations;
- obtaining skills in diagnostics, testing, repair and control of equipment, ability to perform preventive and regulated work.

Depending on the previously completed program, the volume of the internship was 6 CP or 32 CP. The volume of the internship for the graduates of the AERTI Bachelor study program “Aviation Transport” was 6 CP, while the volume of the internship for the graduates of other professional Bachelor study programs was 32 CP. The volume of the internship in the academic Master study program will be 4 CP.

To support the student during the internship, the AERTI provides an internship supervisor-consultant, who coordinates the internship, advises the student and solves internship-related issues with the respective company.

### 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.

Usually, students choose the theme of the Master Theses from the list of themes provided by the AERTI during the second semester of the 1st year. After choosing a theme, students specify the chosen theme with a potential scientific adviser. Students may choose a theme which is not included in the list if the potential scientific adviser of the Master Thesis has approved it. The AERTI compiles the list of themes together with employers, including the managers of companies providing internship places, in accordance with the latest trends in the industry and the labor market and current topics of the European Aviation Safety Agency, as well as based on the current research trends.

The following Master Theses were publicly presented in 2020:

- Using a multifunctional aircraft for fire fighting.
- Research into the influence of V2500 turbofan engine thermal loads on the strength of engine high-pressure turbine rotor components.
- Research into the features of signals from aeronautical radio navigation systems.
- Application of Fibre Bunches in Aviation and Research into their Properties
- Problems of introducing an electronic technical log and their influence on internal procedures and compliance with EASA / CAA regulations.
- Analysing the methods of signal processing in aircraft radars.
- Planning of inspection intervals based on test data.
- Development and simulation of a control device for aircraft movement on the runway.
- Research into the influence of increased low-pressure rotor imbalance on the safety of PW150 turboprop engine.
- Research into the operation safety of Riga International Airport airfield and development of recommendations.
- Research into the influence of fan blade damage on the static fatigue of V2500 engine.
- Analysing the influence of aircraft crew fatigue on flight safety.
- Development of a glider launching winch.
- Assessing the possibility of passenger evacuation during aircraft emergencies in an airport area.

As can be seen from the list of themes chosen for the Master Theses in 2020, they cover a wide range of themes related to safety issues, avionics, airport operations, engine evolution and, of course, aircraft maintenance. The selected themes reflect the issues that are topical for companies operating in the industry, as well as themes that are interesting in terms of research.

## 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.**

RTU Ķīpsala Campus currently has 54 study rooms, 187 laboratories, 19 special training rooms, 10 computer classrooms, 12 workshops and several research centers of national importance. There is also a student dormitory with 950 beds and a special block designed for people with special needs to ensure enjoyable and comfortable living.

All university equipment is available for the implementation of the program, but for the implementation of the study program at the Institute of Aeronautics of Riga Technical University (at Ķīpsalas Street 6B and Lauvas Street 8 in Riga), 23 study rooms and specialized study rooms, training laboratories, workshops and simulation facilities are equipped with computers, projectors, webcams, audio systems, and other technical aids. The average number of work stations in the study rooms is 18. Lecturers have their own work rooms in each of the buildings, which are equipped with computers with Internet connection and printers.

The Institute has 2 computer classrooms with total of 60 work stations. RTU centralized computer classrooms, laboratories and library are also available for the implementation of the program. RTU HPC Centre provides high-performance computer resources and software for the study process and research. RTU organizational units may use software free of charge. The following software packages are available:

| No | Software | For research | For use in class | To be installed on student PCs |
|---|---|---|---|---|
| 1. | Adams | √ | | |
| 2. | *Altium Designer* | √ | √ | √ |
| 3. | *Ansys* | √ | √ | √ |
| 4. | *ArcGIS* | √ | √ | √ |
| 5. | *AutoCAD (Autodesk)* | √ | √ | √ |
| 6. | *COMSOL* | √ | √ | √ |
| 7. | *BM SPSS Statistics* | √ | | |
| 8. | *Intel Parallel Studio* | √ | | |
| 9. | *Mathcad* | | √ | |
| 10. | *Mathworks MATLAB* | √ | √ | |
| 11. | *OriginPro* | √ | | |
| 12. | *RETScreen* | √ | √ | √ |
| 13. | *SolidWorks* | √ | √ | √ |

In addition to the centrally purchased scientific software, the AERTI has purchased the following computer programs to improve research activities: ANSYS Academic Research (1 task) - TEC Technical Support, ANSYS Academic Research (1 task) - TEC Technical Support period.

The computer programs required for planning the curriculum, accounting, record keeping, personnel management and executing other administrative functions are provided centrally and are interconnected in a unified RTU system.

Database subscription agreements are signed both directly with the supplier and through the state agency Cultural Information Systems Centre, which is the national representative of Latvia in the international non-profit organization EIFL (Electronic information for Libraries, http://www.eifl.net/). The EIFL licensing program offers national libraries a subscription to internationally recognized databases at a significantly reduced subscription fee than is offered to individual subscribers, reducing the Library's expenditures. RTU Scientific Library has subscription to the following databases (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazeseresursi/abonetas-datubazes):

- ProQuest Ebook Central, Academic Search Complete EBSCOhost, Applied Science & Technology Source EBSCOhost, Business Source Ultimate EBSCOhost, EBSCOhost eBook Academic Collection, Wiley Online Library, SpringerLink, The International Monetary Fund;
- Subscriptions funded by the Ministry of Education and Science (ScienceDirect, SCOPUS (Elsevier), Web of Science);
- Latvian databases LETA, Letonika, Latvian Standards Database (available only on-site in the library).

The intensity of database use in RTU Scientific Library has been growing since 2016. The issuance of electronic resources has increased from 75,391 to 525,194 units. The new premises of the Library have allowed expanding the range of services for users. Since the opening of the new premises, the number of visits to the Library increased from 103,825 to 235,600 in 2018. RTU Scientific Library is available to anyone interested. It is open to users from Monday to Saturday. There is a 24-hour reading room. In summer, the Library is open every weekday and works part-time. (https://www.rtu.lv/lv/studijas/biblioteka/pakalpojumi-3) Information sources of the Library are organized in an open access collection.

A librarian helps navigate the collection. Bibliographers (information specialists) provide more detailed information and advice. A field-specific librarian service has been established in the Library (https://www.rtu.lv/lv/studijas/biblioteka/nozaru-informacija). Library resources can be found using the search tool Primo Discovery (https://www.rtu.lv/lv/studijas/biblioteka/vienota-informacijas-meklesana). It gives an opportunity to search for information in the library catalogue (https://kopkatalogs.lv/F/?func=find-b-0&local_base=rtu01), in the subscribed databases, as well as in the databases created by RTU Scientific Library (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazeseresursi/bibliotekas-veidotas-datubazes) within one interface. By searching for information in the electronic joint catalogue (https://kopkatalogs.lv/F), you can simultaneously obtain information about the available resources in 12 Latvian libraries. Both the electronic catalogue and RTU portal ORTUS have an option to reserve library resources remotely, remote access to databases is also provided. Since the introduction of RFID technology, users have been able to use five self-service book machines to take out books and return them at any time of the day. The Library provides students, academic staff and other interested parties with various levels of individual consultations and group training sessions on information literacy (https://www.rtu.lv/lv/studijas/biblioteka/lietotajuapmacibas).

The AERTI laboratories, workshops and other equipment are not reserved for particular programs and sharing of existing facilities is encouraged.

Scientific equipment is also involved in the study process within Master and Doctoral programs (under the strict supervision of the laboratory manager). Within the framework of the study program, students have an opportunity to use, strengthen and improve their knowledge, skills and competencies in practical, specialized study rooms, laboratories, workshops or simulation cabins and aircraft:

| No. | Name |
|---|---|
| 1. | Computer Simulation Aeronautics Laboratory |
| 2. | Metalworking Workshop with CNC Milling Cutters and CNC Laser Cutters and Other Equipment |
| 3. | Experimental Materials Laboratory |
| 4. | Module Manufacturing Laboratory/Workshop |
| 5. | Aircraft Navigation and Instrumentation System Laboratory |
| 6. | Fundamentals of Electronics and Electrical Engineering Training Laboratory |
| 7. | Aircraft Maintenance and Repair Training Laboratory |
| 8. | Aircraft Systems Training Laboratory |
| 9. | Propeller Training Laboratory |
| 10. | Aerodynamics Laboratory |
| 11. | Digital and Electronic Equipment Laboratory |
| 12. | JAK-42 Simulation Cabin |
| 13. | A-24 Simulation Cabin |
| 14. | AN-2 Simulation Cabin |
| 15. | Non-Destructive Testing Laboratory |
| 16. | Trainer Plane Socata Rallye |
| 17. | Trainer Plane VEF I-16 |
| 18. | Trainer Helicopter Mi-2 |
| 19. | Aircraft Engine Training Laboratory |
| 20. | Composite Material Manufacturing Workshop |
| 21. | Nanocoating Laboratory |

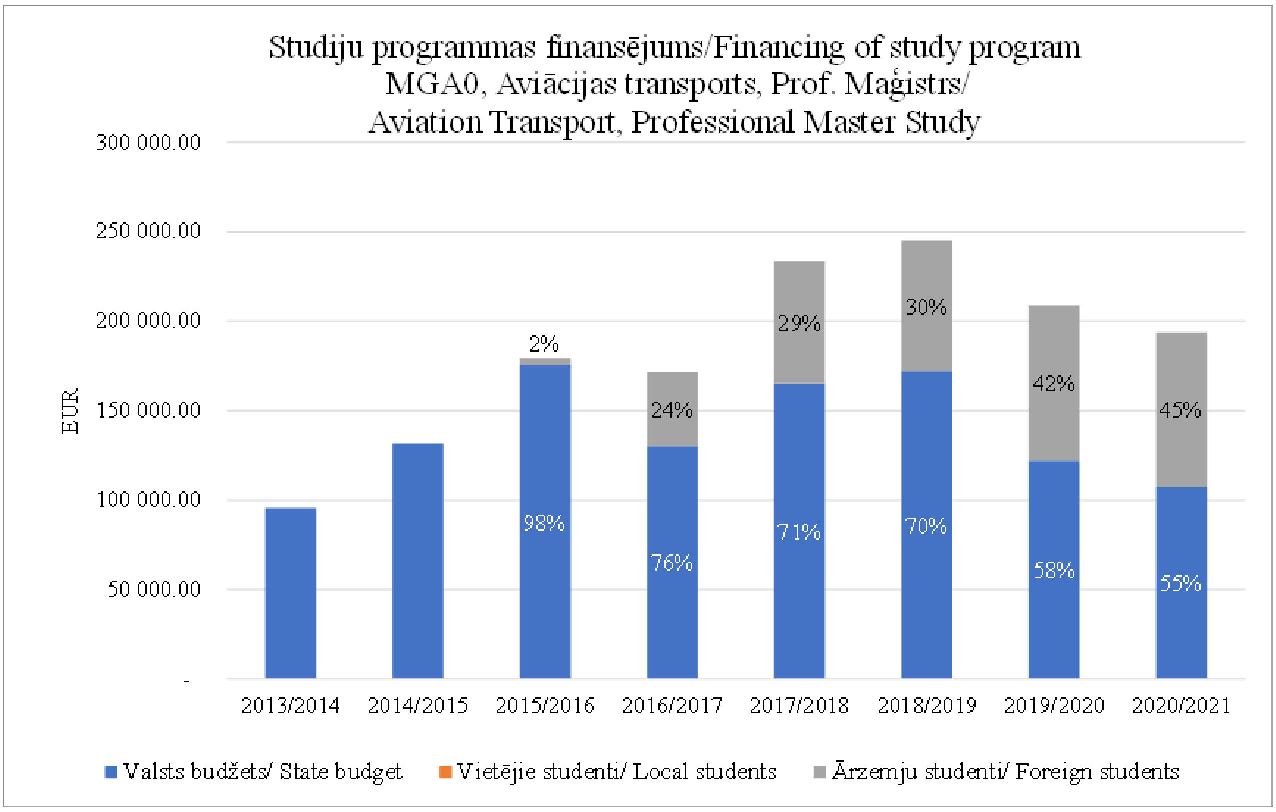
Every year, in addition to the centrally procured books, the AERTI purchases study literature corresponding to the study programs worth more than 1,000 EUR; these resources are included in the collection of RTU Scientific Library (see RTU Library).

**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).**

Not 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).**




RTU funding from the state basic budget consists of study base funding, which corresponds to the list of study programs and the number of students. This funding comprises finances for utility payments, taxes, infrastructure maintenance (including providing data for the Register of Students and Alumni), purchase of inventory and equipment and staff salaries, as well as funding for research. The number of study positions is allocated after negotiations with the Ministry of Education and Science. Study base funding from the state budget is intended to be used for full-time studies. It is calculated based on the number of study positions determined by the state at RTU, as well as the costs of the study position determined by the state and the study cost coefficients in the thematic spheres of education. RTU funding from the state basic budget for the study positions in the respective academic year is distributed in accordance with RTU Senate decision "On the Methodology for Distribution and Use of Basic Budget, Performance Financing and Student Tuition Fees between RTU Organizational Units" from the respective academic year.

This Methodology is annually reviewed and approved considering the necessary changes. RTU has a decentralized budget and a separate budget is planned for each organizational unit. A budget essentially is a plan of revenue and expenditure for a specific period, work, event, or function. RTU revenues and expenditures are managed according to the principles approved by the Senate or determined by an authorized Vice-Rector for Finance.

According to the Methodology, funding for organizational units is allocated either according to the financial or budget year or immediately upon receipt of funding. The financial or budget year of RTU organizational units is from October to September of the following year, for this period the funding is calculated and distributed: the subsidies or the basic budget funding (education and training of state-funded students) is allocated in a form of a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month; financing for students, who pay tuition fees (education and training of students who pay tuition fees, including debtors' finances) is distributed twice a year (in October and April) as a monthly limit – each organizational unit receives 1/6 of the calculated funding for the semester per month; performance funding (research support funding) is allocated as a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month; research base funding (research support funding) is allocated as a monthly limit – each organizational unit receives 1/12 of the calculated annual funding per month. Analysis of the general procedure for financing study programs at RTU reveals that the basic budget and tuition fee funding from local students who pay tuition fees are determined following the basic principles set by the state. In the process of determining the amount of funding, the study cost coefficients of the thematic spheres and the values of the study cost coefficients according to the level of the study program, as well as the number of students at the study program and the corresponding study courses are considered. As mentioned above, by using the study cost coefficients of the thematic spheres of education, it is possible to determine the amount of funding required for the implementation of a specific study program and study course. RTU Senate has decided that in the future the study cost coefficients of the thematic spheres of education will be applied individually to each study course included in the study program, thus ensuring even more appropriate funding for the implementation of the study courses. To implement this system, an expert commission was established by the order of the Vice-Rector for Academic Affairs, which determined the thematic area of each study course.

Financial resources of the study program are sufficient for successful implementation of the study program and their use is regularly controlled by the administration as well as RTU Office of Vice-Rector for Finance.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

The costs per student within the study program are calculated by the Office of the Vice-Rector for Finance. The average cost per student in 2013-2020 was 8 203,31 EUR. The number of study places is allocated after negotiations with the Ministry of Education and Science. The amount of study funding is determined on the basis of the number of study places determined by the state at RTU, as well as the base costs of the study place determined by the state and the study cost coefficients of the thematic areas of education.

## 3.4. Teaching Staff

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

The teaching staff involved in the implementation of the study program is highly qualified and competent in order to ensure the acquisition of the necessary research skills, theoretical knowledge, skills and competencies. The qualification of the teaching staff complies with the criteria specified in Sections 28, 30, 32, 36, 37 and 40 of the Law on Higher Education Institutions.

Employees involved in the implementation of the study program, working in various scientific projects and conferences, transfer the knowledge gained to the study program by improving the content of the study courses. Also, experience of the work in industry and cooperation with industry allows to enrich the study content with up-to-date information, examples and real work environment tasks.

**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.**

| Academic year | Professors | Associate professors | Assistant professors | Lecturers | Assistants | Guest professors | Guest assist. prof. | Guest lecturers | **Total** |
|---|---|---|---|---|---|---|---|---|---|
| 2013/2014 | 10 | 1 | 7 | 4 | 7 | 1 | 0 | 2 | **32** |
| 2014/2015 | 12 | 1 | 7 | 4 | 8 | 3 | 0 | 4 | **39** |
| 2015/2016 | 11 | 0 | 7 | 6 | 9 | 0 | 1 | 2 | **36** |
| 2016/2017 | 11 | 1 | 9 | 4 | 4 | 2 | 1 | 1 | **33** |
| 2017/2018 | 9 | 1 | 10 | 4 | 5 | 0 | 0 | 0 | **29** |
| 2018/2019 | 9 | 1 | 10 | 3 | 2 | 1 | 2 | 3 | **31** |
| 2019/2020 | 9 | 1 | 10 | 2 | 2 | 0 | 2 | 2 | **28** |
| 2020/2021 | 9 | 2 | 10 | 3 | 2 | 1 | 2 | 3 | **32** |
| 2021/2022 | 9 | 3 | 10 | 3 | 1 | 1 | 2 | 3 | **32** |

The study process in academic year 2013/2014 was carried out by 32 members of academic staff, including 10 professors, 1 guest professor, 1 associate professor, 7 assistant professors, 4 lecturers, 2 guest lecturers and 7 assistants. Based on the results of the analysis, it can be concluded that during the reporting period, in accordance with the strategic aims of the study field and study program development, the qualitative value of academic staff has increased, with particular emphasis on the increase in the number of associate professors.

As a result, in academic year 2021/2022 the study process is mainly provided by 9 professors, 1 guest professor, 3 associate professors, 13 assistant professors and 2 guest assistant professors. Consequently, it can be concluded that the quality of academic staff has increased.

**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).**

Academic staff members representing both professional and academic backgrounds participate in the implementation of the study programs, ensuring a balanced environment in which the staff help achieve the set aim and learning outcomes of the study program.

Members of academic staff communicate and cooperate with each other during the meetings of methodological commissions, individual conversations with the heads of study programs, conversations among academic staff members, as well as in meetings of AERTI academic staff, discussing various topical issues of the AERTI, higher education and professional fields. The academic staff of the study program cooperate in the implementation and updating of the content of the study courses, coordinating the topics to avoid repetition of the same content. The academic staff also cooperate within the research groups, offer ideas for sample themes of qualification papers and suggestions for improvement of study programs. Simultaneously, academic staff participate in the development of extracurricular activities for students, for example, to organize student study trips to employer’s companies or to invite guest lecturers.

In accordance with the internal normative documents regulating the study process at RTU, the Methodological Committee (hereinafter – the Committee) operates within the study program (hereinafter – the program) and acts as one of the elements for ensuring the quality of the program implementation.

The main operation areas of the Committee are the following:

1. Evaluation of study course descriptions for the approval at a meeting of the appropriate department and approval by RTU Study Department.
2. Review and approval of study and methodological materials.
3. Organization of class attendance and analysis of results.
4. Organization of methodological seminars on current issues.
5. Providing suggestions for the development and improvement of new study courses.
6. Coordination of Master Thesis themes.
7. Discussion of novelties in the use of information technologies in the study process and providing recommendations to the management of the Institute/Faculty.

Academic staff cooperation is also facilitated by teamwork in joint research projects and contract work. Every year, the AERTI carries out several projects involving employees of various RTU organizational units, as well as foreign partners.

The ratio of the number of students and teaching staff within the study program is on average about one student per lecturer. The relatively small number of students per lecturer can be explained by the interdisciplinarity of the program. This means that there are a relatively large number of teachers who teach one or two courses. Unfortunately, the number of students in the program has also fallen in recent years, which of course has affected this proportion. Given the changes in the prepared program, the interest of bachelors in continuing their studies in the master's program should increase (discussions with students and positive feedback have been received), the number of local students in the program should increase. Following the reduction of COVID-19 restrictions, an increase in the number of foreign students is expected.

# 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 | MGA0 diploms_dipl_supl.zip | MGA0 diploms_dipl_pielik.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) | MGA0_CHE_opinion.docx | MGA0_AIP_atzin.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 | MGA0_stud_statist.pdf | MGA0_stud_statist.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 | MGA0_StEdSt_6_annex.pdf | MGA0_VaIzSt_6_pielik.pdf |
| 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 | MGA0_CoursMapp_8_annex.pdf | MGA0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MGA0_CurricStPogr_9_annex.docx | MGA0_StudProgrPL_9_pielik.docx |
| Descriptions of the study courses/ modules | MGA0_DescriptStud_cour.zip | MGA0_Studkurs_apr.zip |
| Description of the organisation of the internship of the students (if applicable) | Internship_Management_Procedure.pdf | Prakses_organizesanas_kartiba.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | Confirmation - on compliance of the academic staff.edoc | Apliecinājums - AL 55. pants par prof. skaitu akadēmiskās programmās.edoc |

# Engineering Technology, Mechanics and Mechanical Engineering (43521)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Engineering Technology, Mechanics and Mechanical Engineering* |
| Education classification code | *43521* |
| Type of the study programme | *Academic bachelor study programme* |
| Name of the study programme director | *Marina* |
| Surname of the study programme director | *Čerpinska* |
| E-mail of the study programme director | *marina.cerpinska@rtu.lv* |
| Title of the study programme director | *PhD, Assistant Professor* |
| Phone of the study programme director | |
| Goal of the study programme | *To educate and train engineers with a wide range of knowledge in the field of mechanics and mechanical engineering, who can compete well for their place in the labor market and can work in their profession in both local and international companies and projects, as well as to prepare students for further studies at the academic Master's program.* |
| Tasks of the study programme | *1. To provide students theoretical knowledge, skills and abilities in engineering, mechanics and mechanical engineering;*<br>*2. To acquaint with the computer programs used in the industry with the help of laboratory works;*<br>*3. To develop students' technical creative thinking and problem-solving skills so that the acquired knowledge can be used in the development of new techniques and technologies in various mechanical engineering sub-sectors: machine dynamics analysis, machine design, machine testing and diagnostics, robotics, mechatronics.* |
| Results of the study programme | *Graduate of the study programme:*<br>*1. Understands technical processes in mechanics and mechanical engineering;*<br>*2. Is able to evaluate descriptions of technological processes, perform their analysis, assess the quality of operation of mechanical systems, their influencing factors and risks, determine preventive measures appropriate to the risks;*<br>*3. Is able to evaluate the operation processes of mechanical equipment, is able to determine measures for their improvement;*<br>*4. Is able to plan the necessary resources to ensure the successful operation and improvement of engineering systems;*<br>*5. Knows modern materials;*<br>*6. Knows and is able to design, install and operate mechanical systems after additional training on the specific system;*<br>*7. Is able to build an engineering career by effectively cooperating with specialists of other profiles;*<br>*8. Is able to continue studies for a Master's degree.* |

| | |
|---|---|
| Final examination upon the completion of the study programme | *Bachelor's 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 in mechanical 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 in 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 |

## 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 main changes regarding the resources of the study program are related to the construction of the RTU Ķīpsala Campus. Since the construction of the building at 6B Ķīpsalas Street, which was completed during the reporting period, the place of implementation of the specialized courses of the program has changed, and the study process is no longer implemented at 6 Ezermalas Street. Computer rooms with modern equipment and laboratory facilities have become more spacious and more accessible. Thus, a wider experimental base allows implementing higher quality practical work in the study process, focusing on the competencies and skills students will acquire during the practical work. At Ķīpsala Campus, students have access to a modern study environment, i.e., the library is close to the lecture halls (see description of resources), Ķīpsala Sports Centre with a swimming pool is a few minutes away, as well as the Student Service Centre where students can receive career and psychologist consultations. Commuting to the place of studies by public transport is more convenient. The absurd situation that students previously had to spend an extra hour to get from one lecture hall to another has been eliminated.

The amount of credit points of the program has been adjusted from 121 CP to 120 CP. In terms of content, the following changes have taken place within MBM0 program: courses that are no longer relevant to the modern curriculum of the program and have not been implemented during the last ten years have been excluded from the program. New courses that have become more relevant and more important on a socio-economic level have been added. For example, such courses as "MTM208 Robot Kinematics" and "MEE320 Reliability of Medical Equipment" have been added to Part B, and the course "VAS038 Environment and Climate Roadmap" - to Part A. The learning outcomes have been fundamentally reviewed and modified, shifting the emphasis from knowledge accumulation to skills development.

There have been significant positive changes in the academic staff. During the reporting period, new members of academic staff were attracted for the implementation of the specialized courses of the study program, which allowed improving the division of responsibilities and the quality of the courses (see the description of the academic staff). The influence of a novel location of studies on this factor cannot be denied, as modern study environment attracts talented young lecturers.

### 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 Bachelor study program "Engineering Technology, Mechanics and Mechanical Engineering" (MBM0) is an academic program in the study field "Mechanics and Metal Working, Heat Power, Heat Engineering and Mechanical Engineering", which focuses on working with CAD computer software in the field of mechanics and mechanical engineering; however, heat engineering and heat energy courses are also included in the list of compulsory and elective study courses, thus ensuring that the study program covers all current issues in the field.

The title of the study program “Engineering Technology, Mechanics and Mechanical Engineering” reflects the content of the academic program and the areas covered. RMBM0 is a version of the program that students acquire in Latvian; AMBM0 is a version of the program that is delivered in English to foreign students (exchange students).

The meaning of the letters of the program code RMBM0 and AMBM0 is: 1) R - faculty in Riga, A - International Cooperation and Foreign Students Department; 2) M - study program group - Mechanical Engineering; 3) B - type and level of the study program - academic bachelor study programs; 4) M - name of the study program, according to RTU internal classification; 5) 0 - modification of the study program plan - the primary option of the study program. Degree to be obtained - bachelor's degree in mechanical engineering, corresponds to the title of the program, in abbreviated and concise version, in accordance with regulations. The learning outcomes literally include an understanding of technical processes in mechanics and mechanical engineering, while the concept of engineering technology encompasses design, installation, systematic planning, process management and operation skills.

By the end of studies, students must be able to perform engineering calculations, computer simulations, and analysis of results. Students are admitted to the Bachelor study program both with secondary general education (48% -89% of the number of enrolled students in different years of the reporting period), and with secondary vocational education (1% -6% of the number of enrolled students in different years of the reporting period) and higher education (8% -48% of the number of enrolled students in different years of the reporting period). When applying for studies at the expense of the state budget, preference is given to the students with excellent results in exact sciences, but when applying for tuition fee covered studies, average results are also accepted. As the demand for engineering specialists is higher than the number of graduates, it is not planned to introduce stricter admission requirements in the near future. As studying at the university is fundamentally different from studying at school or college, there have been cases where students with greater motivation and self-discipline perform better than those who performed best at school. However, in order not to worsen the quality of studies, students are offered special courses, for example, additional classes in calculus. MBM0 is an academic program, and its duration is 3 years, which is less than other professional programs, where the studies mostly last 4 years. During three years, the studies are intense. It is economically advantageous for a student to obtain a diploma in three years, as it is possible to start Master studies or start employment sooner. Indeed, some students with weaker work abilities must extend their studies, most often foreign students extend their studies for half a year to develop a graduation paper, but it should be considered that in addition to engineering studies, these students must learn Latvian and get used to the new environment, which, understandably, requires time. Thus, this is not a reason to extend the duration of the study program. The students themselves have submitted to RTU the idea of a project within which intensive foreign language courses would be available to future foreign students, six months or a year before full-fledged studies at the university begin.

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

The study program educates and trains engineering specialists who are highly demanded both in Latvia and abroad. Graduates of the study program work as specialists in local and international companies related to specialized mechanical equipment and technologies, as well as in the administration of technology-oriented companies. For example, RMBM0 graduate of 2019 works as a Production Technician at the company “UAV Factory”, graduate of 2018 first worked as a Drafter at the company “RT METĀLS”, but now works as Civil Structural Engineer at “Aile grupa”, company specializing in the design and manufacturing of glass structures; RMBM0 graduate of 2017 works at the company  “Scandicast, SIA”, which specializes in the production of cast iron parts to special orders, and his responsibilities (to design solid molds in SolidWorks) correspond exactly to the skills acquired within the specialized courses of the program. AMBM0 graduate of 2018 works as a Producibility Engineer at Ericsson, Sweden.

Some graduates of the study program establish their own companies, for example, RMBM0 graduate of 2013 is self-employed at the company offering Smart Home solutions, mainly in the UK.

It has been observed that MBM0 graduates who want to find a job faster without pursuing a Master's degree are involved in work in the IT sector (usually after a short additional training at some IT company), which can be explained by the lack of labor force in the IT sector in recent years, while graduates of the program already have good skills in working with several CAD programs so that they can quickly learn other computer programs. For example, RMBM0 2013 graduate works as a second-degree IT specialist at TietoEVRY; MBM0 2018 graduate works as a sales project manager at the company “SIA ESELO”, which provides business analytics systems. A similar trend is observed for foreign students graduating from the MBM0 program, for example, a 2017 graduate of AMBM0 works as a data engineer at SpareBank 1 Utvikling in Norway.

MBM0 students who continue their studies and graduate Master study programs work in the managerial positions, as well as develop engineering careers at the international level (please see examples listed for MMM0). Graduates of the program tend to obtain additional education in business administration and manage engineering projects, for example, RMBM0 graduate of 2019 works as an engineer at “Hilti Group” and continues his studies at RTU to obtain a degree in business administration (MBA). Another RMBM0 graduate of 2019 works as s member of the Board/Sales Manager at Sandvik Coromant, and continues his studies at RTU MBA program.

The examples mentioned in this section are based on the data of the social network "Linkedin", which the graduates and lecturers of the program actively use for "networking" after graduation to discuss issues related to professional challenges.

### 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.

Statistics for the reporting period and graphs illustrating the data are attached. The attached statistics in this section are provided with comments on the number of students enrolled and expelled.

The number of students admitted includes both domestic and foreign students, or exchange students. The number of exchange students studying in English ranged from 41% to 75% during the reporting period, or 69 to 92 students (the total number of admissions ranged from 107 to 169). For a more in-depth analysis refer to statistics on expelled students and graduates.

Some of the admitted foreign students do not start their studies due to personal circumstances and are already expelled in the year of admission. However, the number of students dropped out is mostly related to the number of students enrolled in the previous year. This can be explained by the fact that domestic and international students have very different levels of preparedness. Thus, students settle their academic arrears in the second year, for example, in mathematics and physics, and if they fail to settle their arrears, they are expelled in the second year. International Cooperation and Foreign Students Department of RTU has observed that students who have not had sufficient prior knowledge in mathematics and physics, as well as those students who have started employment in Latvia (not related to the field of study) are no longer able to fully focus on studies. Individual students settle their academic arrears in mathematics and physics for three years, and then are expelled upon failure. The number of students dropped out of the Bachelor study program is significantly higher than the number of graduates, but the difference at the Master study program is smaller, because students enter the Master study program with a clearer understanding of the study process and a stronger motivation to work in engineering. As the goal of RTU is to provide high-quality education and train high-quality specialists, similar dynamics of admissions, expulsions and graduates can be predicted in the future as well. It should be noted that not only the program, but also the strategy of the faculty stipulates that one of the challenges of the field is to reduce the high drop-out rate, while ensuring high-quality graduate training.

#### 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.

Taking into account digitization tendencies in the labor market, the program " Engineering

Technology, Mechanics and Mechanical Engineering" has increased the amount of software used, also at the courses that are not directly related to software use, for example, within the study course "MMP169 Mechanics" students work with MathCAD, SolidWorks. As a result, students understand software offer and integrate in the labor market after short period of studies. Within such courses as "MTM341 Numerical Analysis in Engineering Mechanics", "MTM205 Engineering Mechanics Problems", it is demonstrated to the students how to achieve the desired work result both using the specific software, e.g., MathCAD, and MSC Excel, which is widely used in all areas in the labor market.

With ever increasing amount of freely available information on the Internet, students need to improve their ability to select good quality and reliable information, so study courses such as "MTM205 Engineering Mechanics Problems" include the development of a term paper that includes a literature review. At the level of basic studies of the program "Engineering, Mechanics and Mechanical Engineering", the knowledge (knowledge and understanding) in the study courses is mostly tested by means of revision tests and revision tasks, as well as by means of the final examination. Skills (ability to use knowledge, communication, general skills) are developed by participating in group work and developing term papers, or independent work, which includes a calculation part, may include a simulation part with a computer program, and literature research part. Competencies (analysis, synthesis and evaluation) are developed by working with the so-called case studies (for example, in the course "MTM205 Engineering Mechanics Problems"), students analyze various faults described in the literature that occurred during production or operation, in the course "MTM326 Mechanical Vibration and Acoustics", students analyze cases where the fault occurred as a result of resonance.

As graduates of the study program must be globally competitive to work in multinational companies, it is important to regularly improve the curriculum of the program to meet international standards. Therefore, cooperation with other technical universities is important. During the reporting period, the director of the study program "Engineering Technology, Mechanics and Mechanical Engineering" and the acting director have joined the European University of Technology (EUt+) consortium, which provides an opportunity to promote international competitiveness. At the time of submitting the self-assessment report, a cooperation agreement has been signed with MIT (Massachusetts Institute of Technology, USA), one of the world's leading universities in training of engineering professionals.

**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).**

Not 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.**

MBM0 study courses mostly consist of two interrelated parts — theoretical knowledge acquisition and practical work. This is possible thanks to the growing experimental base (see description of the resources) available to students. Practical work is very important in the acquisition of engineering courses in order to achieve the learning outcomes formulated as skills and competences. Nearly all courses include individual work, which is most often a calculation work/course work with a computer simulation part and a creative or analysis part.

Assessment methods within MBM0 study courses also include such evaluation procedures as revision tests, exams, group tasks. Regardless of the methods chosen by the lecturer, according to the RTU guidelines, the assessment criteria are published at the beginning of the semester. According to the “RTU Regulations for the Assessment of Study Results”, the examination grade does not exceed 50% of the contribution to final evaluation of the study course. The implementation of these requirements at MBM0 study courses has been a topical task in the last five years, and according to the data collected during the self-assessment, 75% of the undergraduate courses at the TMMP department have managed to implement it. Within several courses, such as "MTM205 Engineering Mechanics Problems", group work is also evaluated. Group work helps students acquire the skills they need to start working in a team.

AMBM0 version of the program is implemented in a foreign language—English. According to RTU guidelines for study course development, the content, requirements and assessment methods are identical to RMBM0, which is implemented in Latvian. As students studying in English need literature in English (which would be optimally available in a digital format, as it has been observed that foreign students start their studies with a slight delay even before the Covid-19 pandemic, for example if the migration was delayed due to documents submission) the course description should also include the required literature in English, which in most cases it does, and if necessary, is compiled with the help of the program director.

Examples of student-centered teaching principles at the program include individualization, games, and competitions. Students with a variety of motivations, including students with a drive for excellence and creative performance, enter the program Engineering Technology, Mechanics and Mechanical Engineering. In order to develop their individual talents, within compulsory elective study courses, such as the course "MTM205 Engineering Mechanics Problems", students are motivated to develop, individually or in a group, a practical work with a creative part and to report on it at a student scientific conference. When submitting practical assignments, students are encouraged to apply the theory to a situation that is relevant to them, and students are happy to do so. For example, in 2021 during the spring semester within the course "MTM205 Engineering Mechanics Problems", a student submitted an estimate of the situation when he was involved in a traffic accident while riding a bicycle. In this way, the student discussed the theory of collision. When developing a graduation paper, students already working in their field are invited to choose a topic for their graduation paper that is relevant for a particular company. Within the courses where it is possible, a game format with competition elements is used, for example, at the course "MTM205 Engineering Mechanics Problems" the theoretical material is revised with the assistance of an online game called "Kahoot!", in which students compete by indicating the correct answers for the test on their smartphones.

**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).**

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**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.**

Students can choose the topic of the graduation paper from the list of topics, which is updated by the lecturers every semester according to current trends in the field, also, in cooperation with the chosen graduation paper supervisor, students can offer their own topic. Some faculty topics are suitable only for the specific study level, but most topics can be chosen for both the undergraduate and graduate papers, applying the work tasks drawn up by the lecturer in agreement with the student according to the study level. Within MBM0 study program, topics can be conditionally divided into two groups: topics on the classical mechanics or topics on the strength of materials and material properties. Within the framework of these topics, students must develop a simulation in one of the computer programs acquired during the studies.

Students already working in their field are invited to choose a topic for their graduation paper that is relevant for a particular company.

Additional relevancy to current events and problems in the industry is provided via topics from the academic staff involved in the work of FMETA Mechanics Expertise Center (MEC) (J. Vība, E. Kovals, M. Eiduks). Faculty members inform students about the current graduation paper competitions. For example, the company "Latvenergo" annually announces the topics of the graduation paper, which mechanical engineers with good knowledge of the Latvian language can enter. The topic on vibration of electricity generation equipment is included in the research topic list.

Examples of Bachelor Thesis titles: “Designing and calculation of automobile leaf springs”, “Static strength and stiffness analysis for bearing structure elements of a car”, “Self-excited oscillations of railway wheelsets”, “Structural analysis of storage tank”, “Analysis of automatic speed control option in vehicles”, “Structural analysis of medical cast product”, “Calculation of stiffness of rubbermetallic shock absorbers for various methods of fixing large deformations”, “Strenght of wing ribs”, “Analysis of strenght of the crossbeam bracket”, “Kinematic analysis of a robot arm”, “Analysis of toe and camber angle of a car”, “Hip implant strenght and fatigue analysis”, “Design of configuration Y3+1 drone body strenght optimization and vibration analysis”, “Creep properties of plymeric materials, experimental and numerical simulation”, “Structural analysis of bicycle frame”.

Graduation grades range from excellent to mediocre, and there is no specific trend regarding this matter. There may be three excellent works per semester (assessed with grades 9 and 10), but it happens that there are many good and satisfactory graduation papers in the semester, but there are no outstanding ones. Works with a weaker practical part receive the lowest marks. There are cases when the developed graduation papers are not accepted at all, if plagiarism is detected, especially in the practical part, in which case the student must redo the work. The assessment of plagiarism is centralized in RTU using the special tool “Turnitin”, as all graduation papers are stored in the electronic system ORTUS. The director of the study program receives a notification from the Study Department regarding the works in which plagiarism has been established. The Turnitin tool accurately identifies text that has been copied, not only from literature, but also from the previously submitted works. If the practical part is developed well, but elements of plagiarism are found in the literature review, then the director of the study program and the supervisor may decide whether to allow the work to be defended, but the Evaluation Committee is informed about the level of plagiarism.

## 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.

Implementation of the study courses within MBM0 study program involves the use of computer classrooms or processing halls with appropriate software. The Department of Theoretical Mechanics and Strength of Materials (hereinafter - TMMPK) at 6B Ķīpsalas Street, Riga, has three computer rooms: 416, 419 and 418. Two classrooms are equipped with cameras, which allow conducting remote classes. MBM0 students take program-specific courses (for example, Part A courses MTM341 Numerical Analysis in Engineering Mechanics, MMP101 Fundamentals of Computer Science, MTM119 Computer Graphics (Advanced course for Mechanical Engineers)) in computer rooms specially equipped with computer programs such as MathCAD, MatLAB. Thanks to the RTU HPC (High Performance Center) website, students can download computer programs (SolidWorks and ANSYS) to personal computers, while MathCAD Prime (an analogue of MathCAD) is available for free download and is used for homework completion.

For the acquisition of field-specific study courses (for example, a Part B course "MMP343 Mechanics of Composite and Elastic Materials") at the Department of Theoretical Mechanics and Strength of Materials, the students are provided with Zwick Z150 and Z600 (150kN and 600 kN) dynamic testing machines, Zwick HB50 dynamic testing machine (50kN), Leica optical microscope, as well as various equipment for sample preparation for experiments, such as hardness tester, oven, and grinding machine. Within a Part B course "MTM326 Mechanical Vibration and Acoustics”, students utilize the Armfield wind tunnel for experiments. Students have the opportunity to use the laboratory equipment for the development of the graduation paper (usually under supervision).

The range of literature available in the library is regularly updated. Academic staff is allowed to submit their proposals for the purchase of literature by filling out order forms, which the program director sends out to the academic staff once a year, and after evaluating the forms received and the funds available for the purchase of books, the forms are forwarded to the library. In total, MBM0 and MMM0 study programs process an average of five requests per year. For example, in 2019 to update the curriculum of a Part A study course “MMP219 Resistance of Materials (for mechanical engineering)” and a Part B study course “MMP302 Mechanics of Deformable Firm Bodies” the faculty ordered “Mechanics of Solids and Structures: Second Edition” by David W.A. Rees, 2016. To update the curriculum of Part A study course “MTH306 Construction of Machines and Mechanisms”, faculty ordered a book by Ali M. Sadegh, William M. Worek, “Mark’s Standard Handbook for Mechanical Engineers”, 2017.

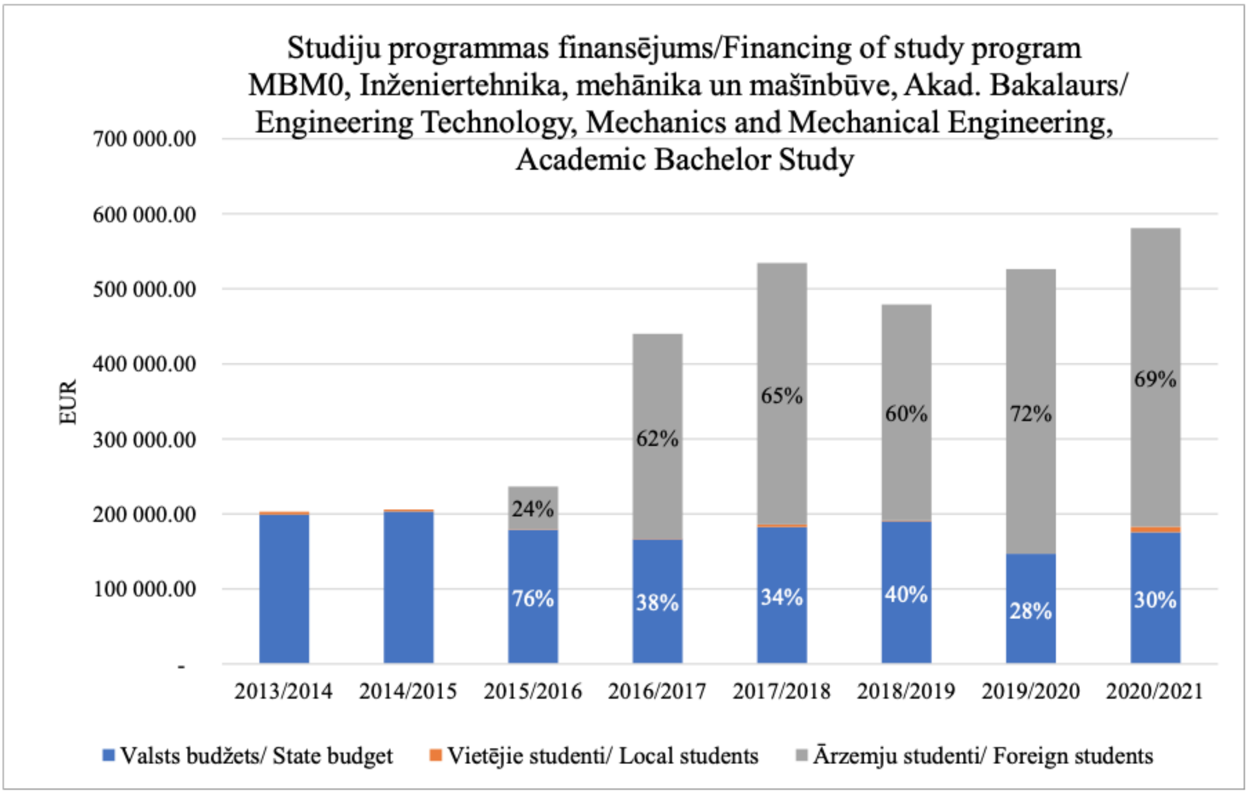
In recent years, students have increasingly preferred electronic versions of the books that can be easily accessed via university’s Moodle system (ORTUS). Students can access Ortus using their username and password. Searching for books in various databases is significantly facilitated by the unified RTU electronic search system Primo. Thus, students who take certain courses of the program in Daugavpils or Liepaja can access the library resources as efficiently as the students in Riga.

Students entering the program in RTU Study and Science Centers have access to the unique laboratories of these centers, for example, in Daugavpils, students have access to the structure and properties/materials science laboratory, where they can perform tensile testing, hardness measurements, impact testing, microstructure inspection, steel heat treatment, etc. Physics laboratories (mechanics, optics measurements) are also available, as well as Laboratory of Electrical Engineering and Electronics, Laboratory of General Chemistry, Laboratory of Material Resistance.

The software of computer rooms in Study and Science Centers is not fundamentally different from the software available in Riga, as RTU HPC provides centralized support to all centers, thus, AutoCAD is available to students in any city, as well as Solidworks, MathCad, MathLab, etc.

**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 study program is financed both from the state budget funds and tuition fees. Tuition fees are mostly (but not all 100%) are received from mobility students, whose studies are financed or supported by a scholarship within frameworks of various international projects. The number of fee-paying students graduating from the program is rising. The number of graduates will be analyzed in the future, since currently the data are not available as to whether the enrolled students who drop out have paid the tuition fees for the semesters they have completed. In 2014, 18% of MBM0 graduates studied for a fee, in 2017 - 56%, but in 2019 - 83%. This tendency can be explained by the active work of the RTU International Cooperation and Foreign Students Department in attracting students, as well as the fact that mobility students who study at the program and are satisfied with the offer recommend RTU to other young people from their country looking for opportunities to study abroad. The trend can also be partly explained by the fact that students who have invested personal resources and extra energy to start their studies are more persistent and do not drop out encountering their first difficulties.

Funding allocation is implemented with the help of RTU Financial System, where responsible and authorized persons enter information at the end of admission at the beginning of the semester. In the section “Study Finances”, information is entered about local, mobile, budget, and fee-paying students, as well as information about each course and their specific credit points number, which each student acquires, and according to this information, RTU on a centralized basis calculates the study funds each program department receives, evaluates, and partially directs to the development of the study program as well. Costs per student in 2017/2018 were EUR 4,040.66.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 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.

23 lecturers from the Department of Theoretical Mechanics and Strength of Materials (hereinafter - TMMPK) are actively involved in the implementation of MBM0 study program, delivering the specific courses. MBM0 is an academic study program, therefore, in accordance with Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions, not less than five professors and associate professors altogether, elected to academic positions at RTU, shall take part in the implementation of the compulsory part and compulsory elective part of academic study programs. Apart from the staff from other departments participating in the implementation of the program, 9 lecturers have been elected from the department as professors and associate professors at the time of submitting the report. In addition, one habilitated professor actively participated in the implementation of the department's programs during the reporting period. For confirmation, please see the attached CV of the lecturers (Aleksandrs Januševskis, Professor; Andrejs Krasņikovs, Professor; Bruno Grasmanis, Professor; Igors Tipāns, Professor; Jānis Auziņš, Professor; Jānis Vība, Habilitated Professor; Olga Kononova, Professor; Vitālijs Beresņevičs, Professor; Vladislavs Jevstigņejevs, Associate Professor; Inga Ļašenko, Associate Professor, elected on 4 June 2020). In the confirmation statement in the Annex only the responsible instructors are listed because some professors involved in administration do not participate in the study process every year.

All long-term lecturers involved in the implementation of MBM0 study program hold a PhD degree in the relevant field. Out of the 12 new lecturers, 9 lecturers have obtained a PhD degree, including 4 who have obtained a PhD degree in the reporting period, one of the lecturers plans to defend the PhD Thesis in the next two years. During the reporting period, 11 lecturers were elected or re-elected to the position of leading researcher, 8 - to the position of researcher. At the end of the reporting period, 10 lecturers have the rights of an NZDIS expert in the field of mechanics and mechanical engineering or materials science, which helps ensure that the study curriculum is regularly updated to account for the latest industry trends.

### 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.

Out of the 23 members of academic staff involved in the implementation of the program, 11 members of academic staff have long-term (more than 10 years) work experience at RTU TMMPK (previously, the Institute of Mechanics), 8 are new member of the staff (who develop a PhD Thesis or have defended it during the last 10 years); 4 lecturers have long-term work experience at another university or organizational unit, but cooperation with TMMPK has started during the last five years. A total of 12 lecturers joined academic staff of MBM0 and MMM0 study programs during the reporting period. The activity of new professors varies from five hours per week (for delivering one course in two languages) up to 40 hours per week. In total, this activity has allowed reducing the workload of long-term lecturers both in delivering the study courses and in supervising graduation papers, thus improving the quality of each individual course, as more time was available for the preparation of materials. According to the data provided in the CVs, the English language skills of the new teachers are at the B1 and B2 levels, which allows for better teaching to English speaking students.

The increase in the number of academic staff members has allowed organizing the activities of the department so that the lecturers deliver the study courses according to their field of expertise, for example lecturers with expertise in mechanics deliver courses on mechanics, dynamics, and vibrations; lecturers who have expertise in materials science deliver courses related to material resistance. In addition, lecturers with expertise in mechanics and mechanical engineering can be conditionally divided into two groups—one group specializes in theoretical mechanics and dynamics, the other specializes in mathematical analysis and computer programming. This is considered when planning the learning process. For example, in 2019, new lecturer S. Upnere defended her PhD dissertation, which contained a large amount of computer programming, and at the same time took over the course on numerical analysis, and since then has successfully delivered it, becoming the 2019 RTU FMETA Lecturer of the Year.

The improvement of the quality of studies was significantly facilitated by the cooperation of the new academic staff, who joined the team during the reporting period, with foreign universities; thus providing information on the development of the industry at an international level. For example, during the reporting period, A. Pupurs started a post-doctoral project in the field of material resistance in cooperation with Luleå University of Technology, Sweden, and the lecturer delivered a course in the field of material resistance; S. Upnere conducted experiments for the dissertation in cooperation with Paul Scherrer Institute, Switzerland.

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

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

**Provide information on the reporting period (if applicable).**

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

The academic staff involved in the implementation of MBM0 study program form research groups and work on national and international projects that result in joint publications and patents. Both long-term lecturers and new lecturers regularly attend conferences where publications are submitted, for example, every year lecturers participate in the international conference "Engineering for Rural Development" organized by LLU. Such cooperation allows understanding the strengths and areas of expertise of each lecturer, which are later used by the lecturers both in planning the study process (allowing lecturers to choose courses according to their strengths) and in recommending the best thesis supervisors to the students.

Here are some specific examples of cooperation. The ESF project "New "smart" nano-composite materials for roads, bridges, structures and transport vehicles" (2013/0025 / 1DP / 1.1.1.2.0 / 13 / APIA / VIAA / 019), which involved five members of the academic staff, was completed during the reporting period. During the reporting period (2017–2020), two new members of academic staff worked on the ERDF project "The quest for disclosing how surface characteristics affect slideability (No.1.1.1.1 / 16 / A / 129)", M. Čerpinska—in the preparation of project proposals and publications, M. Irbe—as a project participant. Four new lecturers of MBM0 and MMM0 courses (R. Vītols, A. Pupurs, M. Irbe, M. Čerpinska) actively cooperate within the framework of RTU platform projects and jointly develop publications. In addition, the new lecturers work together on the projects and develop joint publications with long-term lecturers, for example, in 2019, the new lecturer S.Upnere developed a publication that is indexed in Scopus “Metamodel-based analysis of cross-flow-induced vibrations” together with N. Jēkabsons, who joined the academic staff during the reporting period, and J. Auziņš, a long-time member of the staff. Patents have been obtained in several areas that are relevant to the content of studies in both fields of mechanics and materials science, for example, the group of authors I. Ļašenko, O. Kononova, A. Krasņikovs, J. Ķiploks, A. Viļuma-Gudmona, A. Šenfelds, three of whom are program lecturers, in 2019 obtained a Latvian patent for an invention "Textile material reducing infrared and ultraviolet radiation in the range of thermal spectrum", and the group of authors J. Auziņš, M. Eimanis, V. Beresņevičs, G. Kulikovskis, two of whom are lecturers of the program and one—a PhD candidate, obtained a Latvian patent in 2018 for the invention, "Device and method for generating the propulsion of a submarine".

Interconnection of the study courses. The curriculum of the courses is regularly supplemented in the course descriptions, which is freely available to all lecturers in the RTU Study Course Register in the electronic system Ortus. Faculty members actively use the opportunity to “invite” colleagues to their Ortus course, thus providing them with insight into the course content and materials so that course material is not repeated, and revision materials are provided in sufficient quantities (academic staff are always prepared to revise the course and not to rely on the fact that students covered the topic at another course, as it has been observed that the topic is forgotten after passing the test, if it is not applied in practice for some time). The possibility of inviting within Ortus is provided indefinitely, which means that a lecturer can invite a colleague to a course that was taught several semesters or years ago. The invitation can be made by the responsible lecturer as well as other lecturers registered in the course. This possibility is very important when teachers "take over" courses from colleagues who are on a longer period of absence. For example, in 2018, M. Čerpinska handed over the course MTM205 “Engineering Mechanics Problems” to S. Upnere during parental leave, while in 2020 I. Vaicis handed over the materials of the course MTM411 “Shock Theory” to M. Čerpinska when it was necessary to reduce the workload.

To conduct an objective analysis of the student and instructor ratio, it would be correct to look at MBM0 and MMM0 study programs as whole, for a lecturer who does not take any courses in the MBM0 program can at the same time supervise several theses for the students of this program. At the time of drawing up the self-assessment report, 23 lecturers were actively involved in the implementation of MBM0 and MMM0 study program. Given the dynamics of the number of students, in order to obtain an objective ratio, admitted and expelled students should be deduced from active students who passed the final examinations in the courses taught and submitted their graduation papers. The number of graduates in 2017-2019 will be used for the ratio: a total of 96 students graduated from MBM0 program in both Latvian and English language programs; 106 students graduated from MMM0 program. Assessing these dynamics, a total of 23 faculty members worked with approximately 200 students per year (in two bilingual study programs). It should be noted that teachers who are not involved in the implementation of both programs (whose workload is one or two courses per semester) work with a smaller number of students, 30-40 students each semester.

# Annexes

| | | |
|---|---|---|
| III - Description of the Study Programme - 3.1. Indicators Describing the Study Programme | | |
| Sample of the diploma and its supplement to be issued for completing the study programme | 3.1.1 MBM0 dipl_LV un EN.7z | 3.1.1 MBM0 dipl_LV un EN.7z |
| 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) | MBM0_AIP_atzin_CHE_opinion.pdf | MBM0_AIP_atzin_CHE_opinion.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 | REV-Pielikums 3.1.4 MBM0_stud_statist_LV un EN.docx | REV-Pielikums 3.1.4 MBM0_stud_statist_LV un EN.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 | REV-MBM0_StEdSt_6_annex.docx | REV-MBM0_VaIzSt_6_pielik.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 | MBM0_CoursMapp_8_annex.pdf | MBM0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | REV-3.2.5 MBM0_CurricStPogr_9_annex_EN.pdf | REV-3.2.5 MBM0_CurricStPogr_9_annex_EN.pdf |
| Descriptions of the study courses/ modules | 3.2.6 MBM0_DescriptStud_cour.zip | 3.2.6 MBM0_Studkurs_Apr.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 |

# Heat Power and Thermal Engineering (47522)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Heat Power and Thermal Engineering* |
| Education classification code | *47522* |
| Type of the study programme | *Professional master study programme* |
| Name of the study programme director | *Dmitrijs* |
| Surname of the study programme director | *Rusovs* |
| E-mail of the study programme director | *dmitrijs.rusovs@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., asociētais profesors* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study programme is to prepare qualified leading specialists of the industry in accordance with the approved standard of the profession of Leading Engineer in Heat Power and Thermal Engineering, who would be able to promote the development of the industry and integrate new technological solutions.* |
| Tasks of the study programme | *1.To provide students with a theoretical and practical basis for the systematic use of knowledge and skills in the issues of heat production, thermal engineering, as well as the operation of energy facilities and energy companies, solving complex technological and industry problems and developing strategic plans;*<br>*2. To develop creative and critical thinking by analysing thermal engineering and heat energy technologies and industry development trends;*<br>*3. To develop skills to compile and systematize special scientific literature;*<br>*4. To improve the skills of leading teams of leading specialists in the field and public speaking skills in various business events;*<br>*5. To promote students' interest in further development of competencies in professional, pedagogical, as well as scientific research direction and doctoral studies.* |

| | |
|---|---|
| Results of the study programme | *Graduates of the study programme are able to:<br>1. Analyse current trends in the development of industry, thermal engineering and heat power as well as to prepare reports on innovations, technological discoveries and research results in the sector;<br>2. Assess the opportunities and risks of the development, integration and implementation of thermal engineering, heat power and renewable energy technologies, taking into account production and operational aspects and respecting the principles of environmental management;<br>3. Plan and manage the operation, modernization and development projects of energy companies and energy facilities, observing the directions of sustainable development of the industry;<br>4. Use thermal engineering and heat energy equipment tests' and experiment data processing methods;<br>5. Use regulations and standards binding on the industry, as well as trends of the industry, technical, applied and scientific literature in the performance of professional tasks;<br>6. Substantiate their opinion in business and professional discussions on actual points and problems of the field, to form professional cooperation, observing the principles of business communication and professional ethics;<br>7. Use information technologies, tools and specialized software in the performance of professional tasks.* |
| Final examination upon the completion of the study programme | *Master 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) | *Professional bachelor degree or second level professional higher education in energy or other related engineering, or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in heat power and thermal engineering* |
| Qualification to be obtained (in english) | *Leading engineer in heat power and thermal engineering* |

### Places of implementation

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

### Full time studies - 1 years, 6 months - latvian

| | |
|---|---|
| Study type and form | *Full time studies* |

| | |
|---|---|
| Duration in full years | *1* |
| Duration in month | *6* |
| Language | *latvian* |
| Amount (CP) | *60* |
| Admission requirements (in English) | *Professional bachelor degree in heat power and thermal engineering and/or fifth level professional qualification in heat power and thermal engineering, or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in heat power and thermal engineering* |
| Qualification to be obtained (in english) | *Leading engineer in heat power and thermal engineering* |

### Places of implementation

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

### Full time studies - 2 years, 6 months - latvian

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *2* |
| Duration in month | *6* |
| Language | *latvian* |
| Amount (CP) | *100* |
| Admission requirements (in English) | *Bachelor degree in heat power and thermal engineering, energy or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in heat power and thermal engineering* |
| Qualification to be obtained (in english) | *Leading engineer in heat power and thermal engineering* |

### Places of implementation

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

### Part time extramural studies - 2 years - latvian

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *2* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *60* |
| Admission requirements (in English) | *Professional bachelor degree in heat power and thermal engineering and/or fifth level professional qualification in heat power and thermal engineering, or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in heat power and thermal engineering* |
| Qualification to be obtained (in english) | *Leading engineer in heat power and thermal engineering* |

**Places of implementation**

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

**Part time extramural studies - 2 years, 6 months - latvian**

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *2* |
| Duration in month | *6* |
| Language | *latvian* |
| Amount (CP) | *80* |
| Admission requirements (in English) | *Professional bachelor degree or second level professional higher education in energy or other related engineering, or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in heat power and thermal engineering* |
| Qualification to be obtained (in english) | *Leading engineer in heat power and thermal engineering* |

**Places of implementation**

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

**Part time extramural studies - 3 years - latvian**

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *3* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *100* |
| Admission requirements (in English) | *Bachelor degree in heat power and thermal engineering, energy or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in heat power and thermal engineering* |
| Qualification to be obtained (in english) | *Leading engineer in heat power and thermal engineering* |

**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 previous reporting period, Latvia has undergone several educational reforms and significant regulatory changes, which have also led to the development of a sectoral qualifications structure to align the system. The April 2018 meeting of the Tripartite Cooperation Sub-council of Vocational Education and Employment approved the current version of the Energy Sector Qualifications Framework at the time of the self-assessment report, which also included the new qualification of LQF/EQF Level 7 of Leading Engineer in Heat Power and Thermal Engineering. The new qualification also foresees the existence of an occupational standard, the content of which was developed in 2021 and approved at the meeting of the Tripartite Cooperation Sub-council of Vocational Education and Employment in August 2021.

In the professional Master study programme, graduates of other Bachelor study programmes were previously awarded the fifth level of professional qualification (LQF), with no indication of their eligibility to a specific level, based on the requirements of the laws and regulations in force during the previous reporting period. In accordance with the changes in the legislation and its requirements, and taking into account the approval of the new fifth level of the LQF, which corresponds to occupational standard Level 7 of the LQF/EQF, as well as the principles of non-discriminatory treatment in the various related fields of the sector, the graduates of educational programmes possessing LQF Level 6 who wish to continue their education and improve their professional qualifications by studying at the professional Master study programme "Heat Power and Thermal Engineering", the following amendments to the professional Master study programme are proposed to ensure compliance with its indicators for inclusion in the framework of the procedure for the evaluation of the study field:

1. To determine in all variants of the study programme the professional qualification to be awarded of Leading Engineer in Heat Power and Thermal Engineering” (Decision of the Senate of RTU of 27 September 2021 (Minutes No. 653), Decision of RTU Senate of 25 October 2021 (Minutes No. 655));
2. Admission requirements have been specified for the variant with the volume of 60 CP (decision of RTU Senate of 27 September 2021 (Minutes No. 653));
3. For the variant of the study programme with the volume of 100 CP, the admission requirements are specified in accordance with the admission requirements for graduates of academic Bachelor study programmes in industry-related thematic areas (Decision of RTU Senate of 25 October 2021 (Minutes No. 655));
4. The study programme variant with the volume of 100 CP was adjusted to 1 CP, from 101 CP to 100 CP (Order No. 02000-1.1-e/75 of RTU Vice-Rector for Academic Affairs, 2 July 2021); the order also included an update of the curriculum of the study programme with replacement of some study courses and inclusion of new ones;
5. An additional variant with the volume of 80 CP in the field of related thematic areas has been added to the study programme to ensure the admission of graduates of professional Bachelor

study programmes (Decision of RTU Senate of 25 October 2021 (Minutes No. 655)).

During the reporting period, changes were made to the study programme in accordance with changes in regulatory enactments and industry requirements - for more details see Section 3.2.1.

All changes and amendments are promoted by including them in the evaluation procedure of the study field.

### 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 professional Master study programme "Heat Power and Thermal Engineering" complies with Cabinet Regulation No.512 of 26 August 2014 "Regulations on the State Standard of the Second Level Professional Higher Education" (see in Annex 3.2.1.) and RTU normative documents.

The study programme is implemented under the supervision of the Department of Thermal Power Systems of the Institute of Mechanics and Mechanical Engineering of the Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA) of RTU, with the premises physically located in RTU FMETA building. Changes to the study programme as well as the development and addition of new study courses to the study programme are coordinated with the management of the study field "Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering", as well as the management of the FMETA and RTU, which, together with additional verification and expertise, allows ensuring and maintaining full compliance of the study programme indicators and content with the study field.

Given that the study programme is a professional one, its main indicators, aims, tasks and learning outcomes, as well as admission requirements, are based primarily on the specific features, needs and requirements of the sector, which are expressed in the occupational standard of leading engineer in heat power and thermal engineering, and secondly on the requirements of the regulatory enactments in the field of education. The set of requirements that form the basis of the study programme allows for a more complete interconnection of all indicators.

The trends in the sector, changing needs and technological developments, as well as the European Green Deal and the National Energy and Climate Plan guidelines and development areas, also determine the needs for adaptation and development of the higher vocational education programme and the need to implement modern changes to increase flexibility and remain relevant in line with changing market conditions, which also leads to the updating of the study programme and content. In addition, it is necessary to take into account the development plans of the education sector, including professional higher education, as well as the guidelines and directions of the Sustainable Development Strategy of Latvia for the development of society and the economy, where one of the important issues is also the planned contribution of RTU, FMETA and the study field, determining the integration of the basic principles of sustainability in the content of educational programmes, as well as in the development of employees in various infrastructure and organizational systems.

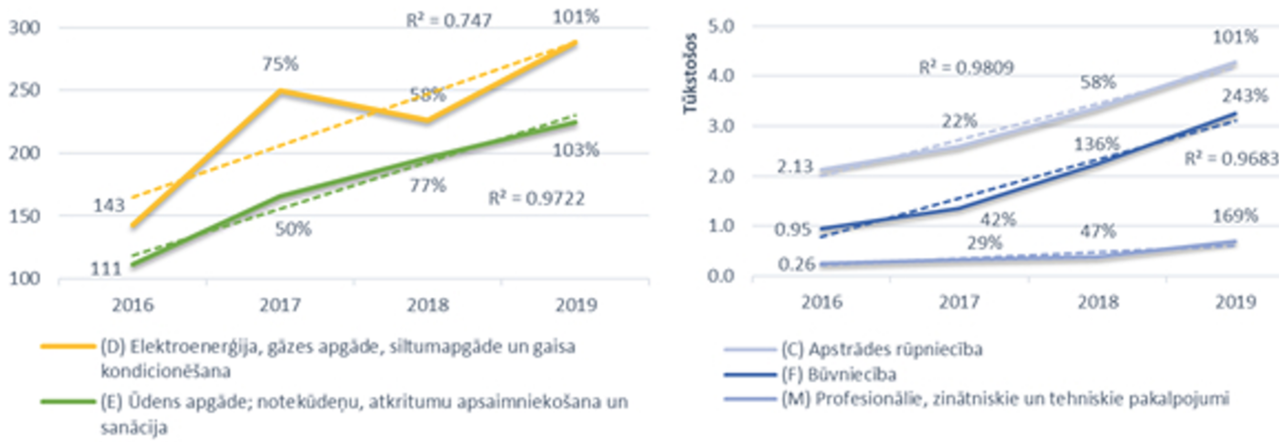
The full-time professional Master study programme "Heat Power and Thermal Engineering" is available in three variants:

1. For 2 years with the volume of 80 CP for graduates of the professional Bachelor study programmes in thematic areas related to the sector, in accordance with the requirements of Paragraphs 20 and 26 of Cabinet Regulation No. 512 of 26 August 2014, and to ensure that graduates are able to continue their studies at the Doctoral study programme in accordance with Paragraph 30 of the said Regulation. The degree and qualification to be awarded shall meet the requirements of Paragraph 29 of the Regulation. This variant of the study programme provides for additional specialization courses and internships to align the professional knowledge and skills of the related fields with the heat power and thermal engineering sector (see also Section 3.1.1).
2. For 1.5 years with the volume of 60 CP for graduates of the professional Bachelor study programme "Heat Power and Thermal Engineering", in accordance with the requirements of Paragraphs 20 and 26 of Cabinet Regulation No. 512 of 26 August 2014, and to ensure graduates' opportunities to continue their studies at the Doctoral study programme in accordance with Paragraph 30 of the said Regulation. The degree and qualification to be awarded shall comply with the requirements of Paragraph 29 of the Regulation.
3. For 2.5 years with the volume of 100 CP for graduates of academic Bachelor study programmes in thematic areas related to the sector, in accordance with the requirements of Paragraphs 20, 26 and 27 of Cabinet Regulation No. 512 of 26 August 2014, and to ensure that graduates are able to continue their studies at the Doctoral study programme in accordance with Paragraph 30 of the said Regulation. The degree and qualification to be awarded shall meet the requirements of Paragraph 29 of the Regulation. This variant of the study programme has additional specialized internship for the development and alignment of professional knowledge and skills in the heat power and thermal engineering sector, for the sequencing of professional education and for the award of professional qualifications, reducing possible differential treatment between graduates of academic study programmes in related subject areas, enabling them to develop their professional competences and to acquire the professional Master study programme and obtain the relevant qualification.

Each variant of the study programme has also part-time extramural studies, with the same volume of CP as appropriate for the specific variant to meet the requirements, with half a year longer study duration than the corresponding full-time intramural variant. This allows the study programme to be flexible to the needs of industry and employers and to provide a broader range of higher vocational education opportunities for those working in the heat power and thermal engineering sector who wish to develop their professional competences.

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

RTU professional Master study programme "Heat Power and Thermal Engineering" is the final study programme of higher professional education in the field of heat power and thermal engineering, it is also the only second-level professional higher education study programme in Latvia that educates and trains high-level engineers in heat power and thermal engineering for the entire Latvian economy, providing the basis for the development of power engineering, manufacturing and other industries, as well as for the maintenance of engineering systems and infrastructure. For several years now, due to the demographic situation and migration in the country, as well as due to the rapid development of technology, the demand for qualified heat power and thermal engineers in the sector has significantly exceeded the supply, and labour market forecasts show that these trends will continue in the coming years.




Dynamics of changes in labour demand in the energy, heat power and thermal engineering and related and allied sectors (data of the Central Statistical Bureau https://stat.gov.lv/lv)

Special attention should also be paid to Cabinet Regulation No. 108 of 20 February 2018 "Specialties (Professions) in which a Significant Shortage of Workforce is Forecast and where Foreigners can be Invited to Work in the Republic of Latvia", which indicates, inter alia, a significant shortage of engineers in heat power and thermal engineering to cover various positions in the national economy (by job codes of the occupational classification), with the national government determining the permission to invite foreign specialists for them. For example, the following items in the Annex to the Regulation could be mentioned: 152, 153, 154, 158 as the title of the relevant profession and in addition: 105, 112, 118, 119, 138, 157, 160, 206, 210, 220 and 221, which are occupied, inter alia, by engineers in heat power and thermal engineering as directly relevant or related professions. The changes in the workforce in the power engineering and related sectors are shown in the figure below.

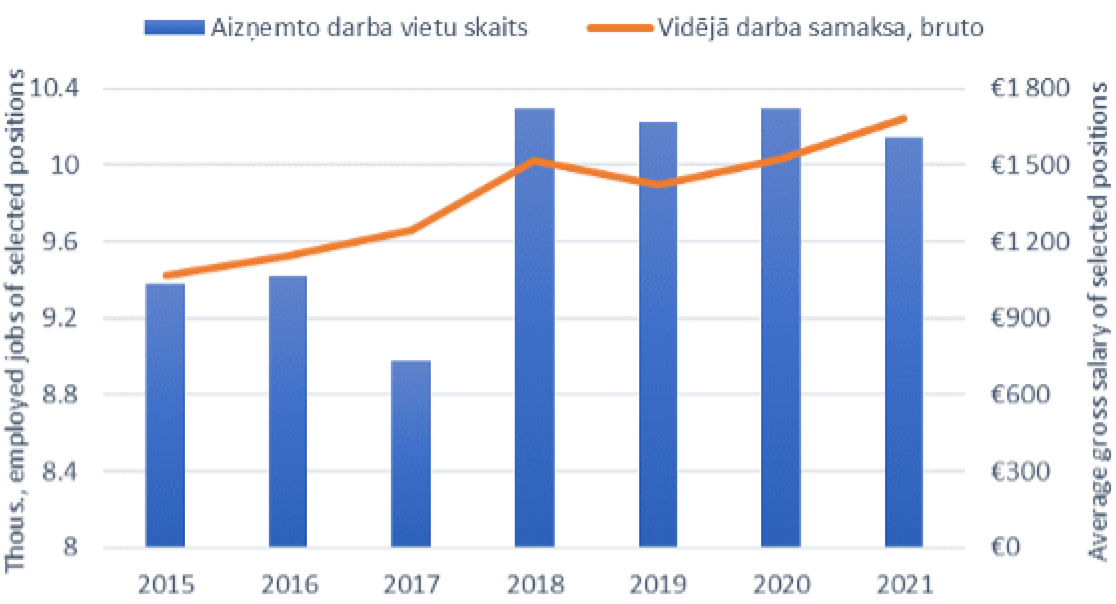
One of the most popular job vacancy portals among Latvian jobseekers and employers, https://cv.lv/lv/, posts on average around 80 to 100 specialist vacancies in the energy sector each month, and several hundred in the industrial and construction sectors, including middle- and top-level management vacancies. The portal is also widely used by a wide range of companies and executive search firms, but due to a high shortage of specialists, highly qualified employees tend to find a new job before they even send their application. There is also a market for the transfer of professionals from one company to another. Therefore, it is important to cover the needs of the market for skilled labour.

The heat power and thermal engineering sector is directly linked to the production of renewable energy, the improvement of the energy efficiency of heating systems and their equipment, and the related decarbonization objectives towards climate neutrality, all of which, together with specific and increasingly sophisticated technological developments, are a key part of the sustainable development of both the sector and the economy. The heat power and thermal engineering sector and, consequently, the professional study programme that ensures the training of young engineers play an important role in the achievement of the goals, guidelines and action plans set out in the Sustainable Development Strategy of Latvia until 2030, the National Development Plan of Latvia for 2021-2027, the National Energy and Climate Plan for 2021-2030, the European Green Deal, the Circular Economy Action Plan, the European Union (EU) 2050 Strategy, and other global objectives, including those set by the United Nations (UN).

Considering all the above, it can be concluded that the usefulness of the study programme is measurable not by its economic indicators, but also **by the economic effect it has on the sector and the economy, along with its contribution to training the required young specialists, introduction of specialized technologies** and implementation of applied research for the maintenance and sustainable development of energy security, heating and industrial markets and municipal infrastructure.

Graduates of the study programme, having acquired industry-specific professional competences, are 100% employed and find jobs in various areas of the national economy throughout Latvia, as well as in European and international companies such as Latvenergo JSC, Rīgas Siltums JSC, Liepājas Enerģija JSC Latvijas Finieris JSC, Grindeks JSC. A large part of the study programme students are already employed in the industry, and many industry representatives decide to continue their studies at a higher level by developing their professional competences.

Graduates of the study programme work in the manufacturing industry, at energy and other enterprises engaged in the production or processing of products or materials, energy production, distribution, redistribution and network maintenance, in the trade of equipment and materials related to the field, at enterprises providing design, maintenance, operation, management services for heating supply systems and thermal engineering equipment and at other enterprises that use thermal energy in their technological processes, not only in the industrial and commercial sectors, but also in the municipal and private sectors. Graduates of the study programme are employed in a wide range of positions, which include not only direct positions, but also other positions required by the industry, including positions in related and similar fields, according to the needs of specific employers. For example, the data on occupied positions are presented below for only 21 positions out of the total number of available and actually occupied positions, of which only two (occupation codes 2422 01 and 2142 36, 1120 03, 1120 06, 1321 05 and 1321 06) are excluded from the list of items of Cabinet Regulation No 108 of 20 February 2018, thus summarizing the statistical data of the State Revenue Service (SRS) on occupied positions according to the occupational classification (available in Latvian: https://www.vid.gov.lv/lv/informacija-par-darba-vietam-2021gada-atbilstosi-profesiju-klasifikatoram).




Changes in occupation and average remuneration of 21 selected positions for heat power and thermal engineering in 2015-2021 (SRS data for January of each year)

The number of occupied positions in January 2021 increased by 8% compared to January 2015. There has been a sharp increase in 2018, mostly in middle-level management positions, indicating a significant labour market demand for these, along with other technical engineering positions. On the other hand, the average salary increases for the positions in question in January 2021 compared to January 2015 was just under 58%, reaching an average level of EUR 1,680. An analysis of the top-level sectoral and binding posts (the example includes occupations with codes 1120 03, 1120 06, 1321 05 and 1321 06) shows that, despite a slight decrease in occupations due to various factors, average gross earnings increased by 47.6% compared to January 2015 and reached an average of around EUR 2 450/month in January 2021. The significant increase in the average salary level in the labour market of the sector and related fields is a positive trend which could further motivate young people to study engineering and to obtain the qualification of Leading Engineer and Master degree in Heat Power and Thermal Engineering, as well as motivate those working in the sector and related thematic areas to improve their professional competences by completing the only Master study programme in Latvia in the field of heat power and thermal engineering.

In the framework of the SWOT analysis of the professional Master study programme, apart from the analysis of its strengths and weaknesses, some opportunities and threats specific to the heat power and thermal engineering sector have been identified (see Section 3 below and Section 2.1.2).

Opportunities:

- The EU Green Deal and related EU legislation create a number of opportunities for moving towards a climate-neutral Europe in 2050:
- rapid development of technologies and equipment in the heat energy, thermal engineering and refrigeration sectors, including the development and use of renewable energy and hydrogen technologies;
- the development of the local energy market and the expansion of specialized areas, including heating and refrigeration, which expands the possibilities for the academic staff of the Department of Thermal Power Systems to collaborate with companies in the sector in different areas;
- increase of the number of local Latvian and international project commissions, it may be forecasted that the demand for technical, engineering and applied industry research projects will grow;
- substantial EU funding is foreseen for the next planning period to directly support the objectives of the Green Deal through various support projects.
- The expansion of the qualification structure in the energy sector in 2021-2022 with new professional qualifications and their specializations at the Master level, including in the field of cold supply.
- Interest expressed by the Latvian and international industry enterprises in promotion of cooperation in various areas, including applied research issues;
- State support measures for adult education and the reduction of administrative burdens in the implementation of lifelong learning contribute to an increased interest on the part of employers and employees in various types of professional development programmes and the acquisition of new qualifications.

Threats:

- Adverse demographic situation in the country and migration, emigration to other countries to study, work and/or live.
- Salaries in industry and other related jobs are often not strictly linked to educational attainment, so graduates of the Bachelor study programme are not sufficiently motivated to pursue a Master degree.

- Salaries in the sector are higher than those of academic staff, leading to a lack of motivation for young graduates to start their academic and scientific careers.
- The goals of the EU Green Deal on climate neutrality are a challenge for the Latvian heat power and energy sector. The lack of a roadmap for the country's transition to a green economy and the implementation of the Green Deal action plans is a major concern.

In order to improve the quality indicators of the study programme and to mitigate the potential impact of negative external factors, the following additional areas of action have been identified for the next reporting period, based on the strengths and opportunities of the study programme:

- To promote the only professional study programme in Latvia and strengthen the position of thermal and heat power engineers by using the support of companies, organizations and regional competence centres, as well as modern social networking technologies, etc.;
- To expand the study programme with additional sub-specialties along with the updating of the structure of qualifications in the sector, e.g., in the field of professional refrigeration equipment and systems, and to improve and develop work-based and adult-oriented studies, integrating modern models for the implementation of vocational education programmes;
- To increase mobility of students and academic staff for exchange of experience and knowledge in line with the Green Deal and industry trends towards achieving RTU aims and the strategic objectives within the study field in terms of sustainable development;
- to take advantage of trends in the Green Deal, the energy, heat energy and heating sector, and the increased collaboration with industry and experts in the design, modernisation and implementation of sustainable study content, including the improvement of academic staff workload indicators, and their stable long-term continuity, as well as the promotion of the development of applied science.

**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 dynamics of changes in the number of students enrolled during the reporting period (see in Annex) reflects relatively high fluctuations in the number of full-time students, what is closely linked to the nature of the engineering and heat and power sector itself. However, decreasing trends may be observed mainly in connection with the general trends in vocational higher education and engineering, i.e., the overall demographic situation and migration in the country and due to the spread of Covid-19 in several waves in 2020 and 2021, which also had a significant impact on the education sector. The usual pre-admission events organized within the study programme “Heat Power and Thermal Engineering”, as well as important annual events, such as " Career Day ", etc. were cancelled, because of introduced restrictions during the Covid-19 pandemic. Some of events were organized remotely in early 2021, attracting relatively large numbers of visitors, but they could not fully replace the in-person events.

In 2021, with a relatively large investment, RTU additionally developed and carried out a fairly extensive enrolment campaign for the study programme, which, together with the active involvement of new study programme partners in the sector, helped slightly improve the indicators and reach the figures of 2017 (see RTU campaign results and additional information in the Annex). The more active involvement of companies and professionals of heat power and thermal engineering field in particular has made a significant contribution, allowing to admit more people from the industry. However, it was concluded that the events organized within RTU reached the target audience with a delay, which would require adjustments in the design of the activities to be organized centrally.

The average number of students enrolled in the study programme (see Annex) in the reporting period is 10.7 students, reaching its maximum (19 students) for two consecutive years in 2013/2014 and 2014/2015 study years. Such indicator level can be rated as good for master study programme in heat power and thermal engineering sector. The analysis shows that on average 95.3% of the total number of enrolled students were admitted to full-time studies.

Admission to the part-time extramural study programme form is at a low level typical for master’s studies, without significant fluctuations, which is closely related not only to the specifics of the field itself, but also to the study plan, which is also adapted for working students.

The highest number of graduates was in 2014, which, including part-time extramural graduates, reached 13 graduates. On average in the reporting period, the share of graduating full-time students represents 46.6% and that of graduating part-time students – 56.3%. High annual fluctuations in the number of graduates are largely related to students' academic leave, reaching the maximum in 2017/2018, as well as during academic year 2019/2020, which was also influenced by the prevalence of Covid-19.

In the reporting period, five graduates of the Master study programme with a weighted average score of 8.6 were included in RTU Golden Fund, which could be considered a stable positive achievement.

The total number of students in the reporting period and their share by the form of implementation of the study programme and source of funding, as well as the share by study year are fluctuating and non-homogeneous values with a downward trend, following also the general national and engineering trends mentioned above. Student number and share change dynamics by the study course reflects also the fluctuations related to various forms of study programme implementation, envisioned for the graduates of different Bachelor study programmes and with a different implementation duration – during the 2$^{nd}$ study year, many students graduate in the middle of the year, but at other programme variants, students continue their studies.

A more detailed analysis of the number of students by study year shows that the student dropout rate is a variable phenomenon influenced by a number of factors, academic leave being one of these factors. Overall, an average of 25.7% students were on academic leave during the reporting period. Considering also the academic failure indicators, more than half of the withdrawn students did not resume their studies after academic leave, which represented on average around 10.7% of the full-time students, which was assessed as a moderately good indicator with room for improvement. No full-time or part-time students were on academic leave during the reporting period, which was quite typical of a given study programme.

The Master study programme is chosen by graduates of professional Bachelor study programmes, graduates of study programmes in other related subject areas, and those working in industry who wish to continue their studies or develop their professional competences. There are also companies in the sector which, due to the nature of their activities, set strict requirements for the qualifications of their employees and are also willing to pay for studies, which also acts as an additional motivator. The study programme design is quite flexible and well suited to working students, and includes a sufficient number of state-funded study positions. All this combined allows for less choice in the form of tuition fee or part-time study programmes, which is also reflected in the corresponding student statistics. However, given that in some years the number of students enrolled has exceeded the number of state-funded study positions, this offer is maintained in order to provide the sector with as many study opportunities as possible to train the necessary specialists in the only study programme in this field in the country.

The new energy sector qualification of Leading Engineer in Heat Power and Thermal Engineering approved in August 2021 has laid an important foundation for the transformation of the heat power and thermal engineering sector and the curriculum of the professional Master study programme towards the Green Deal and Sustainable Industry Development. Major changes have been initiated and development plans are aimed not only at training the qualified leading engineers needed for the sector, but also at integrating new approaches, involving the representatives of the industry more actively in various activities and processes of the programme, and promoting a common interest in specific technologies and research relevant to the development of the economy.

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

## 3.2. The Content of Studies and Implementation Thereof

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

The content of the professional study programme is developed and updated in accordance with Cabinet Regulation No. 512 of 26 August 2014 "Regulations on the State Standard of Second Level Professional Higher Education" and other normative acts, including the requirements of RTU normative documents, as well as the occupational standard. The examination of changes and updates of the content of several levels ensures its compliance with the main requirements.

The professional Master study programme "Heat Power and Thermal Engineering" is the only one in Latvia that educates and trains graduates with a Master degree in heat power and thermal engineering. Given the relatively large range of professional compulsory elective study courses offered by the professional study programme, its content is regularly audited by checking the actual status of the external study courses, which allows for prompt correction of the study programme content by replacing an inactive study course with an active one of the corresponding contents. One of the last such changes was made in 2021 by replacing the study course MKI516 "Foundations of Quality Systems" by MKI350 "Quality Systems (Basics)". The relevance and topicality of the courses of Humanities and Social Studies part are also reviewed.

By including an additional variant of the study programme with the volume of 80 CP, its content was supplemented with a newly developed internship study course for graduates of professional Bachelor programmes in related fields – MSE705 "Internship (specializing)" *(more on the definite study course in point 3.2.4. and Annex 3.2.1. “Description of the study courses”*).

Graduates work in a wide range of different sectors, so the professional Master study programme includes relevant and necessary specialized courses. The rapid development of renewable energy technologies and industry also involves the construction of new energy facilities. The professional study programme includes specialized courses in the various fields of professional activity required by the sector, which are updated in line with industry trends. In order to ensure the competitiveness of future young managers, a module of related qualifications and study programmes in the construction sector with the following study courses was also included in compulsory elective study courses of the study programme in the first half of 2021:

- BO426 "Planning and Organization of Building Construction" provides knowledge and skills in the management of civil and related engineering and systems projects, covering also the new energy sector requirements for the qualification of leading engineers in heat power and thermal engineering;
- BSG361 “Heat Transfer in Building Constructions” provides the theoretical knowledge and practical calculation skills of a special thermal physics unit;
- BSG357 "Planning of the Infrastructure in the Towns" provides the development and improvement of knowledge and skills in the design of civil engineering structures, including heat networks, within an urban planning framework, which covers, inter alia, the new energy sector requirements for the qualification of leading engineers in heat and thermal engineering.

The study programme was also revised to include the economic and economic calculation skills relevant for managers, with the inclusion of the study course IUE466 "Economics of Energetics" offered by the study programme in a related field, which ensures the acquisition of economic aspects relevant to the specifics of the sector.

The content, the learning outcomes, the set aims and tasks of the study courses comply with the learning outcomes, the set aims and tasks of the study programme. The interrelation of the study courses ensures that the planned learning outcomes are achieved at an appropriate quality level. The learning outcomes are also achieved by using methods appropriate to professional education, which are integrated into the content and ensure sufficient quality, e.g., regular study excursions are organized during which professional knowledge is acquired and strengthened. Guest speakers from the sector are invited to deliver individual classes, which helps ensure that the content is relevant to the needs of the sector and current trends.

The last decade, and in particular the last five years, witnessed significant changes in the sector, with very rapid technological developments towards climate neutrality, as well as a significant strengthening of specific requirements, leading also to changes in the sector qualifications. The new version of the Energy Sector Qualifications Framework approved in 2018 also includes a new professional qualification, LQF/EQF 7 of Leading Engineer in Heat Power and Thermal Engineering (see also Section 3.1.1). Due to the rolling reforms of vocational education and the ongoing alignment of the LQF, including the clarification of the needs of the sector in the field of higher-level professional qualifications, the new occupational standard of Leading Engineer in Heat Power and Thermal Engineering was only approved at the meeting of the Tripartite Cooperation Sub-council of Vocational Education and Employment on 11 August 2021.

The professional Master study programme "Heat Power and Thermal Engineering" is the only one in Latvia that educates and trains graduates with a Master degree in heat power and thermal engineering, and with the inclusion of the new qualification, the only one that trains the future heat power and thermal engineers for the industry. The content therefore focuses specifically on meeting the needs of the sector in training the required leaders, including issues of relevance to the sector, methods of implementation and design.

The rapid development of technologies and the significant changes in the sector not only in Latvia, but also in Europe and the world, along with the introduction of the new professional qualification and its occupational standard, have a significant impact on the content of the professional study programme. Starting from autumn 2021, the content is being modernized and updated, for example, the content of the study course MSE428 "Specialized Course in Ecology" has been substantially revised, at the same time developing it in such a way that its content is also relevant for other study programmes to achieve the objectives of optimizing RTU study courses.

The work done in 2021 is not considered to be complete: the analysis of the study programme content has shown that the existing structure of it has certain shortcomings in relation to the newly introduced Level 7 LQF/EQF professional qualification and 2021 occupational standard – a smoother alignment of knowledge coverage is needed, with more detailed revision of the content of individual professional courses and/or replacement of some of them with new ones. Thus, already in autumn 2021, in order to ensure the relevance of the study programme content, a completely new study course MSE704 "Information and Automated Management Technologies of Energy Companies (Study Project)" was developed and included in the programme curriculum. In order to facilitate the development of additional necessary professional competences, it is planned to develop a study project and include a portfolio of completed practical and independent assignments. Such significant changes in the sector as the introduction of the new professional qualification and its requirements also pose a challenge to the study programme; therefore, the process of structuring and developing the content will continue in academic year 2021/2022, also as much as possible involving experts in the field in programme development and further implementation, also taking into account the recommendations of the Ministry of Education and Science and the National Centre for Education in this matter and in the field of vocational education. In the next reporting period, it is planned to conduct closer monitoring of new study curriculum, performing curriculum update and improvement in accordance with the expected reform related amendments to regulatory enactments regulating higher professional education and the changes in the industry to ensure sustainable provision of professional education in compliance with the industry needs.

Taking into account both the problems of the industry in the education and training of the required specialists, as well as the trends of general vocational education and the goals of RTU in the area of modular and lifelong learning programmes, the content of the professional Master study programme "Heat Power and Thermal Engineering" is planned to be structured as modular and lifelog leaning oriented as possible, which is particularly topical for the Master study programmes, where there are many adult and already employed students.  The above trends, taken together with the results of the content analysis, also suggest that the design of new studies should also pay more attention to providing sufficient flexibility for adult and working students to combine study and work. One solution would be to reduce the proportion of external courses, which would avoid the need for unusual timetabling. An additional long-term solution could be to increase the proportion of content covered by industry, which could be achieved by integrating modern work-based learning methodologies into the study programme.

In addition, plans for the development of the study programme to add additional sub-programmes in the next reporting period should be taken into account as much as possible during the structuring and modernization of the content. It would be desirable to provide content that is relevant, firstly, to other engineering professions in the energy sector and, secondly, to related professions in other sectors. This would not only allow for a broader coverage of the needs of the sector, but also increase the quality of the study programme indicators and the effectiveness of its content in achieving the strategic objectives of RTU and the study field.

**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 professional Master study programme "Heat Power and Thermal Engineering" is implemented by including content in accordance with the requirements of Cabinet Regulation No. 512 of 26 August 2014 "Regulations on the State Standard of the Second Level Professional Higher Education", including Paragraphs 23.1 and 23.2 of the Regulation, which, among other things, provide for the inclusion of research study courses in the compulsory part. (see also Annex 3.2.1.-1.).

The relevance of the theme of the graduation paper to the industry, as well as the evaluation of a problem of major importance to the industry, is particularly important in the professional study programme. Leading heat power and thermal engineers are employed in a wide range of sectors and fields (see Section 3.1.3), so the graduation papers cover a wide range of themes. Particular emphasis is placed on the use of relevant research and scientific articles in both the graduation papers and the curriculum. Master Theses often include applied research or parts thereof, as well as elements of scientific research, in accordance with the methodological guidelines for graduation papers (see also point 3.2.6 of the study programme).

Students of the professional Master study programme are offered opportunities to actively participate in the annual RTU Students' Scientific and Technical Conference; they also regularly participate in the annual RTU International Scientific Conference.

During the reporting period, students of the Master study programme have repeatedly received Latvenergo JSC awards for projects relevant to the industry and scholarships for the development of graduation papers within the framework of competitions organized by Latvenergo JSC.

**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.**

In the professional study programme "Heat Power and Thermal Engineering", the choice of the relevant methods for delivering study courses is based on:

- the aim, tasks and learning outcomes of the study programme;
- the aim, tasks and learning outcomes to be achieved for a specific study course;
- specifics of the content of the study courses, as well as the specifics of the technology and industry;
- the student's study opportunities, diverse needs;
- the study environment: available study facilities, information facilities, material and technical facilities;
- opportunities for the involvement of academic staff and industry in the implementation of studies.

The study programme is implemented to educate and train the specialists in heat power and thermal engineering required by the industry. This provides the basis for the choice of methods aimed at the development and consolidation of in-depth professional skills and knowledge. The study content also focuses on the development of general professional skills, such as business communication and cooperation with various industry organizations in solution of professional tasks in the globalized environment, as well as improved presentation skills performing before various target audiences, promoting knowledge and experience exchange in the industry.  The skills and competences to make responsible and reasoned engineering decisions in both management of modernization of power systems and technologies, and their maintenance and design, including environment in the area of circular economy and sustainable development. The study programme also focuses on general and sector-specific digitization, developing professional skills in smart and information technologies, together with the integration of relevant methods into the study content. Practical, independent and other tasks are designed to develop analytical and creative thinking, discussion, cognitive and research skills necessary for the performance of professional duties.

The orientation of the professional study programme also determines the methods of assessment of the respective learning outcomes: the summative assessment method is used in the study courses, which includes examination methods and criteria corresponding to the specific study course and the occupational standard. The study programme offers the internship to consolidate and develop the acquired knowledge and skills in the industry. The evaluation of the learning outcomes is concluded with a state examination – the elaboration of a diploma project and its viva voce examination in front of the State Examination Committee.

In student-centred learning, academic staff use a diverse range of teaching methods, depending on the circumstances:

- traditional methods – lectures, practical classes, laboratory work, seminars;
- methods that promote analytical, critical, systemic and creative thinking, as well as communication skills – group work, discussions, debates, presentations, case studies and modelling, problem-solving, study tours and surveys of experts in the field, etc.;
- methods of encouraging students to work individually or in groups, to use information resources and to select and collect information – reports, projects, homework, study projects, graduation paper;
- meetings with invited experts – professionals in the field;
- students are motivated and encouraged to independently choose the topics of their study projects and graduation paper in accordance with the current trends in the field, which at the same time ensures the achievement of the learning outcomes.

Student-centred methods are used particularly successfully in the specialized courses of the programme, such as MSE428 “Advanced Ecology”, MSE384 “Equipment for Refrigeration Plants”, MSE441 “Specialized Course on Heat Exchange Apparatus”. In the above examples, the study courses successfully integrate various methods, methodological techniques, principles of student-oriented education and forms of lecture organization, which allow providing the necessary professional knowledge and skills, at the same time effectively developing general professional competences, along with increasing students' motivation and interest both in the study process itself and in learning complex engineering material, which all together in some cases reach the level of synergy. The personalized learning approach is also widely used, supporting students' ideas, proposals and initiative in learning the content of their courses. The use of such approaches and methods promotes both the transfer of knowledge and competences (for example, especially in the fast-changing field of information technology, where an increasing number of new specialized and sector-specific computer programmes, tools and auxiliary instruments are emerging), the development of a mutually respectful and lasting relationship between student and instructor that continues beyond the completion of studies, and the full achievement of learning outcomes of a particular study course and study programme.

According to the survey data of the graduates of the study programme (see annex of the study field point No. 2.2.4), the study programme has a high evaluation in the most part of points, which exceeds the average indicators of the study field, but in some positions the average indicators of RTU, the reasons of result are used methods and approaches either.

The set of methods used for the implementation of the study programme and their evaluation show the development in the area of the competence approach, which can be assessed positively in terms of quality assurance and sustainable development of professional higher education.

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

Internship within the professional study programme "Heat Power and Thermal Engineering" is provided in accordance with Cabinet Regulation No. 512 of 26 August 2014 "Regulation on the State Standard of the Second Level Professional Higher Education" and RTU Internship Organization Procedure (RTU Senate Decision of 28 January 2019 (Minutes No. 626)).

The Master study programme, depending on its variant, provides internship for 6, 12 or 32 weeks in the appropriate volume of CP required for the award of the professional qualification of Leading Engineer in Heat Power and Thermal Engineering and graduates of other Bachelor study programmes are provided with an additional volume of internship to align specialized professional skills and competences according to whether the student has obtained professional or academic education in the related or related thematic field in heat power or thermal engineering. The planning of the internship shall be carried out according to the planning of the study year and programme variant: autumn, spring and/or summer semesters.

Students of the professional study programme "Heat Power and Thermal Engineering" have the possibility to find an internship site on their own, to use independent offers within the framework of concluded cooperation agreements, or to ask the internship coordinator and/or academic staff for support and guidance in searching and choosing an internship company (for the chosen internship, despite the wide choice of possible professional fields of activity. Additional assistance in the search and selection of internship company is provided by posting relevant information on RTU website, which also includes links to external information resources such as the https://www.prakse.lv/ portal, and throughout the academic year, especially towards the time of internship, various, mostly paid advertisements are posted on the Ortus bulletin/news board, and all news is also sent regularly to students by e-mail. Internship advertisements are also available on the FMETA website (in Latvian) (https://www.rtu.lv/lv/mtaf/studijas-mtaf/informacija-studentiem-1/prakse_un_darbs), as well as on the FMETA and Department notice boards in the Faculty premises, and in Department and common social networks and other information resources.

Active cooperation with large and small companies in the sector allows us to continuously offer internship opportunities to students, including paid internship in various fields of the sector, about which not only the internship coordinator, but also other instructors inform students.

Students of the study programme have opportunity to undertake paid internships at many companies throughout Latvia, including permanent and new partners of the Department of Thermal Power Systems:

Latvenergo JSC cooperates with RTU in a variety of ways, including in the provision of paid internship, which is also used by students of the study programme "Heat Power and Thermal Engineering". RTU ensures regular updating of the cooperation agreement to ensure the continuity of the cooperation.

During the reporting period, Rīgas Siltums JSC provides paid internships in accordance with the agreement, and regular study tours are also provided at the company and its facilities.

Since 2016, long-term cooperation has been established with EKO AIR Ltd, the only plate heat exchanger production plant in the Baltic States, located in Salaspils.

In 2021, two new cooperation agreements, including the internship provision, have been concluded with regional companies Adven Latvia Ltd (a branch/representative office of the Scandinavian energy company in Latvia) and Liepājas Enerģija Ltd.

In the 60 CP variant of the professional Master study programme "Heat Power and Thermal Engineering", students draw up the internship report, which is presented in front of a committee; in other variants of the study programme, students are additionally required to complete a diary during the internship period to ensure compliance with the professional qualification to be awarded within the Master study programme. A summative evaluation is applied to the internship, which consists of the feedback of the internship supervisor at the organization, the evaluation of the internship report and its design, and public presentation. The experience gained during the internship and the information gathered can also be used in the development of the graduation paper.

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

### 3.2.6. Analysis and assessment of the topics of the final theses of the students, their

**relevance in the respective field, including the labour market, and the marks of the final theses.**

At the end of the professional Master study programme "Heat Power and Thermal Engineering", the student develops a Master Thesis. Students choose the themes of the graduation paper in different ways: independently, choosing the theme of their interest; based on the information collected and analysed during the internship and the observed problems or opportunities for improvement, as well as receiving suggestions for the theme of the graduation paper from the internship supervisor at the company; or choosing current themes proposed by the companies or faculty members in the field.

Leading companies in the sector also offer scholarships for the development of graduation papers by organizing competitions (for example, the annual graduation paper competition by Latvenergo JSC for engineering students from various energy and information technology sectors), which additionally stimulates students both to choose a topical theme for the graduation paper that is more suitable for a particular company and to develop the high-quality paper in compliance with the competition regulations, thus enhancing and strengthening professional skills required in the labour market.

With the introduction of the new professional qualification and the development and approval of the occupational standard of Leading Engineer in Heat Power and Thermal Engineering at the meeting of the Tripartite Cooperation Sub-council of Vocational Education and Employment in August 2021, the professional Master study programme "Heat Power and Thermal Engineering" was being modernized at the time of self-assessment, i.e., are updated methodological guidelines, thus ensuring compliance with the new occupational requirements. However, the clarified requirements for the selection of themes are being phased in from academic year 2021/2022, allowing students to continue with themes already started in their Master Theses and setting new criteria for the selection and agreement of themes for all new Master Theses. It should be noted that, despite the substantial changes in the study programme, the main thematic and higher-level specialist areas in the energy sector and in the sub-sector of thermal power and engineering, as well as in related engineering disciplines, remain the same and do not lose their relevance with the award of the new professional qualification.

The wide range of possible professional fields of activity of heat power and thermal engineers is also reflected in the themes and technologies of the students' graduation papers, ranging from the design or modelling of thermal engineering and individual units of equipment or systems, planning, design and optimization of energy and urban heat energy sources and heating systems. The Maser Theses of the professional Master study programme also include elements of scientific or applied research, which is also reflected in the themes of the Master Theses. The themes of the Master Theses also vividly illustrate the main current technological and market trends in the sector and related fields, and, when looking at practical aspects, include issues such as the problems of fossil fuel and renewable energy use in energy and heating supply, energy efficiency improvement, renovation of buildings and/or their systems, improvement of thermal engineering technologies, optimization of system operation, economic and circular economic aspects in the context of the sector and technological development.

Some examples of the themes of students’ graduation papers in the period of 2013-2021:

- “Thermal Problems in Vacuum Nanocoating Processes”
- “River Water as an Energy Source for District Heating and Cooling”

- "Problems of Housing Stock Hot Water Supply Systems Renovation"
- "Development of Methodology for Mach-Zehnder Interferometer for Combustion Investigations"
- "An Analysis of OTEC Potential and Application"
- "Efficient Use of Municipal Solid Waste by Incineration in CHP"
- "Electric Field Impact on Wood Biomass Combustion and Gasification Processes"
- "Efficient Use of Energy Resources in Medical Buildings Complex"
- "Evaluation of the Status of Rotary Electrical Equipment of TPP with Vibrodiagnostics"
- "Energy-Economic Analysis of Pipeline Materials for the Solar Collector System"
- "Centralized Low Density Heat Systems Solutions in Small Towns of Latvia"
- "Heat Recuperation of Refrigeration Systems"

The quality of the graduation papers of the students of the study programme can be assessed by the grade obtained in viva voce examination. The average grade for graduation papers in the reporting period ranges from 7.0 to 9.2, with an overall median of 8 for all years and an average value of 8.2. The dynamics of graduation paper evaluation over the years is not stable and does not reflect clear downward or upward trends.

During the reporting period, grade "6" was the lowest received for the graduation paper, only 3 students received it. Such ratings also reflect the objectivity of the evaluation of the quality of the graduation papers elaborated and show that there is room for improvement in these indicators through methodological approaches and organizational measures for the development of graduation papers.

In turn, 35% of students received a grade "9" and 4 had a grade "10", in total reaching 44.2% of the total final examination grades in the reporting period. The trend is generally positive and indicates that about 75% of students received a grade in the range of average and above average indicators, which is a very high indicator in the field of engineering.

This is also due to the fact that more motivated and ambitious students choose to continue their studies at the Master level, as well as those who have been working in the field and related fields for a long time, which is also reflected in the higher quality of the graduation papers elaborated than at the Bachelor level. Such indicators lead to the conclusion that the study programme should be developed in different areas and offer more opportunities, including for qualification development and solutions for adults within the framework of lifelong learning, which would further promote both cooperation and exchange of practical experience, as well as improve other necessary indicators.

## 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.

In 2013, the location of the professional study programme was in Riga, Ezermalas Street 6-k, i.e., in one of the remote districts of Riga with a relatively low intensity of public transport. In accordance with RTU Development Strategy, the construction and renovation of Ķīpsala Campus had already begun.

In 2015, within the framework of Ķīpsala Campus development project and the relevant ESF funding, a centralized procurement of laboratory equipment necessary for the implementation of the study programmes, including the study programme "Heat Power and Thermal Engineering", was carried out to provide equipment for the newly constructed Laboratory House.

The Department of Thermal Power Systems of the Institute of Mechanics and Mechanical Engineering has several premises in the Laboratory House, which in 2017 were already provided with a sufficient level of equipment for the implementation of studies and laboratory work. Starting from the autumn of 2017, they were also fully used in the study process. The premises of the Laboratory House are suitable for both laboratory work and lectures for groups of up to 20 students. The location in Ķīpsala, Paula Valdena Street 1, made it difficult to plan classes due to the additional time required for both students and academic staff to move between RTU buildings, which was resolved in 2019 with the full relocation of the FMETA to new premises at Ķīpsalas Street 6B.

In autumn of 2019, the implementation of the study programme "Heat Power and Thermal Engineering" was started in new and modern premises at Ķīpsala Campus, which were also equipped with new laboratory rooms in addition to those already existing in the Laboratory House. This ensures continuity of studies during the day, unlike the previous location at Ezermalas Street 6-k, which increased the time between classes of individual courses, especially in the first years of studies, which required travelling to other premises, including in Ķīpsala.

During the reporting period, a total of € 235 875 was invested in laboratory equipment, special instruments and various types of equipment, mostly in new premises, including ESF funds intended for the construction and development of Ķīpsala Campus. (*see Annex 3.3.1*).

Several multifunctional teaching laboratory stands have been received within the framework of European projects for the implementation of various study courses and for the acquisition and development of professional as well as scientific and research skills in the thematic areas of technical thermodynamics, hydro- and gas dynamics, heat transfer, thermal measurements, etc., providing a total of more than 40 different laboratory activities. Specialized equipment and instruments are designed for both study and professional use, as well as for research: professional skills in working with various types of measuring instruments are being developed and improved, for example, the vapor compression refrigeration process research machine ET900, and the WL 225 fluidized bed heat transfer training bench are used for the implementation of study courses. The PHOTRON FASTCAM Mini UX100 high-speed camera is designed for fast process research and has a wide range of general scientific and industrial applications. The Mach-Zehnder interferometer allows for the detection and measurement of phase shift variations, for example, in 2015, a Master Thesis devoted to the development of a methodology for combustion studies was evaluated with a grade of 10 (outstanding). Other laboratory equipment and facilities of the Department of Thermal Power Systems, as well as technical equipment of other departments of the study field and RTU are also used for the implementation of the study programme.

Along with the change in the permanent study programme location, the pre-existing laboratory facilities were renovated and modernized: laboratory equipment and apparatus were renewed, as well as some older teaching stands. Since the relocation of the study programme to Ķīpsala, the new premises are being upgraded and updated to meet current needs for efficient and high-quality studies.

In addition to the funded investment, the study programme also receives donations from leading companies in the field and from graduates in the form of laboratory equipment and specialized literature, as well as training and operational support in the use of the donated equipment. Industry also provides its own facilities for students during the internship period.

With the relocation of the study process to Ķīpsala Campus, students have also gained more convenient access to the Scientific Library of RTU with available databases, including the LVS Standards Database, which is used as a source of information by many lecturers in specialized study courses for the acquisition of professional knowledge. The Scientific Library is now located in an adjacent building, making the study process much easier. Despite the proximity of RTU Scientific Library, the library of the Department of Thermal Power Systems was retained for the implementation of the study programme. A separate room with desks and computers was allocated for the Department library, where a research assistant and a researcher helped the students use the library and its facilities. The academic staff are always helpful in finding the necessary books, providing recommendations for the use of additional available literature according to the student's needs. For the implementation of the study programme, the Department library has a wide range of specialized books and publications in various areas of the study courses:

- thermodynamics and heat transfer;
- thermal engineering and heat exchangers;
- combustion processes and energy equipment;
- engineering process calculation, research and modelling;
- thermal physics and flow mechanics and many other publications.

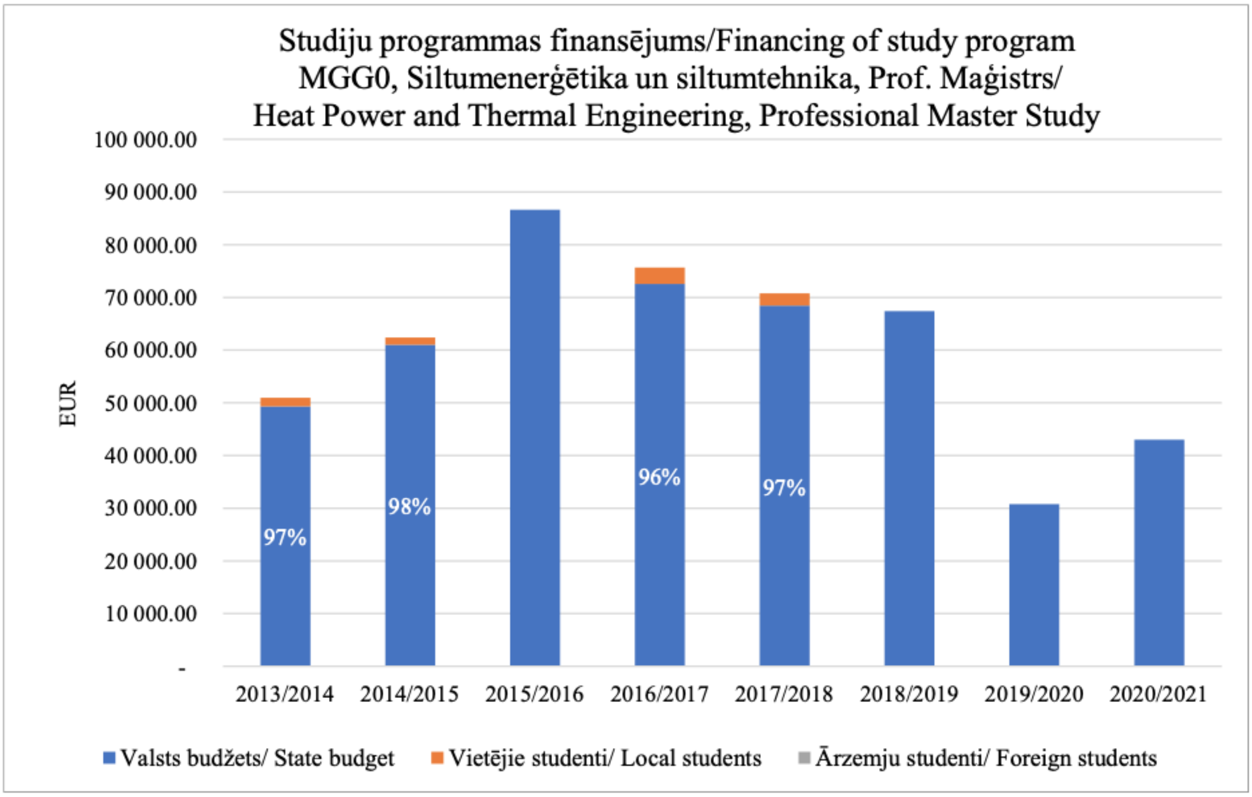
Methodological materials and instructions are regularly developed and updated for the implementation of the study programme, as well as RTU Scientific Library collections are enriched. In total, about 50 textbooks were ordered in the reporting period, including those supplemented with newer technologies, which are used in study courses as basic and/or supplementary literature, e.g.:

- Ranganayakulu, Kankanhalli N. Seetharamu. Compact heat exchangers: analysis, design and optimization using FEM and CFD approach, 2018 Wiley, 978-1-119-42437-6
- Mounir B. Ibrahim, Roy C. Tew, Jr. Stirling convertor regenerators, 2017 by CRC Press, ISBN 9781138075597.
- Yang Shi, Mingxi Liu, Fang Fang. Combined cooling, heating and power systems: modeling, optimization and operation, 2017 Wiley, ISBN978-1-119-28342-3
- Sandler, Stanley I., Chemical, biochemical, and engineering thermodynamics / Stanley I. Sandler. 4th edition. Hoboken, N.J.: John Wiley, 2006., 945 p. + 1 CD-ROM (4 3/4 in.) ISBN 9780471661740
- Nithiarasu, P. Fundamentals of the finite element method for heat and mass transfer / P. Nithiarasu, Zienkiewicz Centre for Computational Engineering, College of Engineering, Swansea University, UK, R.W. Lewis, Zienkiewicz Centre for Computational Engineering, College of Engineering, Swansea University, UK, K.N. Seetharamu, Department of Mechanical Engineering, PESIT, Bangalore, Karnataka, India. 2nd edition. Chichester, West Sussex: Wiley, 2016. xiii, 450 p.: Wiley series in computational mechanics. ISBN 9780470756256
- Heidenreich, Steffen Advanced biomass gasification: new concepts for efficiency increase and product flexibility / Steffen Heidenreich, Michael Müller, Pier Ugo Foscolo. London: Elsevier/Academic Press, 2016. vi, 134 p.:. ISBN 9780128042960.
- Steven G. Penoncello. Thermal Energy Systems: Design and Analysis CRC Press, January 30, 2015, 586 pages ISBN-13: 978-1482245998
- Silvio de Oliveira. Exergy: Production, Cost and Renewability (Green Energy and Technology) Paperback – December 14, 2014 Springer; 2013 edition (December 14, 2014) ISBN-13: 978-1447158936, etc.

In the implementation of the study programme, the recommended sources of literature on fundamental knowledge and skills acquired over the years, as well as the latest publications on more up-to-date and modern technologies, as well as the resources subscribed to by RTU Scientific Library are also used both for study course content acquisition and for developing skills in working with sources of scientific literature.

**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).**

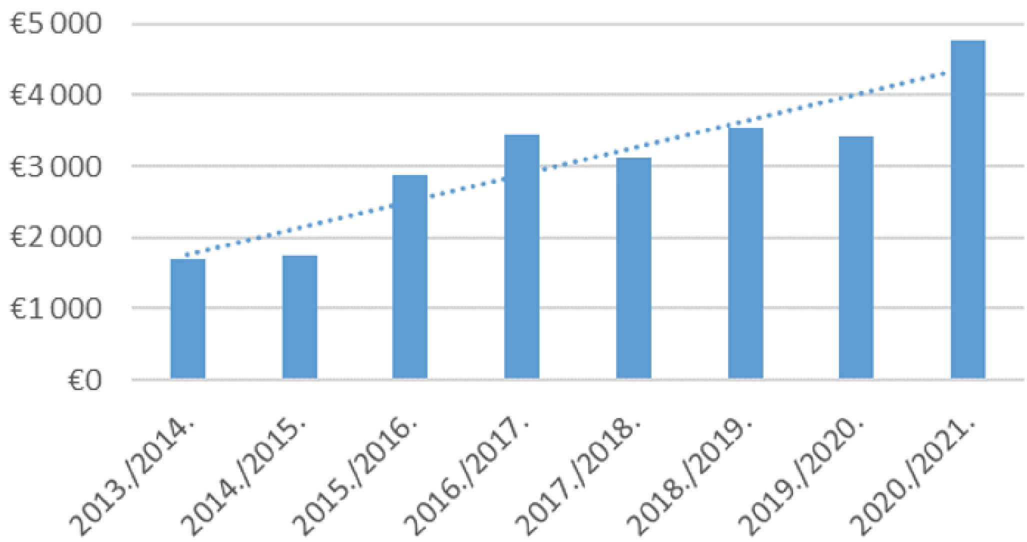



The total funding of the professional Master study programme consists mainly of state-funded subsidies with a small share of tuition fees in the reporting period, which include both full-time intramural and part-time extramural student fees, as well as various types of additional student fees (e.g., for re-examinations).

The cost of implementing the programme increased from €5799 to €6694.22 per student during the reporting period (see point No. 2.3.1. and its annex).

The public funding allocated to the study programme varies considerably from year to year, largely due to fluctuations in the number of students as well as certain funding distribution indicators. Despite a hard-to-detect trend, the annual variation in their volume indicates an average increase of 4% in the reporting period.

The analysis of subsidies awarded during the reporting period shows that their share per full-time intramural state-funded student is uneven due to fluctuations in total funding and an uneven number of students during the reporting period, as well as due to the impact of other factors. Nevertheless, there is a tendency for the share to increase rather steadily, averaging 14.7% in the reporting period (see chart below), which is positively evaluated.




Percentage of study programme subsidies per full-time state-funded student (Source Sections 2.3.1 and 3.1.4 and their Annexes).

As part of the ongoing reforms of vocational education in the country, as well as the country's Sustainable Development Strategy, it is planned to further improve the regulatory framework for higher vocational education, including in the area of finance, in the next reporting period. Public financial support programs for workers are also in place, but at the moment they cover mostly lower levels of vocational education, as well as professional development courses/modules, which should be extended to higher education programmes. On the other hand, for the professional Master study programme, the specificity of the sector and the trend towards the introduction of such support projects will expand the possibilities for attracting additional students and also funding, including for lifelong learning.

The modernization and development plans for the study programme, together with the overall transformation of the sector and the approval of the new occupational standard in 2021, also foresee more involvement of the sector in the implementation of the study programme in different areas. Taking into account all of the above and the general trends in vocational education, higher education and the sector, the following areas for the development of the study programme are evident, including in terms of attracting, distributing and reallocating funding:

- the new occupational standard has led to modernization of the structure and curricula of the study programme, and there is a need to develop new professional specialization courses of sufficient scope, which will also redirect the distribution of funding;

- greater involvement of industry in different processes and areas has the potential to increase the number of students enrolled among both young and working people in all forms of the study programme, including by increasing interest in the content, and to provide a sustainable basis for curriculum development;
- integrating new work-based learning and other modern forms of study into the curriculum would, in addition to improving overall efficiency, reduce the burden of direct costs, given that entrepreneurs also receive direct state-funded support to participate in such programmes, as well as increase indirect and/or direct income, including for the expansion of research areas;
- the development of new sub-areas and/or additional modes of implementation of the programme opens a wide range of opportunities not only for the development of the study programme in the context of industry needs and trends, but also for attracting additional funding of various types, while also ensuring the improvement of the study field and RTU strategic indicators (additional data and information available in points No. 2.3.1. and 3.1.4. and their annexes).

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

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

The qualifications of the academic staff involved in the implementation of the study programme comply with the conditions for the implementation of the study programme, as well as with the requirements of national and RTU normative documents.

Associate professors, assistant professors, lecturers, assistants and researchers elected by RTU are involved in the implementation of the professional study programme, as well as practical and guest lecturers, three experts in the heat power and thermal engineering sub-sector approved by the Latvian Council of Science. This ensures the transfer of multifaceted high-value knowledge.

The academic staff involved in the implementation of the study programme are active in research. Research activities in relevant thematic areas, together with the University's professional development and industry events, including courses and seminars, enable the academic staff to maintain and improve their professional competences in line with the content of the study programme.

Particular emphasis should be placed on the changes in requirements and implementation methods of studies brought about by the spread of Covid-19, with virtually all classes moving to remote mode during the pandemic and the first emergency situation. This pandemic really changed the world and many lecturers, along with students, at RTU, in the country and all over the world, had to learn additional previously unused and new specially developed information technology tools and instruments, as well as to use unusual methodological techniques of conducting remote studies, all of which together make the study process significantly more difficult. However, there is also a positive part - RTU students were also involved in various training, advisory and assisting activities for academic staff, thus creating closer mutual cooperation and greater involvement not only in the teaching material, but also in the organization of the study process itself, which is definitely positive, including from the point of view of mutual transfer of knowledge and skills. In addition, it should be noted that RTU regularly organizes various additional training courses and seminars, with a particular focus on the development of knowledge and skills required by academic staff in new and unprecedented conditions, which is still ongoing. This set of additional training activities and the relatively wide choice of topics and participation times allow academic staff to develop their professional competences without being distracted from the study process, all of which ensures that the quality of studies is maintained even under such difficult conditions.

As mentioned above, practical assistant professors and lecturers are also involved in the implementation of the study programme, and renowned experts in the field are invited to deliver guest lectures and conduct practical classes. Some classes are also regularly held on field trips, which were unfortunately excluded during the pandemic, but alternative solutions were explored with the industry. Industry and practical faculty members work at well-known companies in the industry and actively participate in the resolution of thermal power and engineering issues, including within the energy sector, representing the views of associations or their members and industry experts (e.g., Association of Technical Experts, Latvian Association of Heating Companies). Professional development takes place in the industry, in the work environment, through participation in various industry, business and applied projects by fulfilling direct duties. This approach allows ensuring the appropriate quality of professional study results.

### 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 study programme is implemented by both academic staff members and highly qualified professionals. In recent years, more and more companies and other industry professionals have been brought in to provide students with a better understanding of the industry and to engage in the analysis and resolution of current industry issues, thus broadening their professional knowledge and skills.

During the reporting period, there was also a change in the generation of academic staff in the study programme - some of the retired assistant professors and associate professors were replaced by younger academic staff members. New PhD students and researchers are also involved in the study process by delivering certain specialized study courses and / or classes. Thus, while maintaining a similar proportion of academic positions and scientific degrees of the academic staff, the average age has been significantly reduced since 2013, at the same time ensuring the continuity of the academic staff implementing the study programme.

Changes in the academic personnel

| Amats | 2013./ 2014. | 2014./ 2015. | 2015./ 2016. | 2016./ 2017. | 2017./ 2018. | 2018./ 2019. | 2019./ 2020. | 2020./ 2021. | 2021./ 2022. |
|---|---|---|---|---|---|---|---|---|---|
| Asociētie profesori | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 3 |
| Docenti | 4 | 4 | 4 | 4 | 4 | 4 | 3 | 2 | 2 |
| Lektori | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 |
| Asistenti, t.sk.: | 1 | 2 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| Zinātniskie asistenti | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Pētnieki | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |
| Kopā | 10 | 11 | 10 | 9 | 9 | 9 | 10 | 9 | 9 |

At the moment of drawing up the self-assessment report, the share of responsible instructors holding a scientific degree is 57.1% at the Department of Thermal Power Systems and associate professors account for 42.9%. It should be taken into account that in the coming years a new generation of academic staff is expected and the composition of the academic staff also includes practical assistant professors and lecturers, who are essential for ensuring the quality and compliance of the professional study programme with the requirements of the industry and the occupational standard. The academic staff of other RTU and FMETA organizational units are also involved in the implementation of the study programme; thus, the total proportion of the academic staff holding a scientific degree approximates the University average.

Updating the composition of the academic staff allows ensuring modern methodological methods of studies and introducing various organizational, methodological and professional innovations in the course syllabi, by actively following modern industry trends, which in turn ensures the relevance of studies to the current needs of the industry and increases students' interest in the learning process that certainly serves as a positive factor in ensuring and improving the quality of studies and their learning outcomes. In the next reporting period, it is planned to expand cooperation with the industry, including the recruitment of academic staff, which was also stipulated in the new cooperation agreements signed in 2021. This set of measures allows maintaining a high-quality level of professional studies that meet the requirements of the sector and ensure the sustainable development of professional higher education.

**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).

Cooperation between academic staff and organizational units is important for the implementation of the study programme and the interconnection of study courses. To foster cooperation among academic staff members at the FMETA and at RTU as a whole, a system has been established, which provides for regular academic conferences and professional development seminars to improve teaching methodological competences.

The Department of Thermal Power Systems and the Institute of Mechanics and Mechanical Engineering host meetings of the Department, face-to-face and remote FMETA meetings at various joint events, including seminars and conferences. This allows discussing topical issues and proposals for updating the content of study courses, promoting mutual cooperation for the implementation of the study programme.

At the professional Master study programme, study courses of other FMETA departments as well as of other RTU faculties are delivered; on the other hand, the academic staff of the study programme "Heat Power and Thermal Engineering", including the practical ones, conduct classes within study programmes of other departments, but for some study courses they are also appointed as responsible instructors, which all in all strengthens both mutual cooperation of academic staff and exchange of working experience with regard to teaching methods and approaches used. Guest lecturers from the field are also invited to deliver some of the practical study courses. It also facilitates the exchange of practical experience and ensures better interconnection and timeliness of content.

In turn, when considering the study courses that are implemented by different departments from the point of view of workload and taking into account that there are also joint classes for students of different programmes, the student-to-academic staff ratio should be considered in the context of the study field and the faculties. In some courses, guest lecturers from the field are also invited to share their practical experience, which is indicative of the ratio in the Master programme, which is estimated at an average of 6 students per faculty member. According to Education at a Glance

2019 report of the Organization for Economic Co-operation and Development (OECD, 2019), a low student-instructor ratio is a precondition for a personalized approach to studies. In the professional Master study programme, this is actually implemented in some specialized courses in heat power and thermal engineering, which allows for a more student-centred approach and focus on the development and improvement of professional and general competences.

# 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 | MGG0_diploms_dipl_pielik_dipl_supple.zip | MGG0_diploms_dipl_pielik_dipl_supple.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) | | |
| 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 | MGG0_stud_statist.xlsx | MGG0_stud_statist.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 | MGG0_StEdSt_6_annex.docx | MGG0_ValzSt_6_pielik.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) | MGG0_ProfSt_7_annex.pdf | MGG0_ProfSt_7_pielik.pdf |
| 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 | MGG0_CoursMapp_8_annex.xlsx | MGG0_KursKart_8_pielik.xlsx |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MGG0_CurricStProgr_9_annex.xlsx | MGG0_StudProgrPl_9_pielik.xlsx |
| Descriptions of the study courses/ modules | MGG0_DescriptStud_cour.zip | MGG0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | MGG0_Descr_org_internsh.pdf | MGG0_Prakse_Apr.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Engineering Technology, Mechanics and Mechanical Engineering (45521)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Engineering Technology, Mechanics and Mechanical Engineering* |
| Education classification code | *45521* |
| Type of the study programme | *Academic master study programme* |
| Name of the study programme director | *Marina* |
| Surname of the study programme director | *Čerpinska* |
| E-mail of the study programme director | *marina.cerpinska@rtu.lv* |
| Title of the study programme director | *PhD, Assistant Professor* |
| Phone of the study programme director | |
| Goal of the study programme | *To educate and train engineers with a wide range of knowledge in the field of mechanics and mechanical engineering, who are able to compete well for their place in the labor market and can work in their profession in both local and international companies and projects, as well as to prepare students for further studies at the PhD study program.* |
| Tasks of the study programme | *1. To provide students with the in-depth theoretical knowledge, skills and abilities in engineering, mechanics and mechanical engineering;<br>2. To acquaint students with the latest research and development tendencies in the field of mechanics and mechanical engineering;<br>3. To strengthen skills in working with computer programs used in the field with the help of laboratory works, as well as to develop understanding of continuous development of computer programs, so that after completing the course the student is able to work with various similar alternatives;<br>4. To develop understanding of the cycle of creation of innovative engineering products, cooperation of specialists in various fields.* |

| | |
|---|---|
| Results of the study programme | *Graduate of the study program:<br>1. Understands technical processes in mechanics and mechanical engineering, as well as are able to give their suggestions for their improvement;<br>2. Is able to evaluate descriptions of technological processes, perform their analysis, assess the quality of operation of mechanical systems, contributing factors and risks, determine preventive measures appropriate to the risks;<br>3. Is able to evaluate the operation processes of mechanical equipment, provide suggestions for process improvements;<br>4, Is able to plan the necessary resources to ensure the successful operation and improvement of engineering systems;<br>5. Knows and is able to design, install and operate mechanical systems after additional training on the specific system;<br>6. Is able to build an engineering career by effectively cooperating with specialists of other profiles and jointly developing innovative engineering products;<br>7. Is able to continue studies at PhD study programs.* |
| Final examination upon the completion of the study programme | *Master's Thesis* |

# Study programme forms

### Full time studies - 2 years - latvian

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *2* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *80* |
| Admission requirements (in English) | *Bachelor degree in mechanical engineering, mechanics and metal processing, or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Master degree in mechanical 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 - 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 mechanical engineering, mechanics and metal processing, 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 in 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 |

## 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 main changes regarding the resources of the study program are related to the construction of the RTU Ķīpsala Campus. Since the construction of the building at 6B Ķīpsalas Street, which was completed during the reporting period, the place of implementation of the specialized courses of the program has changed, and the study process is no longer implemented at 6 Ezermalas Street. Computer rooms with modern equipment and laboratory facilities have become more spacious and more accessible. Thus, a wider experimental base allows implementing higher quality practical work in the study process, focusing on the competencies and skills students will acquire during the practical work. At Ķīpsala Campus, students have access to a modern study environment, i.e., the library is close to the lecture halls (see description of resources), Ķīpsala Sports Centre with a swimming pool is a few minutes away, as well as the Student Service Centre where students can receive career and psychologist consultations. Commuting to the place of studies by public transport is more convenient. The absurd situation that students previously had to spend an extra hour to get from one lecture hall to another has been eliminated.

The amount of credit points of the program has been adjusted from 81 CP to 80 CP. In terms of content, the following changes have taken place within MMM0 program: courses that are no longer relevant to the modern curriculum of the program and have not been implemented during the last ten years have been excluded from the program. There were more than ten study courses of that kind, and that situation did not allow potential students, when they read program description, to gain true understanding of the curriculum to be acquired within the definite study program. New study courses of greater topicality and socioeconomic significance have been added, for example, the study courses "MEE412 Biomaterials" and "MTM701 Biotextiles in Engineering Area", were added to Part B of the study program. The learning outcomes have been fundamentally reviewed and modified, shifting the emphasis from knowledge accumulation to skills development.

There have been significant positive changes in the academic staff. During the reporting period, new members of academic staff were attracted for the implementation of the specialized courses of the study program, which allowed improving the division of responsibilities and the quality of the courses (see the description of the academic staff). The influence of a novel location of studies on this factor cannot be denied, as modern study environment attracts talented young lecturers.

### 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 study program "Engineering Technology, Mechanics and Mechanical Engineering" is an academic program of the study field "Mechanics and Metal Working, Heat Power, Heat Engineering and Mechanical Engineering", which focuses on working with CAD computer programs in the field of mechanics and mechanical engineering, but also includes courses on heating equipment and heat engineering in the list of compulsory and elective courses, thus ensuring that the study program covers all current issues of the field.

The title of the study program “Engineering Technology, Mechanics and Mechanical Engineering” reflects the content of the academic program and the areas covered. RMMM0 is the version of the program that students obtain in Latvian, AMMM0 is the version of the program that students from abroad (exchange students) obtain in English. The meaning of the letters of the program code RMMM0 and AMMM0 is: 1) R - faculty in Riga, A - International Cooperation and Foreign Students Department; 2) M - study program group - Mechanical Engineering; 3) M - type and level of the study program - academic master study programs; 4) M - name of the study program, according to RTU internal classification; 5) 0 - modification of the study program plan - the primary option of the study program. Degree to be obtained - master’s degree in mechanical engineering, corresponds to the title of the program, in abbreviated and concise version, in accordance with regulations. The learning outcomes literally include an understanding of technical processes in mechanics and mechanical engineering, while the concept of engineering technology encompasses design, installation, systematic planning, process management and operation skills.

The Master study program "Engineering Technology, Mechanics and Mechanical Engineering" is an academic program of the study field "Mechanics and Metal Working, Heat Power, Heat Engineering and Mechanical Engineering", which focuses on working with CAD computer programs in the field of mechanics and mechanical engineering, but also includes courses on heating equipment and heat engineering in the list of compulsory and elective courses, thus ensuring that the study program covers all current issues of the field. RMMM0 is the version of the program that students obtain in Latvian, AMMM0 is the version of the program that students from abroad (exchange students) obtain in English.

As a result of studies, students must be able to perform engineering calculations, complex computer simulations and in-depth analysis of results. As the duration of studies is only 2 years, prior knowledge of higher mathematics and computer science is required to achieve these results. During the reporting period, only students with higher education were admitted to the Master study program, and in all cases it was technical education. There are no plans to relieve the admission requirements in the near future, as the program cannot be successfully completed without the relevant prior knowledge.

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

The study program educates and trains engineering specialists who are highly demanded both in Latvia and abroad. Graduates of the program work in leading positions and as specialists in local and international companies related to specialized mechanical equipment and technologies. Specific employment examples for MBM0 and MMM0 graduates of 2013 and 2015 respectively: Quality Control Engineer at Rubate Metal (this company focuses on metal processing - production of metal products); Board Member at Rubate Metal Ltd; R&D Manager at "Trelleborg Wheel Systems"; ERP & Production Engineer at "UAV Factory"; first Head of Design and Technology Bureau (R&D) at Baltic Scientific Instruments, then Production Manager at UAV Factory.

MMM0 graduate of 2015 works as a Mechanical Engineer at "RK Machinery", in a company that develops customized mechanical solutions, metal structures and projects; MBM0 and MMM0 graduate of 2014 and 2016 respectively works as a Construction Project Manager at "UPB, AS"; MMM0 graduate of 2016 works as a Mechanical Designer at "PERUZA SIA", a local company that develops customer-tailored mechanical equipment at the international level; another MMM0 graduate of 2016 works as the Head of Engineering Department at Ltd "Torgy Baltic", a company which develops fasteners for gas and oil pipes; MMM0 graduate of 2018 works as a Mechanical Engineer, CAD specialist, Project Assistant at "Tecnopali North Europe", which is the largest steel lighting pole, mast and accompanying steel structure producer in the Baltics.

Most graduates work at the international companies located in Latvia, but graduates of the program can also build an engineering career outside Latvia, for example, MBM0 and MMM0 graduate of 2015 and 2017, respectively, works as a CAD/CAM Engineer at "AMC Sheet Metal Fabrication Ltd." in UK.

International students who graduate from the program work as specialists at the international companies related to specialized mechanical equipment and technologies. Foreign students mostly find work abroad, but some students who graduate program with particularly good results continue to work in Latvia despite the fact that Latvian is not their native language, for example, AMMM0 graduate of 2021 works for "Plast-Tech Ltd", a company located in Saldus region that manufactures innovative products from composite materials.

The examples mentioned in this section are based on the data of the social network "Linkedin", which the graduates and lecturers of the program actively use for "networking" after graduation to discuss issues related to professional challenges.

**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.**

Statistics for the reporting period and graphs illustrating the data are attached. The data shows that increase in students rate in last years was achieved because more international students chose the program. The attached statistics in this section are provided with comments on the number of students enrolled and expelled. The number of students enrolled in the Master study program is not directly related to the number of graduates from the Bachelor study program, as foreign students who have obtained a Bachelor's degree at the university in their own country also apply for Master studies. As the strategy of the faculty envisages the attraction of well-prepared students, it is not planned to increase the number of enrolled students in the near future. Meanwhile, the number of students expelled is related to the number of students enrolled in the previous year. Students settle their academic arrears in the second year, and if that fails, students are expelled in the second year. Unlike the undergraduate program MBM0, where the number of dropouts is conditioned by the lack of prior knowledge in mathematics (and relevant courses are available to improve this prior learning), the dropout of the students from the Master study program most often occurs because students find work and are no longer able to combine it with intensive studies.

### 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.

According to the program plan, the study program consists of compulsory courses, compulsory elective courses, free elective courses and Master Thesis development. During the reporting period, the list of elective courses has been improved based on the development trends of the engineering profession worldwide, for example, the study program was supplemented with the course “MTM406 In biological systems rooted robots”, realizing that mechanical engineers will have to deal with the calculations of robotic systems more and more often at work.

In recent years, within the program "Engineering Technology, Mechanics and Mechanical Engineering" the students received more intense training in software use, also at the courses that are not directly related to it, for example, within the study course "MTM411 Shock Theory". As a result, students understand software offer and integrate in the labor market after short period of studies. Within such courses as "MTH504 Numerical Analysis for Research of Dynamics of Machines (for Master Students)", "MTM411 Shock Theory", it is demonstrated to the students how to achieve the desired work result both using the specific software, e.g., MathCAD, and MSC Excel, which is widely used in all areas in the labor market.

The curriculum of the study courses is updated in accordance with the development trends of the industry. Students are offered to work with topics related to new technologies; for example, within the course "MTH502 Dynamics and Control of Machines (for Master Degree students)" in 2020 students developed control schemes for different types of hybrid cars.

At the higher study level of the program "Engineering Technology, Mechanics and Mechanical Engineering", the knowledge (knowledge and understanding) of the study courses is mostly tested by means of revision tests and revision tasks, as well as by means of the final exam. Skills (ability to use knowledge, communication, general skills) are developed by participating in group work and developing term papers, or independent work, which includes a calculation part and may include a simulation part with a computer program and literature research part. Competencies (analysis, synthesis and evaluation) are developed by working with the so-called case studies, for example, within the course "MTM411 Shock Theory", students analyze descriptions of various types of damage resulted due to collision or impact.

As graduates of the study program must be globally competitive to work in multinational companies, it is important to regularly improve the curriculum of the program to meet international standards. Therefore, cooperation with other technical universities is important. During the reporting period, the head of the study program "Engineering Technology, Mechanics and Mechanical Engineering" and the acting head have joined the European University of Technology (EUt+) consortium, which provides an opportunity to promote international competitiveness. At the time of submitting the self-assessment report, a cooperation agreement has been signed with MIT (Massachusetts Institute of Technology, USA), one of the world's leading universities in training of engineering professionals.

**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 award of the Master's degree is based on the latest findings of the mechanical engineering field, which have been published in the latest literature and scientific journals available in databases. The latest literature is ordered once a year, but databases are available continuously. During the studies, information about the latest achievements is included in the content of lectures. The most active work with the latest achievements in the field of science takes place during the elaboration of the final thesis. When developing a thesis, students are trained to search for information in high-quality scientific journals on the latest developments in their chosen topic. Excellent marks are given to works in which the student has been able to repeat or improve a recent finding, for example, to test the experimental part of a published study (in a scientific article from the Scopus database) with another computer program.

**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.**

MMM0 study courses mostly consist of two interrelated parts—theoretical knowledge acquisition and practical work. This is possible thanks to the growing experimental base (see description of the resources) available to students. Practical work is very important in the acquisition of engineering courses in order to achieve the learning outcomes formulated as skills and competences. Nearly all courses include individual work, which is most often a calculation work/course work with a computer simulation part and a creative or analysis part.

Assessment methods within MMM0 study courses also include such evaluation procedures as revision tests, exams, group tasks. Regardless of the methods chosen by the lecturer, according to the RTU guidelines, the assessment criteria are published at the beginning of the semester. According to the “RTU Regulations for the Assessment of Study Results”, the examination grade does not exceed 50% of the contribution to final evaluation of the study course. The implementation of these requirements at MMM0 study courses has been a topical task in the last five years, and according to the data collected during the self-assessment, 80% of the Master level courses at the TMMP department have managed to implement it. Within several courses, such as "MTM411 Shock Theory", group work is also evaluated. Group work helps students acquire the skills they need to start working in a team.

AMMM0 version of the program is implemented in a foreign language—English. According to RTU guidelines for study course development, the content, requirements and assessment methods are identical to RMBM0, which is implemented in Latvian. As students studying in English need literature in English (which would be optimally available in a digital format, as it has been observed that foreign students start their studies with a slight delay even before the Covid-19 pandemic, for example if the migration was delayed due to documents submission) the course description should also include the required literature in English, which in most cases it does, and if necessary, is compiled with the help of the program director.

Examples of student-centered teaching principles at the program include individualization, games, and competitions. Upon completion of the higher-level courses, students are motivated to develop, individually or in a group, a practical work with a creative part and to report on it at a student scientific conference. Students already working in their field are invited to choose a topic for their Master Thesis that is relevant for a particular company. Within the study courses where this is possible, a game format with competition elements is used, for example within the course "MTH504 Numerical Analysis for Research of Dynamics of Machines (for Master Students)", students must form teams and guess which mathematical model corresponds to which real object.

**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 academic program does not provide for a separate practical placement, however, in order to stimulate interest in studies and develop an understanding of work in the industry as a whole, the faculty invites students to participate in competitions regularly organized by RTU Development Fund in summer.

**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.

Students can choose the topic of the graduation paper from the list of topics, which is updated by the lecturers every semester according to current trends in the field, also, in cooperation with the chosen graduation paper supervisor, students can offer their own topic. Students already employed in the industry are encouraged to select the topic of their graduation paper that is topical for a concrete organization. Some faculty topics are suitable only for the specific study level, but most topics can be chosen for both the undergraduate and graduate papers, applying the work tasks drawn up by the lecturer in agreement with the student according to the study level. Within MMM0 study program, topics can be conditionally divided into two groups: topics on the classical mechanics or topics on the material properties. Within the framework of these topics, students must develop a simulation in one of the computer programs acquired during the studies.

In the program "Engineering Technology, Mechanics and Mechanical Engineering", the Master Thesis usually consists of an introduction, literature review, mathematical modelling and a practical part or simulation in a computer program. The Master Theses, in which the students choose the topic according to their interests, stand out with due to a deeper understanding of the situation and a more thoroughly developed practical part.

Additional relevancy to current events and problems in the industry is provided via topics from the academic staff involved in the work of FMETA Mechanics Expertise Center (MEC) (J. Vība, E. Kovals, M. Eiduks). Faculty members inform students about current thesis competitions. For example, the company "Latvenergo" annually announces the topics of the graduate papers, which mechanical engineers with good knowledge of the Latvian language can enter. The topics on vibration in production equipment are regularly included in the research topic list.

Examples of Master Thesis titles: “The feasibility study of constructing a wind turbine on horizontal support”, “Design and fabrication of a 3D printed part with the aim to intehradation to the real production process”, “Tent shielding ultriviolet radiation with covering of the nano fibers mat”, “Calculating the optimum design of electric component fr maximum cooling”, “Design and mechanical property analysis of aluminium nano silicon carbide fasteners”, “Numerical analysis of heat transfer of cylinder blocks with fins”, “Prediction of strenght for fuselage frame of airplane shaped drone”, “Analyzing the effect of aerodynamic drag on the range in electric vehicles”, “Development and improvement of the battery of electric vehicles”, “Investigatio of fluid flow and heat transfer of ventilated protective clothing”, “Research of vehicle accidents and synthesis of means of their prevention”, “Analysis of rocker bogie mechanism”.

Graduation grades range from excellent to mediocre, and there is no specific trend regarding this matter. There may be three excellent works per semester (assessed with grades 9 and 10), but it happens that there are many good and satisfactory graduation papers in the semester, but there are no outstanding ones. Works with a weaker practical part receive the lowest marks. There are cases when the developed graduation papers are not accepted at all, if plagiarism is detected, especially in the practical part, in which case the student must redo the work. The assessment of plagiarism is centralized in RTU using the special tool “Turnitin”, as all graduation papers are stored in the electronic system ORTUS. The director of the study program receives a notification from the Study Department regarding the works in which plagiarism has been established. The Turnitin tool accurately identifies text that has been copied, not only from literature, but also from the previously submitted works. If the practical part is developed well, but elements of plagiarism are found in the literature review, then the director of the study program and the supervisor may decide whether to allow the work to be defended, but the Evaluation Committee is informed about the level of plagiarism. The assessment of such a paper may not be higher than satisfactory or good.

## 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.

Implementation of the study courses within MMM0 study program involves the use of computer classrooms or processing halls with appropriate software. The Department of Theoretical Mechanics and Strength of Materials (hereinafter - TMMPK) at 6B Ķīpsalas Street, Riga, has three computer rooms: 416, 419 and 418. Two classrooms are equipped with cameras, which allow conducting remote classes. MMM0 students take program-specific courses (for example, Part A course “MTM409 Technical System Vibration and Stability” and Part B courses “MTH502 Dynamics and Control of Machines (for Master Degree students)”, “MTH504 Numerical Analysis for Research of Dynamics of Machines (for Master Students))” in computer rooms specially equipped with computer programs such as MathCAD, MatLAB un MatLAB Simulink add-on, SolidWorks, ANSYS.  Thanks to the RTU HPC (High Performance Center) website, students can download computer programs (SolidWorks and ANSYS) to personal computers, while MathCAD Prime (an analogue of MathCAD) is available for free download and is used for homework completion.

Some courses also use computer programs developed by the lecturers in the framework of their research and available in computer rooms, for example, the program EDAOpt is used within the course “MTM408 Optimization Methods”, the main developers of which are long-term lecturers prof. J. Auziņš and prof. A. Januševskis.

For the acquisition of field-specific study courses (for example, a Part B course " MMP518 Theory of Elasticity, Viscoelasticity and Plasticity") at the TMMPK, the students are provided with Zwick Z150 and Z600 (150kN and 600 kN) dynamic testing machines, Zwick HB50 dynamic testing machine (50kN), Leica optical microscope, as well as various equipment for sample preparation for experiments, such as hardness tester, oven, and a grinding machine. In a Part A course "MTM409 Technical System Vibration and Stability”, students utilize the Armfield wind tunnel for experiments. Thanks to the active participation of the academic staff in research projects, a wide range of equipment is available for Part B courses "MTM701 Biotextiles in Engineering Area" and "MTM702 Introduction to Mechanics of Textile Materials": knitting machine 334 IDEA S TERRY, universal fiber processing equipment complex, fiber carding machine Y275A Model 01HD CE, laboratory vibration sieve Virations-Siebmaschine “analysette 3”, electro spinning device (Fisherbrand Single Syringe

Pump 110V, Model 14831200 & 11939747). In 2020, the range of equipment was supplemented with the force measuring device MultiTest-I 2.5 (MECMESIN, England) - for the study of mechanical parameters of tensile testing equipment. Students have the opportunity to use the laboratory equipment for the development of the graduation papers (usually under supervision).

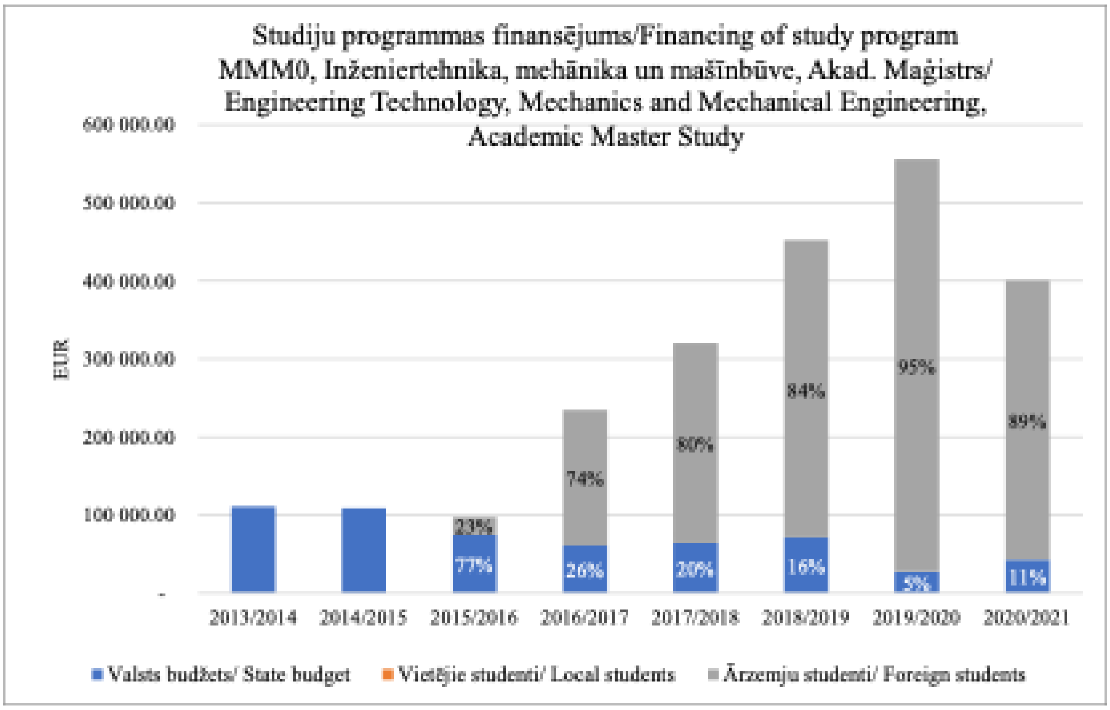
The range of literature available in the library is regularly updated. A special procedure has been developed that allows academic staff to submit their proposals for the purchase of literature by filling out order forms, which the program director sends out to the academic staff once a year, and after evaluating the forms received and the funds available for the purchase of books, the forms are forwarded to the library. In total, MBM0 and MMM0 study programs process an average of five requests per year. For example, in 2019 the book by Ali S. Nobari “Vibration-based Techniques for Damage Detection and Localisation in Engineering Structures”, 2018, was ordered in order to update the curriculum of Part B course MMP510 “Experimental Mechanics and Technical Diagnostics”.

Despite the fact that the latest books tend to be very expensive, the decision to purchase them is not rejected, as long as their purchase can have a positive effect on the study process in the long term. For example, in 2020-2021 it was decided to purchase Norman S. Nise's book "Control system Engineering" from Wiley.com, which cost 166.95 USD, to improve the content of the course "MTH502 Dynamics and Control of Machines (for Master Degree students)". In recent years, students have increasingly preferred electronic versions of books that can be easily accessed via university’s Moodle system (ORTUS). Students can access Ortus using their username and password.

Searching for books in various databases is significantly facilitated by the unified RTU electronic search system Primo.

**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 study program is financed both from the state budget funds and tuition fees. Tuition fees are mostly (but not all 100%) are received from mobility students, whose studies are financed or supported by a scholarship within frameworks of various international projects. The number of fee-paying students graduating from the program is rising. The number of graduates will be analyzed in the future, since currently the data are not available as to whether the enrolled students who drop out have paid the tuition fees for the semesters they have completed. In 2014, 17% of graduates studied for a fee, in 2017 - 69%, but in 2019 - 100%. This tendency can be explained by the active work of the RTU International Cooperation and Foreign Students Department in attracting students, as well as the fact that mobility students who study at the program and are satisfied with the offer recommend RTU to other young people from their country looking for opportunities to study abroad. The trend can also be partly explained by the fact that students who have invested personal resources and extra energy to start their studies are more persistent and do not drop out encountering their first difficulties.

Funding allocation is implemented with the help of RTU Financial System, where responsible and authorized persons enter information at the end of admission at the beginning of the semester. In the section “Study Finances”, information is entered about local, mobile, budget, and fee-paying students, as well as information about each course and their specific credit points number, which each student acquires, and according to this information, RTU on a centralized basis calculates the study funds each program department receives, evaluates, and partially directs to the development of the study program as well. Costs per student in 2017/2018 were 6,060.99 EUR.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 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.

23 lecturers from the Department of Theoretical Mechanics and Material Resistance (TMMPK) are actively involved in in the implementation of MBM0 and MMM0 study programs delivering specific study courses. MBM0 and MMM0 are academic study programs, therefore, in accordance with Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions, not less than five professors and associate professors altogether, elected to academic positions at RTU, shall take part in the implementation of the compulsory part and compulsory elective part of academic study programs. Apart from the staff from other departments participating in the implementation of the program, 9 lecturers have been elected from the TMMP department as professors and associate professors at the time of submitting the report. In addition, one habilitated professor actively participated in the implementation of the department's programs during the reporting period. For confirmation, please see the attached CV of the lecturers (Aleksandrs Januševskis, Professor; Andrejs Krasņikovs, Professor; Bruno Grasmanis, Professor; Igors Tipāns, Profesors; Jānis Auziņš, Professor; Jānis Vība, Habilitated Professor; Olga Kononova, Professor; Vitālijs Beresņevičs, Professor; Vladislavs Jevstigņejevs, Associate Professor; Inga Ļašenko, Associate Professor, elected on 4 June 2020). In the confirmation statement in the Annex only the responsible instructors are listed because some professors involved in administration do not participate in the study process every year.

All long-term lecturers involved in the implementation of MBM0 and MMM0 study programs hold a PhD degree in the relevant field. Out of the 12 new lecturers, 9 lecturers have obtained a PhD degree, including 4 who have obtained a PhD degree in the reporting period, one of the lecturers plans to defend the PhD Thesis in the next two years. During the reporting period, 11 lecturers were elected or re-elected to the position of leading researcher, 8 - to the position of researcher. At the end of the reporting period, 10 lecturers have the rights of an NZDIS expert in the field of mechanics and mechanical engineering or materials science, which helps ensure that the study curriculum is regularly updated to account for the latest industry trends.

### 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.

Out of the 23 members of academic staff involved in the implementation of the program, 11 members of academic staff have long-term (more than 10 years) work experience at RTU TMMPK (previously, the Institute of Mechanics), 8 are new member of the staff (who develop a PhD Thesis or have defended it during the last 10 years); 4 lecturers have long-term work experience at another university or organizational unit, but cooperation with TMMP has started during the last five years. A total of 12 lecturers joined academic staff of MBM0 and MMM0 study programs during the reporting period. The activity of new professors varies from five hours per week (for delivering one course in two languages) up to 40 hours per week. In total, this activity has allowed reducing the workload of long-term lecturers both in delivering the study courses and in supervising graduation papers, thus improving the quality of each individual course, as more time was available for the preparation of materials. According to the data provided in the CVs, the English language skills of the new teachers are at the B1 and B2 levels, which allows for better teaching to English speaking students.

**Dynamics of lecturers 2013./2014. - 2021./2022.**

| Amats/ Postition | 2013./ 2014. | 2014./ 2015. | 2015./ 2016. | 2016./ 2017. | 2017./ 2018. | 2018./ 2019. | 2019./ 2020. | 2020./ 2021. | 2021./ 2022 |
|---|---|---|---|---|---|---|---|---|---|
| Profesors/ Professor | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 |
| Asociētais profesors/ Assoc. Professor | 1 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| Docents/ Docent | 3 | 3 | 4 | 4 | 4 | 4 | 5 | 5 | 5 |
| Lektors/ Lecturer | 4 | 4 | 3 | 3 | 3 | 4 | 3 | 3 | 3 |
| Asistents/ Assistant | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Pētnieki/ Researchers | 0 | 0 | 0 | 1 | 1 | 1 | 4 | 4 | 4 |
| Kopā/Total | 17 | 17 | 17 | 18 | 18 | 20 | 23 | 23 | 23 |

The increase in the number of academic staff members has allowed organizing the activities of the department so that the lecturers deliver the study courses according to their field of expertise, for example lecturers with expertise in mechanics deliver courses on mechanics, dynamics, and vibrations; lecturers who have expertise in materials science deliver courses related to material resistance. In addition, lecturers with expertise in mechanics and mechanical engineering can be conditionally divided into two groups—one group specializes in theoretical mechanics and dynamics, the other specializes in mathematical analysis and computer programming. This is considered when planning the learning process. For example, in 2019, new lecturer S. Upnere defended her PhD dissertation, which contained a large amount of computer programming, and at the same time took over the course on numerical analysis, and since then has successfully delivered it, becoming the 2019 RTU FMETA Lecturer of the Year.

The improvement of the quality of studies was significantly facilitated by the cooperation of the new academic staff, who joined the team during the reporting period, with foreign universities; thus providing information on the development of the industry at an international level. For example, during the reporting period, A. Pupurs started a post-doctoral project in the field of material resistance in cooperation with Luleå University of Technology, Sweden, and the lecturer delivered a course in the field of material resistance; S. Upnere conducted experiments for the dissertation in cooperation with Paul Scherrer Institute, Switzerland.

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

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

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

The academic staff involved in the implementation of MBM0 and MMM0 study programs form research groups and work on national and international projects that result in joint publications and patents. Both long-term lecturers and new lecturers regularly attend conferences where publications are submitted, for example, every year lecturers participate in the international conference "Engineering for Rural Development" organized by LLU. Such cooperation allows understanding the strengths and areas of expertise of each lecturer, which are later used by the lecturers both in planning the study process (allowing lecturers to choose courses according to their strengths) and in recommending the best thesis supervisors to the students.

Here are some specific examples of cooperation. The ESF project "New "smart" nano-composite materials for roads, bridges, structures and transport vehicles" (2013/0025 / 1DP / 1.1.1.2.0 / 13 / APIA / VIAA / 019), which involved five members of the academic staff, was completed during the reporting period. During the reporting period (2017–2020), two new members of academic staff worked on the ERDF project "The quest for disclosing how surface characteristics affect slideability (No.1.1.1.1 / 16 / A / 129)", M. Čerpinska—in the preparation of project proposals and publications, M. Irbe—as a project participant. Four new lecturers of MBM0 and MMM0 courses (R. Vītols, A. Pupurs, M. Irbe, M. Čerpinska) actively cooperate within the framework of RTU platform projects and jointly develop publications. In addition, the new lecturers work together on the projects and develop joint publications with long-term lecturers, for example, in 2019, the new lecturer S.Upnere developed a publication that is indexed in Scopus “Metamodel-based analysis of cross-flow-induced vibrations” together with N. Jēkabsons, who joined the academic staff during the reporting period, and J. Auziņš, a long-time member of the staff. Patents have been obtained in several areas that are relevant to the content of studies in both fields of mechanics and materials science, for example, the group of authors I. Ļašenko, O. Kononova, A. Krasņikovs, J. Ķiploks, A. Viļuma-Gudmona, A. Šenfelds, three of whom are program lecturers, in 2019 obtained a Latvian patent for an invention "Textile material reducing infrared and ultraviolet radiation in the range of thermal spectrum", and the group of authors J. Auziņš, M. Eimanis, V. Beresņevičs, G. Kulikovskis, two of whom are lecturers of the program and one—a PhD candidate, obtained a Latvian patent in 2018 for the invention, "Device and method for generating the propulsion of a submarine".

Interconnection of the study courses. The curriculum of the courses is regularly supplemented in the course descriptions, which is freely available to all lecturers in the RTU Study Course Register in the electronic system Ortus. Faculty members actively use the opportunity to “invite” colleagues to their Ortus course, thus providing them with insight into the course content and materials so that course material is not repeated, and revision materials are provided in sufficient quantities (academic staff are always prepared to revise the course and not to rely on the fact that students covered the topic at another course, as it has been observed that the topic is forgotten after passing the test, if it is not applied in practice for some time). The possibility of inviting within Ortus is provided indefinitely, which means that a lecturer can invite a colleague to a course that was taught several semesters or years ago. The invitation can be made by the responsible lecturer as well as other lecturers registered in the course. This possibility is very important when teachers "take over" courses from colleagues who are on a longer period of absence. For example, in 2018, M. Čerpinska handed over the course MTM205 “Engineering Mechanics Problems” to S. Upnere during parental leave, while in 2020 I. Vaicis handed over the materials of the course MTM411 “Shock Theory” to M. Čerpinska when it was necessary to reduce the workload.

To conduct an objective analysis of the student and instructor ratio, it would be correct to look at MBM0 and MMM0 study programs as whole, for a lecturer who does not take any courses in the MBM0 program can at the same time supervise several theses for the students of this program. At the time of drawing up the self-assessment report, 23 lecturers from the department were actively involved in the implementation of MBM0 and MMM0 study program. Given the dynamics of the number of students, in order to obtain an objective ratio, admitted and expelled students should be deduced from active students who passed the final examinations in the courses taught and submitted their graduation papers. The number of graduates in 2017-2019 will be used for the ratio: a total of 96 students graduated from MBM0 program in both Latvian and English language programs; 106 students graduated from MMM0 program. Assessing these dynamics, a total of 23 faculty members worked with approximately 200 students per year (in two bilingual study programs). It should be noted that teachers who are not involved in the implementation of both programs (whose workload is one or two courses per semester) work with a smaller number of students, 30-40 students each semester. Including not only the lecturers of the department, but all RTU lecturers, the calculation can be done as follows: in the semester the student must acquire 20 CP, which means 7-8 courses, respectively cooperation with 7-8 lecturers, because according to the curriculum the same lecturer rarely teaches two courses for one group in one semester. In the winter of 2021, there were 4 students in the 1st year of RMMM0, but in the AMMM0 group there were about 30 students, respectively, 7-8 lecturers per 34 students, which means 4-5 students per lecturer from each course.

# Annexes

| | | |
|---|---|---|
| III - Description of the Study Programme - 3.1. Indicators Describing the Study Programme | | |
| Sample of the diploma and its supplement to be issued for completing the study programme | 3.1.1 MMM0 dipl_LV un EN.7z | 3.1.1 MMM0 dipl_LV un EN.7z |
| 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) | MMM0_AIP_atzin_CHE_opinion.pdf | MMM0_AIP_atzin_CHE_opinion.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 | REV-Pielikums 3.1.4 MMM0_stud_statist_LV un EN.docx | REV-Pielikums 3.1.4 MMM0_stud_statist_LV un EN.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 | REV-MMM0_StEdSt_6_annex.docx | REV-MMM0_ValzSt_6_pielik.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 | MMM0_CoursMapp_8_annex.pdf | MMM0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | REV- MMM0_CurricStPogr_9_annex_EN.pdf | REV- MMM0_StudProgrPL_9_pielik_LV.pdf |
| Descriptions of the study courses/ modules | 3.2.6 MMM0_DescriptStud_cour.zip | 3.2.6 MMM0_Studkurs_Apr.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 |

# Mechanical and Instrumental Engineering (42521)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Mechanical and Instrumental Engineering* |
| Education classification code | *42521* |
| Type of the study programme | *Professional bachelor study programme* |
| Name of the study programme director | *Anita* |
| Surname of the study programme director | *Avišāne* |
| E-mail of the study programme director | *anita.avisane@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., docente* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study program is to provide practical, science-based education necessary for the mechanical engineering industry, providing the essential knowledge, skills, and competencies that enable the mechanical engineer to adapt to the labor market and implement the acquired knowledge in the fields of mechanical engineering and mechanics.* |
| Tasks of the study programme | *1. To provide students with comprehensive knowledge in the field of mechanical engineering, to develop skills and develop competencies in accordance with the requirements of the labor market;<br>2. To develop skills to apply the theoretical knowledge acquired in technical and humanitarian study courses to solve practical tasks;<br>3. To develop skills for performing engineering calculations for design purposes;<br>4. To provide knowledge to develop the technical documentation necessary for the production process, in accordance with regulatory enactments and standards for the development of technical drawings;<br>5. To acquaint with production planning, management, as well as quality management measures;<br>6. To develop business competencies, work planning, and presentation skills;<br>7. To develop research skills and promote their us.* |

| | |
|---|---|
| Results of the study programme | *Knowledge:<br>Ability to demonstrate basic and specialised knowledge characteristic of the science of manufacturing engineering and the profession of mechanical engineer and critical understanding of this knowledge, in addition a part of this knowledge is on the level of the latest achievements of the respective field of science or profession. Ability to demonstrate comprehension of the most crucial notions and regularities of the science of manufacturing engineering and professional sphere.<br>Skills (ability to apply knowledge, communication, general skills):<br>- is able to use the mastered theoretical basis and skills of mechanical engineer;<br>- to carry out professional innovation or research activity;<br>- to formulate and analytically describe information, problems and solutions in the sector of science of manufacturing engineering and profession of mechanical engineer;<br>- to explain and argue on the above mentioned topics both with specialists and laymen;<br>- is able to structure independently his/her studying, lead further learning and professional improvement of himself/herself and his/her subordinates;<br>- to demonstrate scientific approach to problem solution;<br>- to take responsibility and initiative, carrying out work individually, in team or leading work of other people,<br>- to take decisions and find creative solutions under changing or unclear conditions.<br>Competencies (analyses, synthesis and evaluation):<br>Is able to independently acquire, select and analyse information on manufacturing engineering and use it, take decisions and resolve problems in the sector of the science of manufacturing engineering and profession of mechanical engineer, to demonstrate understanding of professional ethics, to evaluate the effect of his/her professional activity on the environment and society and to take part in the development of the respective professional field.* |
| Final examination upon the completion of the study programme | *Bachelor's Thesis with a Design Project* |

# 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) | *Profesional bachelor degree in mechanical and instrumental engineering* |
| Qualification to be obtained (in english) | *Mechanical engineer* |

### Places of implementation

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

### Part time extramural studies - 5 years - latvian

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *5* |
| 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 mechanical and instrumental engineering* |
| Qualification to be obtained (in english) | *Mechanical engineer* |

### 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 volume of the professional Bachelor's study program "Mechanical and Instrumental Engineering" is 160 CP, which consists of study courses (124 CP), internships (24 CP), and a state examination (12 CP), a part of which is the elaboration and defense of a bachelor's thesis. General Secondary Education or 4-year Vocational Secondary Education is required to start studies. As a result of the successful acquisition of the study program, students are awarded a professional degree in the Bachelor Degree in Mechanical and Instrumental
Engineering and Qualification of Engineer in Mechanical Engineering. The study program is implemented full-time (4 years) and part-time (5 years) in the Latvian language. The latest teaching methods are integrated into the study program, supplemented with the most relevant tehnological knowledge. The new teaching staff was attracted to the implementation of separate study courses.

In order to fulfill the Sports Development Concept of Riga Technical University 2017-2020. (approved by the decision of the Senate sitting of March 27, 2017, protocol No. 608 "On approval of RTU Sports concept and tasks in the reorganization of RTU sports structural units") the study course *Sports - 0 CP* was excluded from the study program.

In order for the structure and content of the study program to comply with the requirements of the State Standards of Higher Education of the Republic of Latvia, changes were made in the study program of Mechanical and Instrumental Engineering (MCN0) according to the "Riga Technical University Uniform Requirements for Academic and Professional Study Programs" (Protocol No. 588 of the Senate Decision of 23.03.2015).

The volume of credit points for Part A of the study program was changed from 99 CP to 101 CP. Professional specializations (RMCNT (technology of machines and apparatus), RMCNK (design of machines and apparatus), RMCNM (metallurgy and metalworking) were canceled. Study courses IET 103 Economics [2CP], IUE417 Economics of Engineering Solutions [2CP], MAB415 Computer-Aided Design of Technological Processes (study project) [2CP] and MAT254 Metallurgy and Metal Pressing (study project) [2CP] A new study course SDD700 Innovative Product Development and Entrepreneurship [6CP] was included.

The volume of credit points for Part B of the study program has been changed from 11 CP to 9 CP and the volume of the section of humanitarian and social study courses (B.2) - from 2 CP to 4 CP. Part B excluded professional specializations with the specialized study courses included in them.

The volume of credit points for Part D of the study program has been changed from 26 CP to 24 CP. The study course MAB016 "Pre-diploma practice in mechanical engineering" [14 CP] and MAT016 "Pre-diploma practice in technology" [14 CP] have been replaced by the study course MAB018 "Practical Placement for Pre-Graduation project" [12 CP].

The RTU Vice-Rector has approved changes to the program for Studies Order No. 02000-1.1/51 of May 16, 2017, based on the decision of the meeting of the commission of the study direction

“Mechanics and Metal Processing, Heat Power Engineering, Heat Technology and Mechanical Engineering” of April 20, protocol No.2.

At the beginning of 2021, the content of the study courses was reviewed and analyzed. At the MMI meeting on 19.08.21. protocol No. 25604-2 / 4 a decision was made to make changes to the study program “Mechanical and Instrumental Engineering” to improve the quality and competitiveness of the program.

The study course IDA700 Basics of Labor Protection 1 CP was replaced by VAS038 Environmental and Climate Guide 1CP in section A. Section A was supplemented with current study courses: MAB267 Basis of the Automated Design - SolidWorks 2CP, MAT123 LEAN production technology 2 CP. The volume of credit points for Part D of the study program has been changed from 26 CP to 24 CP. The existing internship study courses were replaced with the study course MMM010 “Designer ” [20 CP].

Changes to the program have been submitted for approval to the Commission for the Study of Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering. The decision of the study direction commission at the meeting of September 9, 2021, protocol No.4.

**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 study program “Mechanical and Instrumental Engineering” is the 6th level of European Qualifications Framework (EQF) and Latvian Qualifications Framework (LQF) study program. The graduates obtain a Professional Bachelor’s degree in Mechanical and Instrumental Engineering and the Qualification of Engineer in Mechanical Engineering.

The study program aims to ensure a professional, practically applicable, science-based education for the specialists demanded in the field of machine technologies. Thus, having completed the studies, the students acquire the knowledge, skills, and competencies, which enable a mechanical engineer to adapt to the labor market, as well as to continue studies for acquiring a higher education degree.

In order to achieve the aim of the study program, the main tasks are as follows: according to the title and aim of the program to provide education corresponding to the Bachelor’s level and Mechanical Engineer’s qualification, ensuring understanding of the essential concepts and regularities of the Mechanical Engineering and Mechanics industry; to ensure the development and improvement of the study process by using modern study methods and techniques (in lectures, practical classes, during internships and project development); to ensure the development of skills and competencies, using the acquired knowledge and understanding in solving practical tasks; to ensure understanding and skills in production planning and management, as well as quality management in accordance with the requirements of the industry; develop skills to perform research work, analytical thinking and other relevant skills and competencies that would allow, inter alia, to continue studies at a higher level, as well as to promote their use in practice; to create an understanding of the need to continuously improve qualifications as the industry and technologies develop, to develop and implement innovative solutions, to promote interest in lifelong learning and international mobility.

According to the study program's title, aim and tasks, the study results are also formulated as all skills and competencies required for a Bachelor's degree in Mechanical and Instrumental Engineering. It should be noted that these skills and competencies are entirely in line with the industry requirements set out in the relevant professional standard (Mechanical Engineer Professional Standard). In the development and evaluation, representatives and leading specialists of the mechanical engineering and instrument-making industries, scientific experts in Mechanical Engineering and Mechanics, and representatives of the Association of Mechanical Engineering and Metalworking Industries of Latvia (MASOC) have participated.

RTU is a long-term member of MASOC, a representative of RTU MTAF (Faculty of Mechanical Engineering, Transport and Aeronautics) is included in the board of MASOC. MASOC is a member of ORGALIME, the European Association of Engineering Industries, and there is extensive cooperation with industry associations and other organizations around the world. In order to cooperate and participate in the activities of MASOC, the study programs are regularly evaluated in the MTAF Convection meetings. The study program also envisages an internship. The aim of the Bachelor's thesis with the project part is to solve the actual tasks in the Mechanical and Instrumental Engineering industry in cooperation with companies. The defense of the Bachelor's thesis with the project part takes place at the meeting of the State Examination Commission, which includes at least 50% of the leading specialists in the field. Thus, regular and uninterrupted connection with the industry and operative management of the study process is ensured, taking into account the actual tendencies in Mechanical Engineering.

Admission requirements are coordinated with the aim, tasks, and study results of the study program, as studies can be started if the applicant has general secondary or professional secondary education and meets other RTU requirements formulated in RTU Admission Regulations for academic and professional undergraduate programs. The basic principles of admission are that admission is based on the results of centralized examinations (CE) in mathematics, Latvian and foreign languages (if in addition to the above CE is passed in physics, the results of these CEs are taken into account in the ranking) and annual marks in other subjects.

Thus, there is a transparent interconnection between the aim, tasks, study results, and admission requirements of the study program, providing the economy with new specialists with one of the most demanded engineering qualifications and a bachelor's degree, which ensures the existence of an essential national industry - Manufacturing.

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

Students of the study program "Mechanical and Instrumental Engineering" are in demand in the labor market not only when they have already completed their studies but also during their studies. Given that the capacity of the education system to train the specialists needed for the industry is several times lower than the actual demand for the relevant specialists, most students are admitted to practice and start their work before graduation.

The mechanical engineering and metalworking sector employs about 23,000 people. The total turnover of the sector in 2020 was about 1.9 billion EUR, of which about 1.5 billion in export revenue.

The main problem that the industry has long faced is the availability of qualified professionals. MASOC's annual industry research shows that 70% of companies identify the lack of qualified professionals as a significant impediment to development.

The most considerable shortage as a percentage of the existing number of employees is engineering personnel. The two most demanded specialties are mechanical engineers (incl. designers, technologists) and mechatronics engineers.

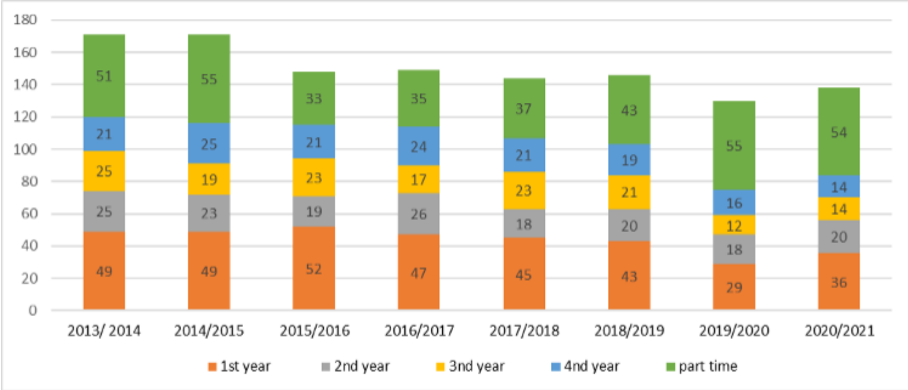
According to the results of a recent MASOC industry study, the industry currently needs approximately 150-220 additional mechanics and 60-100 mechatronics engineers.

**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.**

Analyzing the number of students in the period from 2013/2014. academic year until 2020/2021. study year, it can be concluded that the total number of students decreases slightly.

| Number of students in the current study year | 2013/ 2014 | 2014 /2015 | 2015 /2016 | 2016 /2017 | 2017 /2018 | 2018 /2019 | 2019 /2020 | 2020 /2021 |
|---|---|---|---|---|---|---|---|---|
| *Total number of students* | *171* | *171* | *148* | *149* | *144* | *146* | *130* | *138* |
| 1. course | 49 | 49 | 52 | 47 | 45 | 43 | 29 | 36 |
| 2. course | 25 | 23 | 19 | 26 | 18 | 20 | 18 | 20 |
| 3. course | 25 | 19 | 23 | 17 | 23 | 21 | 12 | 14 |
| 4. course | 21 | 25 | 21 | 24 | 21 | 19 | 16 | 14 |
| Part time | 51 | 55 | 33 | 35 | 37 | 43 | 55 | 54 |
| On academic leave | 17 | 18 | 31 | 38 | 47 | 29 | 28 | 25 |
| Graduates | 10 | 7 | 5 | 7 | 11 | 4 | 4 | 8 |
| Studies for a fee | 75 | 72 | 59 | 62 | 61 | 64 | 55 | 56 |

Dynamics of the number of students by courses and study years




The table shows the dynamics of full-time and part-time students. A small number choose to study part-time, which is related to the student's chosen job before studies and the financial support of the workplace. The number of students depends on the number of study places financed from the state budget.

The changes in the number of students can be explained both by the demographic indicators and the decrease in the total number of students in the country and by the fact that tuition fees have been increased. However, the number of budget places in the program has practically not changed during this period. Students choose a similar specialty or part-time studies, receiving financial support from the workplace. The student chooses part-time studies also for the reason that it is possible to combine work in the chosen field with studies at a university.

Analyzing the number of graduates, it must be concluded that it is not large compared to the admitted students. Students are admitted to defend the Bachelor's thesis when all their academic and financial obligations are fulfilled.

A proportion of students (around 30%) indicate that it is not possible to complete their studies on time due to workload. Almost all students are forced to work from the 2nd year due to their financial situation. A small part indicated that they could not complete their studies due to their own or their family's health problems and studying remotely at RTU counseling points.

As the drop-out rate shows over the years, the main reason is the failure in the first two courses, because we admit students with a low rating. However, there is also a part of students that leaves at the last year because it is not able to develop a Bachelor thesis in time (primarily due to workload). Another important reason is the lack of financial resources due to tuition fees and other outstanding liabilities. A small number of students study with private funding; some of the studies are paid for by the employer because the students themselves do not always have enough financial resources to pay for the studies. Due to the crisis in the country, some students and their guarantors are losing their solvency, and new sources of income are being sought; thus, study time is declining.

The study program is implemented in Latvian. However, every year a part of the study course is implemented in English by inviting guest lecturers. The study program is interdisciplinary, so students have to study various study courses related to the field of study so that the studies finally acquire the knowledge required by the professional standard. After graduation, the students can work in various companies - metalworking, woodworking, food production, etc.

### 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 information included in the study courses: the results to be achieved; the set goals; the content of the permanent work meets both the aims of the study program and the results to be achieved, as well as the requirements of the professional standard – Mechanical Engineer.

At the Faculty of Mechanical Engineering, Transport and Aeronautics, the content of study programs is regularly analyzed at the conventions, discussing them with the industry representatives. The program's content is also constantly analyzed by MASOC management and its representatives. The opinion of the industry representatives is that the study program is essentially relevant to the industry. The study program is comprehensive; the general study courses provide students with basic knowledge in STEM, humanitarian and social fields. In turn, in the specialized study courses of the field, students are introduced to the most up-to-date information and fundamental knowledge in mechanics, material processing technologies and automation, which is in line with the needs of the industry for employees with a general understanding of a wide range of issues. In general, the content of the study program covers all the necessary knowledge for a student to successfully start working in the relevant field. Proposals for the improvement of the program are regularly received from the representatives of the industry, which are also implemented as far as possible. Evaluating the content of the updated standard of the profession "Mechanical Engineer" changes were introduced in the program, supplementing or changing the content of individual study courses and changing the study courses included in the program.

The content of the study course integrates the latest information related to the requirements of the Industry 4.0 concept regarding autonomous robots, simulations, 3D printing, and additive technologies.

The updating of study courses is carried out by the structural units responsible for the study courses. Those responsible and the academic staff are involved in implementing the study courses. Changes in basic sciences and general education courses with less variable content (mathematics, physics, chemistry, theoretical mechanics, etc.) are related to the entry of new technologies. The content of specialized courses in the field is changing rapidly; thus, part of the content of study courses is renewed every year.

The program improvement plan was discussed and approved in the structural units implementing the program and in the study field commission.

**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).**

Not 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.**

Various methods are used to acquire and evaluate the courses and practical skills of the program - analysis of problem situations, seminars, group work, laboratory work, problem-oriented studies, use of information technology. RTU generally determines the organization of the study process, which is regularly updated based on the situation in the country. RTU has adopted and is bound by the "Regulations for the Evaluation of Study Results".

In the implementation of the study program, the principles of student-centered education have been taken into account. In addition to the group tasks, individual tasks are set for students, taking into account the student's interests and desire to specialize. The schedule of classes and the times of examinations are developed taking into account the possibilities of students as employed persons. Students are informed about the examination methods, criteria, and the procedure for appealing the assessment. Students are introduced to the expected results and report form of each course and test papers at the beginning of any study course. The content of the course, expected results, recommended literature and other important information are provided in the description of each course.

The results of the study process are analyzed in discussions with the director of the study program, as well as in the meetings of the Department of Mechanical Engineering and Mechatronics. The course of studies is analyzed in the following aspects: implementation of the study program and study plan by content and volume; the level of assessment of students' knowledge, skills, and abilities and its compliance with the qualification requirements for specialists in professional programs; course acquisition results; and financial and economic compliance of the study process with the possibilities and requirements of the institute.

The study program includes various work and assessment methods: tests (oral / written), tests (written), exams (oral / written), course projects (written) with their defense (oral), which is concluded by a qualification paper with a diploma project evaluation.

A ten-point grading system is used to assess knowledge. Students' work is mainly evaluated based on their success in the exam session.

The study results are determined and introduced to the student in each study course. So that as a result of the assessment, the student knows, understands his/ her competence and abilities, as well as receives recommendations for further improvement.

The student's knowledge of the study program is assessed after taking the study courses twice in the academic year - in winter and spring sessions. During this time, students take exams in study courses in accordance with the developed individual study plans. Exam questions are designed so that the students can prepare themselves to achieve the goal of the study course described in the description of each course. If necessary, students demonstrate the acquisition of the study subject on stands, use posters and models. Explanations shall be given orally. Exam questions are prepared on the basis of the course syllabus by the responsible lecturer, whose duties include teaching the respective study course.

The study program includes an internship in a company related to the Mechanical Engineering industry. The internship is in total 20 CP and forms a significant part of the student's acquisition of skills and competencies. For a detailed description of the internship, see 2.4. section.

**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).**

An essential component of the program is the internship, which until the enrollment in 2021 (inclusive) was in the amount of 26 CP, but starting from 2022, the internship will be in the amount of 20 CP. So far, the internship has been divided into four parts: Production training practice 4 CP; Practical Placement of Engineering 4 CP; Designer practice 4 CP; Practical Placement for Pre-Graduation Project 12 CP. The first three internships were implemented during the first, second, and third study years. The last internship was divided into two parts in the autumn and spring semesters of 6 CP and 6 CP in the fourth year. In part-time studies, the Practical Placement for Pre-Graduation Project is divided into two parts, 6 CP and 6 CP in the autumn and spring semesters. Each of the internships has tasks, which are indicated in the description of the study course:

- ability to understand and implement locksmith, machining, welding, and soldering work, as well as assembly and repair work;
- to recognize the technical production equipment, the latest technological processes in the company, to formulate the necessity of production mechanization, application of automation means and quality measures;
- to master the stages of mechanical designer documentation development, to perform construction analysis, development, design, and peculiarities of designing work in the company;
- ability to evaluate the existing technological processes and the need for their improvement, to solve the accuracy of the equipment operation, to develop proposals for the improvement of the technological process, to improve the structures of devices and mechanisms;

- to develop and strengthen the student's communication skills and the ability to defend one's opinion in public and acquire independent work skills.

Starting from 2022/2023, the internship in the amount of 20 CP will be implemented in four parts (4 CP, 4 CP, and 12 CP). Each part will be implemented in one study year in the spring semester. The main results of the internship:

- the ability to draw medium-complex mechanical components;
- the ability to accurately set the required dimensions and tolerances in the assembly drawings, mark assembly units, design drawings in accordance with standards;
- the ability to use computer-aided design programs for 2D drawing and 3D model development;
- the ability to prepare material and component specifications;
- the ability to orientate in the production process.

The aim and tasks of the internship are closely related to the duties and tasks specified in the professional qualification requirements, which ensure the application of theoretical knowledge in practice. The internship supervisor at the internship provides feedback (fills in the feedback), in which the assessment of the internship's knowledge, theoretical training, communication skills, etc., is indicated. A constant close connection with the representatives of the industry is maintained, thus finding an opportunity to develop and improve the curriculum for the labor market requirements even better. For each of the internships, the student prepares an internship report, which is presented and defended in the internship defense commission of the department.

Internships outside RTU are an integral part of professional programs, which students must complete following the 2014 Cabinet of Ministers of the Republic of Latvia. August 26, Regulations No. 512. "Regulations on the second standard professional higher education state standard", RTU Senate 2002 Decision of April 29, protocol No. 467 "On the structure of the second level professional study programs" and RTU Senate 2019 decision of January 28, Protocol No. 626 "On Approval of the Procedure for Organizing Internships at Riga Technical University in a New Edition".

The internship takes place in accordance with the regulations, the general rules of which have been developed by the RTU Senate. The regulations are published on the RTU website and in the ORTUS system.

The administration of the study program, taking into account the documents mentioned above, has developed regulations for the internships as mentioned earlier in the program "Mechanical and Instrumental Engineering". Before the internship, a meeting with the director of the study program is organized, during which the documentation of the internship, the course of the internship, and its defense are explained. Students communicate with the internship coordinator from the university and the internship manager in the company during the internship.

According to the regulations, the place of internship may be a company or organization engaged in the manufacturing and is included in MASOC association (e.g., PERUZA; LATVIJAS FINIERIS; JAUDA; METĀLMEISTARS, etc.), as well as vocational training institutions using their production workshops (e.g., Riga Technical College). The aim of the internship is to systematize, strengthen and expand theoretical knowledge and acquire practical skills and abilities. The tasks performed during the internship must be directly related to the study program "Mechanical and Instrumental Engineering". Thus the theoretical knowledge acquired during the studies, the ability to independently perform the assigned tasks on the internship, research and analyze problems, and make economically informed decisions to address specific issues are strengthened.

During the internship, the student has:

- to acquire the professional skills specified in the professional qualification requirements, which would promote professional competence and the ability to apply knowledge appropriate to the field;
- develop the ability to analytically formulate and solve current issues and/or problems in the industry;
- must acquire independent work and teamwork skills;
- to learn to orientate in the legislation related to the company, occupational safety, health, quality control, and environmental protection in the current legislation;
- to learn and apply the basic principles of professional ethics and corporate social responsibility.

The issues of internship management are formulated in the regulations. 3-sided agreements are closed with RTU, the company, and the student for the internship. It is possible to choose the internship places from the previous years and those offered by the companies of the industry as the current "MASOC" association and choose others of their choice, provided they meet the industry and program requirements.

**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.**

The topics of students' Bachelor's theses are mostly related to the given task in the company where the student works or undergoes a Practical Placement for Pre-Graduation Project internship. Current industry trends focus on the automation/optimization of complete or partial production lines and existing solutions or technology development (see below for a list of examples of Bachelor's thesis topics). Bachelor's thesis projects are mostly related to solving real problems in a particular company, so the topics of these theses are often developed to an actual, working equipment or production line, which allows the student to apply for the highest possible grade and to ascertain that the proposed engineering solution is correct.

Examples of Bachelor's thesis topics -

- Engineering of two stroke engine and frame for motorcycle;
- Plywood supply line for defect filling;
- Turbo Zerglis;
- Biomass storage container module optimisation;
- Modernization of crushers conveyor;
- An equipment designing for bending and modification of the welded and rolled metal profiles;
- Automatic log processing and sorting line design;
- Design of Platform for Moving Portal Crane;
- Design of a polyethilene tray sealing machine;
- Dual-layer profiled sheet production machine design;

- Improvement of Technological Process of Hydraulic Rotator Blades and Development of Additional Equipment;
- Development of Moving Floor Design for Conveying Wooden Chips;
- 3-axis CNC milling machine additional rotation table;
- Package packing station;
- Developing a suspended tilter for the production department of steel pillars, beams and supports;
- Carbone fibre tube winding machine.

The presentation and defense of the final theses is carried out at an open meeting of the State Examination Commission (SSC). The commission consists of both MTAF academic staff and company representatives. Thus, students' Bachelor's theses are evaluated not only from a theoretical point of view but also with a great deal of practical orientation from the industry. Students must be able to justify their work solutions not only from a functional but also from a technological and economic point of view.

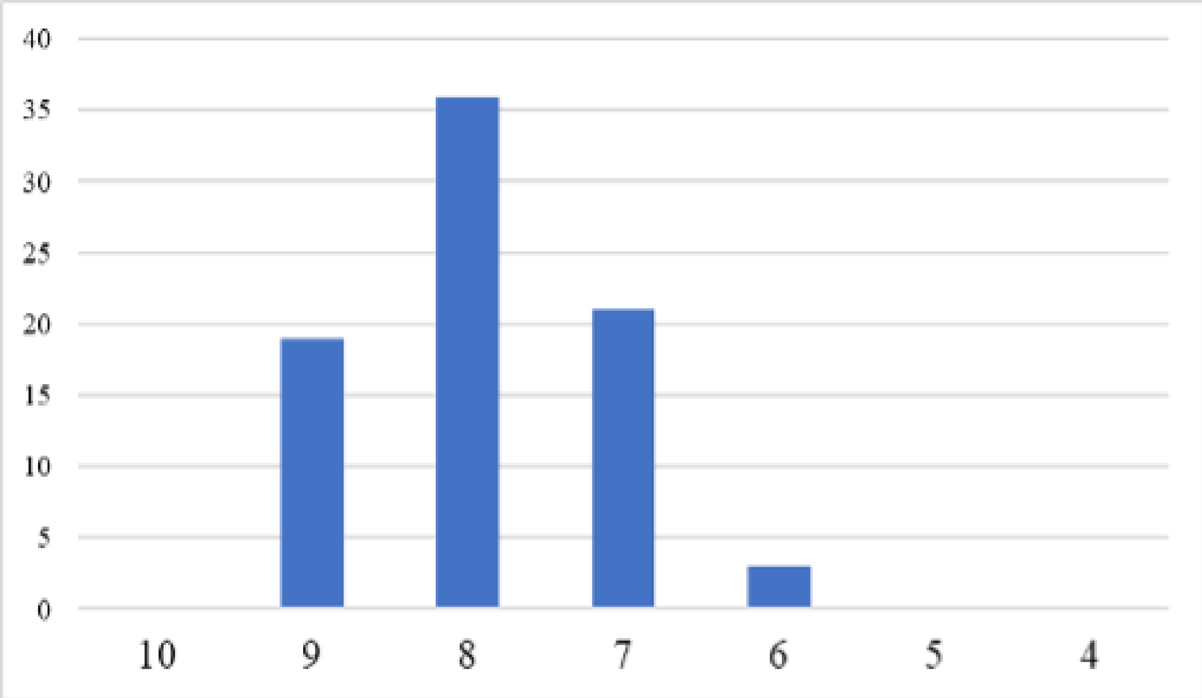
At the moment, there is a very significant shortage of engineers in the labor market. Due to this large deficit, representatives of production companies tend to participate in open meetings for the defense of Bachelor's theses. After defense, the company represenatives tend to address young engineers to offer work (for example, *Biomass storage container module optimization*) or to develop proposed engineering solutions (for example, *3-axis CNC milling machine additional rotation table*).

According to the data of the Central Statistical Bureau (CSB), in 2020 there was an increase of + 2.3% in turnover and 1.4% in exports in the mechanical engineering and metalworking sector. Therefore, it can be concluded that, given the economic situation in Europe and the world, the sector is still evolving and the need for a skilled workforce remains. This is also confirmed by the information published on the MASOC website that the most significant problem in the industry is the lack of qualified employees (approximately 70% of companies in the sector indicate this as the most significant problem).

Graduates of the study program "Mechanical and Instrumental Engineering" are working in companies such as AS "Latvijas finieris", SIA "Peruza", SIA "Aerodium", SIA "WeMPS", SIA "EHT Fabrik", SIA "Buschmann tools", SIA "Instro", AS "Jauda", SIA "EMJ Metāls", SIA "UAV Factory", SIA "Amateks", SIA "Aisis", SIA "Naglis & Err", SIA "Forma", SIA "Fonons" and others.

Analyzing the last study years, it can be concluded that the highest percentage of graduates received a grade of 8 (very good) (46%). Grade 9 (excellent) was 16% of graduates and grade 7 (good) was 26%. None of the graduates had a final thesis rating of 4 (almost average).

Final work evaluations since 2014/2015. academic year (from 10-4 points)




Industry representatives review bachelor's theses – specialists in the field, company managers from such companies as A/S „Latvijas finieris" Iekārtu rūpnīca, SIA "Duroc Machine Tool", SIA "PLC Solutions", SIA "WeMps", SIA „Peruza" and MASOC - Mechanical Engineering and Metalworking Industry Associations. The commission consists of 7-8 members, at least half of whom are representatives of the field and employees involved in implementing the study program.

After each defense of Bachelor's theses, the VPK commissions provide a report on the average student assessment. The final grade consists of the Bachelor's thesis supervisor, the reviewer and the evaluation component of the presentation and defense of the thesis. The revised final assessment is obtained as a result of a collegial decision of the VPK commission. During the defense of the Bachelor's thesis, the Defense Protocol is filled in, which reflects the questions and the obtained evaluation.

During the elaboration of the Bachelor's thesis, a progress report of the Bachelor's thesis is organized at least twice, in which students present the progress of their work. A commission from the program's academic staff evaluates students' performance. If the commission finds in the last report of the Bachelor's thesis that the student has not fulfilled the relevant requirements, then the student is not admitted to the defense of the Bachelor's thesis. The student must improve his/her work and is allowed to defend in the next semester with the program director's approval.

## 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.**

All material and technical support available at RTU is also available to the students and teaching staff of the study program to implement the study courses. The program is mainly implemented in training laboratories, such as Metrology Training Laboratory, Automation Training Laboratory, Materials Technology Training Laboratory. However, some classes also occur in scientific laboratories, such as Welding Laboratory and Mitotoyo Laboratories.

To implement study courses, where necessary, students work in computer classrooms, with computer programs such as MathCAD, MatLAB, AutoCAD, SolidWorks, ANSYS etc. Thanks to RTU HPC (High Performance Center), students are given the opportunity to download various computer programs, including AutoCAD and SolidWorks, free of charge on their private computers.

The range of literature available in the RTU library is regularly updated. Funds for the purchase of study or scientific literature are available for each study program. Each year, the teaching staff has the opportunity to submit a list of literature required for the implementation of the specific study program by filling in an order form, which is approved by both the program director and the dean of the faculty. The literature purchased in this way is available to the library for all interested parties. The electronically available literature is becoming more and more relevant.

### 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 study program is implemented at the expense of the state budget. Only 1% - 4% of students study the program for tuition fees. The number of paid students is consistently small due to the program’s relatively large number of budget places.

The costs per student within the study program are calculated by the Office of the Vice-Rector for Finance. Costs per student from 2013 to 2020 averaged € 4,075.28. The number of study places is allocated after negotiations with the Ministry of Education and Science. The amount of study funding is determined on the basis of the number of study places at RTU determined by the state, as well as the base costs of the study place determined by the state and the study cost coefficients of the thematic areas of education.

The study cost coefficients for Bachelor’s and professional study programs in the thematic areas of education are determined by the Regulations “Procedures for Financing Higher Education Institutions and Colleges from the State Budget” approved by the Cabinet of Ministers on December 12, 2006 (https://likumi.lv/ta/id/149900).

RTU funding from the state budget for the provision of study places in the respective study year is distributed in accordance with the RTU Senate decision “On the Methodology for Distribution and Use of Basic Budget, Performance Financing and Paid Student Funds to RTU Structural Units”. The methodology is annually reviewed and approved in the new version, considering the necessary changes.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 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 lecturers from the Faculty of Mechanical Engineering, Transport and Aeronautics, other RTU Faculties, and from Study and Science Centers participate in the professional bachelor study program “Mechanical and Instrumental Engineering”. Guest lecturers and specialists from the industry are invited as guest lecturers to increase the quality of studies and inform students about the latest events in the specialty. When the teaching staff or inviting guest lecturers are chosen, the head of the responsible structural units of the study courses makes sure that lecturers have high qualifications. This ensures that they will be able to provide students with a high-quality education to achieve the results set by the program.

The fundamental theoretical courses and professional specialization study courses in the field of the study program are implemented by the teaching staff of the Department of Mechanical Engineering and Mechatronics (MMK), RTU Daugavpils Study and Science Center (DSSC) and RTU Liepāja Study and Science Center (LSSC).

**Anita Avišāne, Dr.Sc.Ing., RTU Assistant Professor, Engineering and Technology Expert of the Latvian Council of Science in Mechanical Engineering and Mechanics.** More than ten years of academic and scientific experience at Riga Technical University. More than ten years of professional work experience in production and service companies performing the duties of a constructor, production automation, technologist, and designer. Professional development is carried out by regularly participating in online courses and seminars. Member of the RTU Promotion Council P-16.

**Irīna Boiko, Dr.Sc.Ing., RTU Professor, Engineering and Technology Expert of the Latvian Council of Science in Mechanical Engineering and Mechanics.** Professional experience of more than seven years in the industry (hardware company), the experience of pedagogical work in RTU and vocational education institutions for more than 17 years. Carries out active scientific research work, participating in the implementation and management of LCS (Latvian Council of Science), ESF, ERDF, TOP (Market-oriented research project), and other projects; member of the International Program Committee for various conferences. Co-author for more than 40 scientific articles published during the last six years. Participation in more than 30 international scientific conferences. Co-author of 2 Latvian Republic patents and 1 Latvian Republic patent application. From 2012 works at the RTU Innovation and Technology Transfer Center as an intellectual property specialist, continuously practicing in intellectual property-related issues, as well as raising the qualification in specialized courses, which allows conducting the study courses “Basics of Patents” (bachelor and master studies) and “Fundamentals of Patents” (at PhD study level). Actively cooperates with the industry by participating in the Certification Scheme Committee of the Certification Authority of JSC Inspecta Latvia (currently Kiwa Inspecta), as well as by participating in the training of Latvian Association of Welding Specialists (LMSB), participating in the training of mechanical engineering specialists (welders, locksmiths, plumbers) and examination. Has participated in the international mobility for lecturers and researchers within the framework of ERASMUS +. Exchanging experience and conducting lecture courses, including leading universities such as the Technical University of Vienna and the Technical University of Chalmers. Continuous professional development and research, mostly related to mechanical engineering technologies (including welding and related processes), allows conducting study courses - “Basics of Production Engineering”, “Computer Aided Engineering (CAE) Programmes for Mechanical Engineering”, “Materials Processing Technology and Theory” and “Welding Technologies and Equipment”.

**Guna Čivčiša, Dr.Sc.Ing., Leading Researcher.** Experience of academic and scientific work in a higher education institution for more than 15 years, administrative experience in quality management and project management for more than eight years. Professional interests are related to quality assurance, industrial measurement, and analytical directions. Academic knowledge is increased by gaining practical experience in industrial production, which is then integrated into the implemented study courses. Knowledge and competencies are regularly supplemented by participating in professional development training, exchange of academic experience, and scientific conferences.

**Ēriks Geriņš, Dr.Sc.Ing., Professor.** Long-term academic and scientific work experience in a higher education institution (more than 50 years). Professor since 2004. From 1988 until 2005 – former FMETA (MMF, MZF, TMF) deputy dean for education, while from 2005 - Dean of FMETA (Faculty of Mechanical Engineering, Transport and Aeronautics). Member of the Council of the Association of Mechanical Engineering and Metalworking Industries of Latvia (MASOC) for many years. Expert for the Investment and Development Agency of Latvia (LIAA) since 1996. Since 1994. - Expert of the Latvian Chamber of Commerce and Industry. Professional interests and scientific activity are mainly related to mechanical engineering technologies, cutting theory, cutting tools, design and optimization of flow mechanics, and instrumental systems. This knowledge ensures a qualitative study process in appropriate study courses at different study levels. Actively involved in the promotion process as a member of the RTU Promotion Council "RTU P-16" (since 2001) and a member of the RTU Promotion Council "RTU P-22" (since 2013). Supervisor of several doctoral theses. Continuous professional development, including participation in the implementation of scientific projects, scientific conferences, and professional development seminars, as well as the publication of research results in internationally recognized journals, allows for regular improvement of the content of study courses. Received several Letters of Recognition, and Acknowledgment by RTU, Ministry of Education and Science of the Republic of Latvia, MASOC, and the Cabinet of Ministers of the Republic of Latvia. State Award (2019): Cross of Recognition of the Three-Star Order for Special Merits for Latvia.

**Andrejs Grigorjevs Mg. Sc. Ing., Lecturer** (RTU Daugavpils Study and Science Center). Professional experience in academic work for more than ten years. Ten years of experience in manufacturing and data protection. Additional education - the only Certified SolidWorks expert in Latvia with eight years of experience in production. Personal data protection specialist with three years of experience. He is currently pursuing a second-level professional higher education in teaching specialty. The acquired additional knowledge and expertise ensure the implementation of quality study courses.

**Ivans Griņevičs, Dr.Sc.Ing., Assistant Professor.** Professional experience in academic and scientific work at Riga Technical University for more than ten years. Currently works as director of RTU Daugavpils Study and Science Center. Professional knowledge is developed by attending conferences, participating in online courses and seminars, and regularly participating in Erasmus / Erasmus+ experience exchange programs abroad (Germany, Bulgaria, Sweden, Lithuania), which promotes the acquisition of new methods and the development of academic knowledge. Industry-relevant scientific publications indexed in international databases (including Scopus). Main research areas - automation of assembly process for threaded connections.

**Viktors Gutakovskis, M.Sc.Ing., RTU Lecturer, Researcher**. More than ten years of work experience in the academic environment. Duties are related to supervising lectures, laboratory work, and bachelor's theses. Participates in conferences and seminars, as well as in the development of scientific articles for international scientific journals. Qualification is improved by attending several courses related to teaching methods, research methods, and CAD / CAM systems. Attend online qualification courses (in English). Within the framework of the Erasmus program, he has carried out teaching activities at Kaunas University of Applied Engineering Sciences (KTK). In addition, the acquired knowledge and experience gained while working in the metal processing companies SIA "Baltmet Holding" and SIA "MEKO un Ko" help ensure the implementation of quality study courses and the transfer of experience to students.

**Ernests Jansons, Mg.Sc.Ing., Assistant**. An applicant for a scientific degree in the FMETA study program "Production Technology". Since 2015 have participated in several local and international scientific research projects. Co-author of 10 scientific publications indexed in international databases (SCOPUS, Web of Science, etc.). Scientific quality improvements are ensured by participating in international scientific conferences and mobility trips abroad. The significant experience was gained working in the manufacturing industry. Combining theoretical knowledge with practical, he engages in such study subjects as "Fundamentals of Design", "Apparatus Design", "Industrial Product Design", etc. He also works in the Metrology Scientific Laboratory, promoting cooperation with companies.

**Jānis Kaņeps, Mg.Sc.Ing., Assistant Professor (practical).** About 40 years of academic work experience at RTU. The main areas of professional activity are production automation, electro-pneumatic automation, mechatronics, and computer-aided design. He has written two books on this topic: Pneumatic Transport Devices (2007) and Technical Graphics. Computer-Aided Design in TurboCAD" (2001). Has advised entrepreneurs in the field of programmable equipment management and participated in the establishment of the FMETA Production Automation and Mechatronics Training Laboratory. In recent years, the most significant attention has been paid to the research of the possibilities of low-cost technical equipment used in mechatronics training and the development of primary lines of study methodology for teaching work with such equipment. One of the main principles of this methodology is the use of visual programming in the training of non-IT specialists. There are two scientific methodological publications in 2016 on these issues.

**Kalvis Kravalis, Dr.Sc.Ing.** Professional experience: 12 years of academic work experience in a higher education institution. Scientific research has been carried out for 16 years, specializing in the study of the properties of liquid metal systems and their components under the influence of magnetohydrodynamic effects, the behavior of electrically conductive media in magnetic fields, experimental liquid metal systems for high energy sources. Active participation in international conferences and publications. Participation in the Scientific Council of the Institute of Physics of the University of Latvia. Teaching students the principles of flow mechanics of liquids and gases. Theoretical knowledge is strengthened during practical work in the laboratory. Study materials and methods are regularly improved and renewed.

**Artis Kromanis, Dr.Sc.Ing., Associate Professor, Leading Researcher.** Eight years of academic work experience in a higher education institution. Scientific and research activities are related to mechanical engineering technology and LEAN production technologies. The research results are published in industry-relevant scientific publications, including the Scopus and ISI Web of Science databases. Academic experience is supplemented with practical experience in the private sector, in companies such as SIA “Metal3D”, SIA “Blue Energy Global” and SIA “Pilnmeness tehnologijas”, participating in their product and service development projects. Supervisor of several bachelor’s theses, master’s theses, and also doctoral theses. In addition, he has obtained the qualification of European Patent Attorney, enabling him to provide competent assistance in intellectual property matters, in particular patents. Member of the European Patent Institute (EPI) and its vocational training committee representative. Member of the International Association for the Protection of Intellectual Property (AIPPI) and the Association of Licensing Managers (LES). Representing Latvia’s interests in the European Commission’s Coal and Steel Committee (COSCO) in accordance with its knowledge framework in production technologies. LCS (Latvian Council of Science) expert.

**Oskars Liniņš, Tzk(1985), Dr.Sc.Ing(1992), Professor(2008).** Academic and scientific work experience at RTU for 54 years. At the moment, the basic disciplines are “Fundamentals of Design” (MAB 370), “Apparatus Design” (MAB357,375), “Tribosystems Calculation” (MAB540), and a new subject “Wear Resistance and Calculation of Machine Parts” has been prepared for the new doctoral program. Also participates in the subjects related to metrology and electro pneumatics. Supervising student Internships in companies. Supervising bachelor and master theses. Prepare methodological materials and design requirements for students. Has published books on the following topics: Pneumatics, Production Automation, Sensitive Element Systems, Machining and Materials Used by Engineers. In the last period of scientific work, more than ten scientific publications have been written and submitted. Member of the scientific committee of “Production Technology” scientific conference. Secretary of the FMETA (former TMF) Council (2004-2018). Member of the Council of Professors of Mechanical Engineering (until 2018) and of the RTU Promotion Council "RTU P-16". Has received several RTU Honorary Diploma.

**Jānis Lungevičs, Mg.Sc.Ing. Researcher, Lecturer**. RTU has been working as a researcher since 2016 and has been involved in several local and international research projects, mainly related to the study of surface friction and wear properties. Regularly participates in the production of high-level scientific articles. Elected lecturer of FMETA since 2018. Participation in the following academic courses: Construction of devices, General metrology, Latest directions of measurement technology, Calculations of tribosystems for local and international students. Provides video lecture filming and editing proceses. Supervisor of the Metrology Scientific Laboratory. The laboratory works closely with the Japanese company Mitutoyo, which provides regular training for the laboratory staff on the latest measuring equipment. The acquired knowledge is transferred to both students and representatives of the Latvian manufacturing industry, who regularly turn to the laboratory to consult or perform accurate measurements.

**Dmitrijs Ļitvinovs, Dr.Sc.Ing., FMETA Researcher, RTU Liepājas Study and Science Center (LSSC) Assistant Professor.** Academic work experience at RTU for more than eight years.

Scientific activity and research have been carried out for more than 14 years, specializing in analyzing vibration signals of rotating equipment, which is confirmed by participation in scientific projects and participation in international scientific conferences and publications. Various research results are published in scientific papers. Attended RTU pedagogical qualification improvement courses. Since 2013, he has been lecturing on topics related to computer-aided design (AutoCAD and SolidWorks) and physics, as well as supervising bachelor's and master's theses for students of the FMETA Department of Mechanical Engineering and Mechatronics (LSSC).

**Natālija Mozga, Dr.sc.ing., RTU MTAF Associated Professor.** Professional work experience in a higher academic environment 25 years. In addition, scientific activities and research have been carried out for more than 25 years, specializing in the automation of production processes, as well as computer-aided design. Participate in scientific projects and international scientific conferences and publication preparation. She has extensive experience in managing RTU final theses and doctoral theses, developing study courses, as well as managing study courses. Author and co-author of 12 textbooks and brochures and two monographs. LCS expert in "Mechanical Engineering and Mechanics" sub-branches of the scientific branch "Mechanical Engineering Technology" and "Measuring Instruments and Metrology". Member of RTU Promotion Council "RTU P-16" for more than 15 years.

**Gatis Muižnieks, Dr.sc.ing. , RTU, Assistant Professor.** Professional experience in the academic environment since 2007. Performing pedagogical work, working as an assistant professor, researcher, assistant, research assistant and laboratory assistant. Provides study courses - Material Science, Structures and Properties of Engineering Materials, Materials Science, Additional Chapters. In addition, he attends pedagogical training courses at Riga Technical University and The European Association of Distance Teaching Universities. Scientific consultant at SIA "Mašīnbūves kompetences centrs". Experience as a mechanical engineer at SIA "LUCO" adds practical knowledge and skills in developing production technologies, choosing materials, and processing them. Industry expert - evaluation of submitted projects. Scientific and research activities are related to studying physical, mechanical properties, structures, and other regularities of various materials.

**Jānis Ozoliņš, RTU Professor Emeritus., State Emeritus Scientist, Dr.Sc.Ing., Researcher.** More than 60 years of professional experience in academia and administrative experience in higher education institutions. Scientific activity for more than 50 years, specializing in materials science. Expertise and consultations for mechanical engineering companies are performed in cooperation with the MASOC. Author of the textbook 'Materials Science'. The results of the latest scientific research are used in the study process. In addition to his work at RTU, he has been a guest lecturer at the Latvian Maritime Academy for ten years. Participation in international scientific conferences on the history of technology and materials science research. Prepared video lecture materials for several academic courses.

**Guntis Pikurs, M.Sc.Ing., Assistant Professor (practical).** More than 15 years of academic work experience at Riga Technical University and more than 20 years of work experience in the Latvian Mechanical Engineering Industry. Regular participation in conferences and seminars related to production and repair technologies. G. Pikurs is the author and co-author of several scientific publications and has participated in scientific projects both in Latvia and internationally. Achieving full-fledged study results is ensured both by the acquired theoretical knowledge and significant practical work experience in the industry.

**Guntis Spriņģis, Mg.Sc.Ing., Lecturer.** Professional work experience in the academic and scientific environment at Riga Technical University for more than ten years, currently also the Deputy Director of RTU Daugavpils Study and Science Center (DSSC). In addition, he obtained a bachelor's degree in English philology. Professional knowledge is developed by attending conferences, participating in online courses and seminars, as well as regularly participating in Erasmus / Erasmus + experience exchange programs abroad (Poland, Germany, Austria, Spain, Lithuania), which promotes the acquisition of new methods and the development of academic knowledge. His industry-relevant scientific publications are indexed in international databases (including Scopus). Main research areas - research of friction and wear process of matched surfaces.

**Guntis Strautmanis, Dr.Sc.Ing., RTU DSSC Associated Professor.** Professional experience: more than 40 years of academic and research experience in a higher education institution. Has a lathe operator diploma, which provides an excellent basis for academic work and helps to teach subjects in the technical field. More than 30 scientific publications in the field of rotor dynamics and more than 20 of them are published in internationally recognized journals or conferences with indexing in international databases (Scopus). Author and co-author of 5 patents and inventions. LCS expert.

**Valentīna Strautmane, Mg.sc.ing.,** Professional work experience in a higher education institution, academic and scientific environment for more than ten years. In addition to the obtained master's degree in economics, more than 20 years of work in the chief technologist's department at the Riga Wagon Building Factory and the provide an excellent basis for academic and research work in the fields of innovation and management. In cooperation with Daugavpils Railway Transport Technical School, she has written and published methodological literature. Participation in conferences and seminars in the fields of transport, educational methodologies, and others. Achieving full-fledged study results is ensured both by the acquired knowledge and extensive practical work experience, especially in the field of transport.

**Edgars Šīrons, Dr.Habil.Sc.Ing. (1993), Professor (1985).** Academic work experience at RTU is 63 years. At the moment, the basic discipline is "General Metrology", which contains 5 textbooks published in different years, as well as auxiliary literature "Tolerances and Sessions" Part I (1982). Several laboratory works have been developed and implemented. The course is digitized and contains ten video lectures. New supplemented methodological instructions for the elaboration of study work have been developed, which are inserted in e - studies. The work will be continued by digitizing the study work. Study assignments have been developed and summarized in an album. The second discipline, "Additional Departments of Metrology" is a written and published textbook (2011) for laboratory work, which is supplemented with theoretical knowledge and can therefore be used to acquire the course. The digitization of the lecture course is being worked on, and ten video lectures will be recorded. Part II (1985) of the Manual "Tolerances and Seats" has been published to be used as an aid to laboratory work. Several original laboratory works have been created and implemented. During 63 working years at RTU (former RPI) he worked in various levels of administrative work: for 11 years (December 1964 - September 1975) Head of the Department of Apparatus Construction; 21 years (December 1972 - March 1994) Dean of the Faculty of Apparatus Construction and Automation, organizer of teaching and scientific work. He has headed various scientific and methodological councils at RTU (RPI) and also at the State level at the Ministry of Higher and Secondary Technical Education, which was evaluated by the Government: N.b. University employee (1988): MK Honorary articles (1984 and 1987) IM Honorary articles (1973, 1974, 1986), etc. Practical work experience in the production of instruments has helped a lot in my academic work, working as a senior master in the instrumental workshop of the Riga Electrical Fittings Factory (June 1953 - September 1955).

**Antons Štekleins, Dr.Sc.Ing., Researcher.** Professional experience: production manager in a vacuum equipment manufacturing and vacuum technology application research company for more than eight years. Participation in several international vacuum equipment manufacturing projects.

Many years of professional experience and qualification in a manufacturing company allow to achieve study results and supplement the theory with practical examples that significantly improve the learning process. More than two years of academic and scientific work experience. Research competence in working with students is ensured both by participation in scientific conferences and the development of publications in internationally recognized collections of articles indexed by SCOPUS and others. The doctoral degree provides an opportunity to conduct classes in academic study programs and increase competence and knowledge by constantly following the news in the field of production. He uses the gained professional and educational experience, knowledge, skills, and competence in pedagogical work, creating and improving the content of courses, choosing modern and appropriate teaching methods, and developing collaborative communication with students.

**Toms Torims, Dr.Sc.Ing., Professor.** Experience in academic and scientific work in a higher education institution for more than 14 years. RTU professor (since 2014), Latvian representative at the European Nuclear Research Agency (CERN), research associate at the European Nuclear Research Agency, Latvian representative at the European Nuclear Research Agency, Adviser to the Minister of Foreign Affairs of the Republic of Latvia, Adviser to the Rector of RTU. Active scientific activity (author of more than 50 scientific publications in internationally recognized journals), including CERN, allows implementing high-quality study courses closely related to scientific research topics: production and processing technologies, applications of particle accelerators in industry. Supervisor of several doctoral theses, author of teaching and methodological aids. 2021 By the decision of President E. Levits and the Chapter of the Order, Toms Torims has been appointed an officer of the Order of the Three Stars.

**Gunārs Upītis, Dr.Sc.Ing., Professor.** RTU lecturer since 1972. Provide study courses “Machine Elements”, “Lifting and Transport Machines”, “Mechanical Engineering Drawing”. As a visiting professor, he has conducted study courses “Computer Design of Machines” and “Methods of Statistical Data Analysis” at the Latvian Maritime Academy. Scientific qualification in the field of machine vibration analysis. As a certified specialist of the Latvian Union of Civil Engineers and an expert of the RTU Non-Destructive Testing Laboratory, he has long participated in solving technical problems of various Latvian companies, specializing in GEM analysis of Latvenergo AS hydroelectric power plants and combined heat and power plants (CHPP) large metal structures. Practical experience, calculation results, and theoretical findings are used to update and supplement the content of study courses and ORTUS e-learning materials “Machine Elements. Course aids”.

**Armands Leitāns, Mg.Sc.Ing., Lecturer, Researcher.** Academic work experience at RTU since 2014. Leading laboratory assistant in academic courses Electropneumatic Technique, Electro-, Pneumo-, Hydroautomation, General metrology. Additional academic works include evaluating students’ study practice reports and supervision of bachelor’s thesis. Scientific and research activities are related to the field of tribology, mainly testing of tribological properties of new materials, surface protective coatings, oils, and lubricants. Scientific and research activities are reflected in scientific publications cited in the international databases of scientific publications Scopus and the Web of Science. Academic experience is supplemented by working on projects in the National Education Content Center as an expert - school consultant, advising students on research, and participating in the competition evaluation commission. Qualification is improved by attending professional development courses and internships in companies.

### 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.

There have been changes in the academic staff during the reporting period. Five professors of the last academic team terminated their educational activities. The study courses of these lecturers have been taken over by other lecturers of the Department of Mechanical Engineering and Mechatronics. Department of Apparatus Construction and Department of Materials Processing Technology implementing the profiling study courses in the field of the study program were merged in the Department of Mechanical Engineering and Mechatronics in 2019, which significantly increased the workforce capacity management. As a result of the merger, the potential of the academic staff serving the bachelor's professional study program "Mechatronics" increased. It should be noted that the average age of the academic staff decreased due to the defense of several scientific dissertations in the field. As a result, the number of new lecturers has increased, and as a result of re-election, assistant professors have moved to the category of associate professors.

| Accademic staff | 2014/ 2015 | 2015/ 2016 | 2016/ 2017 | 2017/ 2018 | 2018/ 2019 | 2019/ 2020 | 2020/ 2021 |
|---|---|---|---|---|---|---|---|
| Proffesors | 5 | 5 | 7 | 7 | 6 | 6 | 4 |
| Asociated proffesors | 5 | 5 | 4 | 5 | 3 | 4 | 5 |
| Assistant professors | 6 | 7 | 5 | 6 | 5 | 6 | 4 |
| Lecturers | 4 | 4 | 2 | 6 | 6 | 5 | 3 |

During the preparation of the self-assessment report, the team of academic lecturers of the Department of Mechanical Engineering and Mechatronics, involved in the implementation of the study program "Mechatronics", actively carried out research, teaching, published, participated in conferences, as well as improved their qualifications. In the European Social Fund project, the academic staff of the Department of Mechanical Engineering and Mechatronics had the opportunity to improve their English language skills and train in various companies in the field of the specific support objective of the Operational Program "Growth and Employment" During the reporting period, several lecturers of the Department of Mechanical Engineering and Mechatronics participated in the internship program. As well as within the framework of this project, the English language skills were improved by the academic staff of the Department of Mechanical Engineering and Mechatronics. Also this project, which focuses on three main goals: the improvement of the competence of the existing academic staff, the renewal of the academic staff, promoting the employment of doctoral students in academic work, allowed to attract three doctoral students, encouraging the renewal of the academic staff. The involved doctoral students will ensure the sustainability of the study process. Ernests Jansons, Didzis Avišāns, and Viktors Gutakovskis are involved in the study process using the specific support goal of this project.

Breakdown by academic qualification

| Qualification | No. | % |
|---|---|---|
| Proffesors | 4 | 25 |
| Asociated proffesors | 5 | 31 |
| Assistant professors | 4 | 25 |
| Lectureres | 3 | 19 |
| Amount: | 16 | 100 |

Percentage distribution of current academic staff by academic qualification in the academic year 2020/2021 indicates that the academic staff of the study program “Mechatronics” has the high scientific qualification and work experience. The largest share of the academic staff consists only of professors and assistant professors.

**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).**

A total of about 44 lecturers implements the study program. In the implementation of the study program it is essential to ensure the cooperation of the academic staff. One of such cooperation mechanisms is the implementation of study projects within the framework of several successively implemented study courses. For example, to solve the problem situation in mechanical engineering, such study courses as MAT377 Machining Theory and Processes, MAB339 Manufacturing Technology of Machines and Devices and MAB414 Computer Aided Design of Technological Processes (CAM) are offered. Thus, cooperation between lecturers is promoted, and in parallel, students acquire skills and competencies for structured problem-solving.

Meetings of the structural units are organized at least once a week at the Institute of Mechanics and Mechanical Engineering and the Department of Mechanical Engineering and Mechatronics. Academic staff project meetings and seminars are held. In addition, the university and the faculty have a system that provides regular academic conferences and professional development seminars to improve the teaching methodological competencies.

The academic staff of the current study program additionally implements Bachelor's level study courses in the study programs of other structural units both in the flow of Latvian students and in the flow of foreign students.

On average, 40 to 50 lecturers are involved in the implementation of the study program, excluding guest lecturers in the field. The average ratio of the number of students and lecturers within the study program is one lecturer and 10 to 15 students. The given relationship and the program's content provide an individualized approach to studies. Thus, it is possible to integrate a student-centered approach and promote the development and improvement of the above-mentioned professional competencies.

# 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 | MCN0_diploms_dipl_pielik_dipl_supple.zip | MCN0_diploms_dipl_pielik_dipl_supple.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) | | |
| 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 | MCN0_stud_statist.docx | MCN0_stud_statist.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 | MCN0_StEdSt_6_annex.pdf | MCN0_ValzSt_6_pielik.pdf |
| 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) | MCN0__ProfSt_7_annex.pdf | MCN0__ProfSt_7_pielik.pdf |
| 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 | MCN0_kartejums_8_annex.xlsx | MCN0_kartejums_8_pielik.xlsx |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MCN0_CurricStProgr_9_annex.zip | MCN0_StudProgrPL_9_pielik.zip |
| Descriptions of the study courses/ modules | MCN0_Studkurs_Apr_DescriptStud_cour.zip | MCN0_Studkurs_Apr_DescriptStud_cour.zip |
| Description of the organisation of the internship of the students (if applicable) | Internship_Management_Procedure.pdf | Prakses_organizesanas_kartiba.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Medical Engineering and Medical Physics (42526)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Medical Engineering and Medical Physics* |
| Education classification code | *42526* |
| Type of the study programme | *Professional bachelor study programme* |
| Name of the study programme director | *Jurijs* |
| Surname of the study programme director | *Dehtjars* |
| E-mail of the study programme director | *jurijs.dehtjars@rtu.lv* |
| Title of the study programme director | *profesors, Dr.habil.phys.* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study program is to educate and train highly qualified specialists - Bachelors in Medical Physics and Medical Engineering (in accordance with the professional standard for a medical physical technology engineer) for professional activities in the fields of medical engineering and medical physics possessing professional knowledge of the design of medical equipment, apparatuses and tools, their physical and technical operation principles, their manufacturing technology, application procedures and safety; possessing the practical skills for working with medical equipment – its purchase, installation, use, calibration and quality management, as well as the ability to plan and monitor application of radiation technology, patient and personnel dosimetry; to equip graduates for experimental research work; to train students so that they can continue studies at the Master level.* |
| Tasks of the study programme | *To provide students with the knowledge and skills necessary for completion of professional tasks in accordance with the requirements of the higher engineering education and professional standard for medical physical technology engineer;*<br>*- to ensure acquisition of the skills relevant for the field of medical engineering and medical physics that would allow developing skills in designing of new and improvement of the existing systems, products and technologies, to use the newest achievements of physics in medicine, as well as to train students for creative research and pedagogical activity in medical engineering and medical physics.*<br>*- to provide internship opportunities to the students with an aim to apply the acquired knowledge in medical engineering and medical physics;*<br>*- to motivate students to analyze the obtained knowledge and experience, and continue gaining them;*<br>*- to improve students' foreign language skills;*<br>*- to educate students in professional ethics issues, promote observation of ethical principles;*<br>*- - to develop students' oral and written professional communication skills in medical engineering and medical physics;*<br>*- to develop team-working skills.* |

| | |
|---|---|
| Results of the study programme | *Graduates of the study programme:*<br>*1. Is able to apply the acquired theoretical knowledge and practical skills in the development and improvement of innovative medical equipment, devices and technologies;*<br>*2. Is able to analyse the development trends of medical equipment and technologies, as well as to evaluate functional, economic and other preconditions justifying the necessity of designing new medical equipment, devices and technologies or redesigning existing equipment, devices and technologies;*<br>*3. Is abe able to use traditional and modern computerised calculation systems, design, manufacture and processing technologies in the design process, taking into account environmental and civil protection, fire safety and hygiene requirements;*<br>*4. Is able to construct, design and service modern medical equipment;*<br>*5. Is able to analyse, evaluate, systematize and use the results of applied and scientific research, in joint work with medical practitioners, biologists and other specialists, is able to participate in teamwork, implement creative and research work, is able to justify and present its conceptual solution;*<br>*6. Is able to evaluate the conditions for the acquisition of medical engineering equipment and technologies, manage the installation, use, adjustment of medical engineering equipment, develop appropriate inspection methodologies;*<br>*7. Is able to evaluate the safety and security of modern medical equipment and technologies, analyse the causes of damage to the equipment or system and organise their prevention, if necessary, perform supervision, servicing, repair, testing and calibration of medical equipment and technologies;*<br>*8. Is able to apply radiation source protection engineering calculation methodologies, develop and apply mathematical modelling models in radiation physics, biophysics and medical physics, are able to perform dosimetric, radiometric and radiation spectrometric measurements and document them;*<br>*9. Is able to provide measures for the supply of radioactive radiation to the patient, as well as to carry out the necessary activities to ensure radiation safety.* |
| Final examination upon the completion of the study programme | *Bachelor Paper with the engineering project* |

# Study programme forms

### Full time studies - 4 years, 6 months - latvian

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *4* |
| Duration in month | *6* |
| Language | *latvian* |
| Amount (CP) | *180* |
| 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 medical physics* |
| Qualification to be obtained (in english) | *Medical physical technology engineer* |

### Places of implementation

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

### Full time studies - 4 years, 6 months - english

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *4* |
| Duration in month | *6* |
| Language | *english* |
| Amount (CP) | *180* |
| 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) | *Professional bachelor degree in medical physics* |
| Qualification to be obtained (in english) | *Medical physical technology engineer* |

### 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.

In accordance with the agreement concluded between Riga Technical University and Riga Stradins University on April 3, 2014 "On the joint implementation of the study program "Medical Engineering and Physics"" (RTU Reg. No. 01000-4.1.28 and RSU Reg. No. .6.2.-25/2014/0226) and license No. 04051-168 issued by the Ministry of Education and Science on the right to implement the joint professional Bachelor study program "Medical Engineering and Physics", for acquiring a professional Bachelor degree in medical physics and a qualification of medical physical technology engineer (June 23, 2014 decision No. 25 of the study program licensing decision), since the academic year 2014/2015 the professional Bachelor study program "Medical Engineering and Physics" is carried out jointly with Riga Stradins University (conformity to the criteria specified on the Law on Higher Education Institutions section 55.[1] "Joint study program" )(see Annex).

Study courses carried out by Riga Stradins University are as follows, distributed by the sections of the study program:

| ***No*** | ***Title of the study course*** | ***CP*** | ***RTU course code*** | ***RSU course code*** | ***Instructor*** | ***RSU Department*** |
|---|---|---|---|---|---|---|
| 1. | Basics of Occupational Safety and Civil Protection | 2 CP | SFI701 | AUVMK_033 | assoc. prof. Ivars Vanadziņš | Faculty of Medicine, Department of Occupational and Environmental Medicine |
| 2. | Health Economics | 2 CP | SFI702 | VVDG_025 | Lekturer A.Dūdele | Faculty of Medicine, Health Management instructor group |
| 3. | Anatomy and Physiology | 4 CP | SFI705 | MK_060 | assoc. prof. Dzintra.Kažoka | Faculty of Medicine, Institute of Anatomy and Anthropology, Department of Morphology |
| | | | | CFUBK_055 | assoc. prof. L.Blumfelds, docente G.Gersone | Faculty of Medicine, Department of Human Physiology and Biochemistry |
| 4. | Cell and Tissue Microstructure | 2 CP | SFI703 | MK_032 | professor Valentīna Groma | Faculty of Medicine, Institute of Anatomy and Anthropology, Department of Morphology |
| 5. | Medical Instruments, Equipment and Systems, Their Use | 2 CP | SFI704 | KPUMTK_004 | assoc. prof. Oļegs Sabeļņikovs | |
| 6. | Medical Terminology in English | 2 CP | SFI700 | VC_059 | Lekturer M.Karulis | Language Centre |
| 7. | Medical Ethics | 2 CP | SFI706 | HZK_016 | assist. prof. I.Neiders | Department of Humanities |
| 8. | Public Health and Epidemiology | 3 CP | | SVUEK_089 | Professor Ģ.Briģis | Faculty of Public Health and Social Welfare, Department of Public Health and Epidemiology |

At the moment, the following study courses implemented by RSU are not realised:

- Business Risks

- Business Economics and Fundamentals of Marketing
- Healthcare Organization and Economics
- Project Management

It is planned to implement these courses as soon as a sufficient number of students apply for the relevant field. The partner university has specified that the minimum number of students in order to carry out the relevant study course is 8 - 12 students, at the moment, the relevant number has not been achieved in order to implement the relevant specialization field.

In the current accreditation period, the total number of credit points for the study program has been changed from 181 CP to 180 CP. In accordance with the current legal enactments, the distribution of study program sections was changed, where Section A - Compulsory study courses amount to 118 CP, accordingly, Section B - Compulsory elective study courses in total make up 19 CP within the framework of which the professional specialization courses amount to 11 CP, humanities and social sciences study courses - 4 CP, and languages - 4 CP. Furthermore, the total amount of Internship was changed from 26 CP to 25 CP.

In the Section A - Compulsory study courses, the study courses Labor Protection and Civil Defense were joined into one course "Basics of Occupational Safety and Civil Protection", which was carried out by the Department of Occupational and Environmental Medicine of the RSU Faculty of Medicine. The study course "Economics", which was carried out at all RTU study programs, was also changed to a more specialized study course "Health Economics", which is implemented by the Health Management Lecturer Group of the RSU Faculty of Medicine.

The study course "General Metrology" carried out by RTU was changed to a more specialized study course "Measurements of Medical Equipment Technologies", as well as the study course "Radiation Safety in Medicine", was changed to the study course "Radiation and Environmental Safety in Medicine", its curriculum was reviewed to include the themes to meet the requirements towards study course content specified in the Environmental Protection Law and the Civil Defense Law. The following study courses were excluded from the Section A – "Computer Studies (Basic Course)" and "Basics of Communication", however, new study courses such as "Basics of Nanomedicine" and "Medical Instruments, Equipment and Systems, Their Use" were added. The volume for the following study courses in Section A was also changed – “Anatomy and Physiology” from 2 CP to 4 CP, “Medical Equipment Design” from 3 CP to 4 CP. By combining 3 study courses into one, i.e., "Medical Tools, Devices and Systems" 3 CP, " Physiological Measurement Equipment" 2 CP, "Measurement Tools in Medicine" 3 CP, a unified large-scale two-part study course "Medical Instruments, Equipment and Systems" was created amounting to 8 CP, the aforementioned study course is carried out throughout 2 semesters. Some study courses that were previously a part of Section B - Compulsory elective study courses were transferred to Section A - Compulsory study courses - these are as follows:

| | |
|---|---|
| Radiation Therapy Technologies | 3 CP |
| Introduction to Biochemistry and Biophysics | 3 CP |
| Basics of Biomaterials and Biomechanics | 3 CP |
| Spectroscopy Methods in Medicine | 5 CP |
| Computer Systems in Medicine | 5 CP |
| Electronics in Medicine | 2 CP |
| Micro- and Nanotechnologies | 3 CP |

In the module for developing professional competence in business (innovations, company organization and foundation, management methods, business economics, basics of project development and management, record keeping and financial accounting system, knowledge of the regulation of legal labor relations, including the courses on social dialogue development in society as well as knowledge of other novelties in business or institution management, the following study courses of the study program in the amount of at least 6 credit points are included:

| | |
|---|---|
| Health Economics | 2.0 |
| Fundamentals of Quality Control and Monitoring | 3.0 |
| Basics of Occupational Safety and Civil Protection | 0.5 CP out of 2 CP |
| Introduction to Medical Engineering | 0.5 CP out of 2 CP |
| Medical Physics | 0.5 CP out of 3 CP |
| Fundamentals of Law in Medicine | 2 CP |
| Business Sociology | 2 CP |
| Medical Equipment Design | 1 CP out of 4 CP |
| Methods of Medical Equipment Manufacturing | 1 CP out of 4 CP |

Competence training, business games and other practical methods are mainly used in the implementation of the module.

The following specialization study courses of different specializations were added to Section B - Compulsory elective study courses:

| | |
|---|---|
| Biomaterials | 2 CP |
| Computerized Decision-Making in Medicine | 2 CP |
| Electronic Elements and the Design of Electronic Equipment | 4 CP |
| Basics of Artificial Intelligence in Medicine | 2 CP |
| Medical Textile Materials | 2 CP |
| Nanotechnologies in Medicine | 2 CP |
| Assistive Technologies | 2 CP |
| Design of Prostheses | 2 CP |
| Business Risks | 3 CP |
| Technical Mechanics | 2 CP |
| Strength of Materials | 2 CP |
| Business Economics and Fundamentals of Marketing | 2 CP |
| Project Management | 2 CP |

The following specialisations with relevant professional specialization study courses in the amount of 11 CP were created within Section B of the study program - Compulsory elective study courses:

- ***Specialization "Medical Equipment"***, comprising study courses Theoretical Mechanics 2KP, Strength of Materials 2 KP, Heat Study 2 KP, Biological Signal Analysis 5 KP
- ***Specialization "Medical Physics and Nanomedicine"*** comprising study courses Technical Mechanics 4 KP, Nanotechnologies in Medicine 2 KP, Biological Signal Analysis 5 KP
- ***Specialization "E-Medicine"*** comprising study courses Technical Mechanics 2KP, Pattern Recognition and Image Processing Methods in Medicine 3 KP, Computerized Decision-Making in Medicine 2 KP, Basics of Artificial Intelligence in Medicine 2 KP, Fundamentals of Computer Graphics 2 KP
- ***Specialization "Medical Electronics"*** comprising study courses Technical Mechanics 2 KP, Biological Signal Analysis 5 KP, Electronic Elements and the Design of Electronic Equipment 4 KP
- ***Specialization "Biomechanics and Assistive Technologies"*** comprising study courses Technical Mechanics 2 KP, Biological Signal Analysis 5 KP, Assistive Technologies 2 KP, Design of Prostheses 2 KP
- ***Specialization "Medical Materials"*** comprising study courses Technical Mechanics 2 KP,

Biomaterials 2 KP, Basis of Biomaterial Technology 3 KP, Medical Textile Materials 2 KP, Functional Medical Implants 2 KP

- ***Specialization "Medical Engineering Business"*** comprising study courses Technical Mechanics 2 KP Health Care Organization and Economics 2 KP, Business Risks 3 KP, Project Management 2 KP, Business Economics and Fundamentals of Marketing 2 KP

The study course Medical Ethics 2 CP and Fundamentals of Law in Medicine 2 CP were added to the elective study courses in humanities and social sciences, the students select one study course from this section in the amount of CP and Fundamentals of Law of 2 CP that should be mastered by all students of the study program.

The volume of the following study courses was changed:

| | | | |
|---|---|---|---|
| Strength of Materials | **5 CP** | Strength of Materials | **2 CP** |
| Technical Mechanics | **5 CP** | Technical Mechanics | **5 CP** |
| Theoretical Mechanics | **3 CP** | Theoretical Mechanics | **2 CP** |
| Functional Medical Implants | **3 CP** | Functional Medical Implants | **2 CP** |

The following study courses were excluded from Section B of the study program - Compulsory elective study courses:

| | |
|---|---|
| Analogue and Digital Integrated Circuits | 3 CP |
| Digital Devices and Systems | 3 CP |
| Physiological Measurement Equipment | 2 CP |
| Investment Economics | 2 CP |
| Machine Elements | 3 CP |
| Organization of Small Business | 2 CP |
| Computer Aided Control Systems in Medicine | 3 CP |
| Measurement Tools in Medicine | 3 CP |
| Microprocessor Technology | 3 CP |
| Multimedia Applications | 3 CP |
| Simulation and Analysis of Radio Electronic Circuits | 3 CP |
| Cell and Microbiology | 2 CP |
| Organization of Management at Enterprise | 2 CP |
| Social Psychology | 2 CP |
| The German Language | 2 CP |
| The French Language | 2 CP |

In Section B6 of the study program - Languages - the intended amount for the study course "English" was changed from 4 CP to 2 CP, this course is carried out by RTU Institute of Humanities, where the students master technical terminology in English, however, 2 CP are delivered by the Department of Languages of RSU. Within the study course "Medical Terminology in English", the students master medical terminology in English.

**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 Bachelor's professional study programme "Medical Engineering and Physics" has been developed in accordance with the Cabinet of Ministers Regulation No. 512 of 26 August 2014, Regulations Regarding the State Standard of Second Level Professional Higher Education, https://likumi.lv/doc.php?id=268761, taking into account the standard of medical physical technology engineering professions, and the requirements for the implementation of a joint inter-university study programme laid down in the Law on Higher Education Institutions, as well as also the requirements of RTU internal regulatory documents (see relevant annexes). The right to be admitted in accordance with these Regulations and to study at RTU is equal for a citizen of Latvia, a non-citizen of Latvia, a citizen of the European Union, a citizen of the European Economic Area or a citizen of the Swiss Confederation and a long-term resident of the European Community who has a valid residence permit. Foreigners may apply for studies in the official language of RTU at the expense of natural or legal persons, if the previous education conforms to the requirements of the relevant undergraduate study programme regarding previous education. Full-time students have their studies at the expense of the State budget or natural or legal persons. Special requirements and criteria for admission to each of the undergraduate programmes are published on the RTU website www.rtu.lv. The deadlines for the submission of applicants' applications and other documents, the competition, entrance examinations and registration are determined by an order of the rector and published on the RTU website www.rtu.lv. The number of places for admission to studies with the funds of the State budget or natural or legal persons in each full-time study programme shall be determined by the RTU Senate not later than one month before the start date of the submission of applications.

Students with secondary or secondary vocational education are enrolled in the study programme, taking into account centralised examinations in mathematics, Latvian, foreign language Admission of applicants to full-time and part-time undergraduate study programmes takes place according to CE results in mathematics, Latvian and foreign language, annual grades in separate subjects in the secondary education document and according to the results of entrance examinations. If, in addition to the CE mentioned, CE physics or chemistry have been passed, then the results of these CE shall be taken into account in the calculation of the ranking. If, in addition to the CE mentioned, CE physics or chemistry have been passed, then the results of these CE shall be taken into account in the calculation of the ranking. The CE percentage in mathematics shall be summed by 1; CE percentage in Latvian is summed by multiplying by 0.8, CE percentage in a foreign language is summed by multiplying by 0.7; The CE percentage in physics and/or chemistry is summed by multiplying by 1.

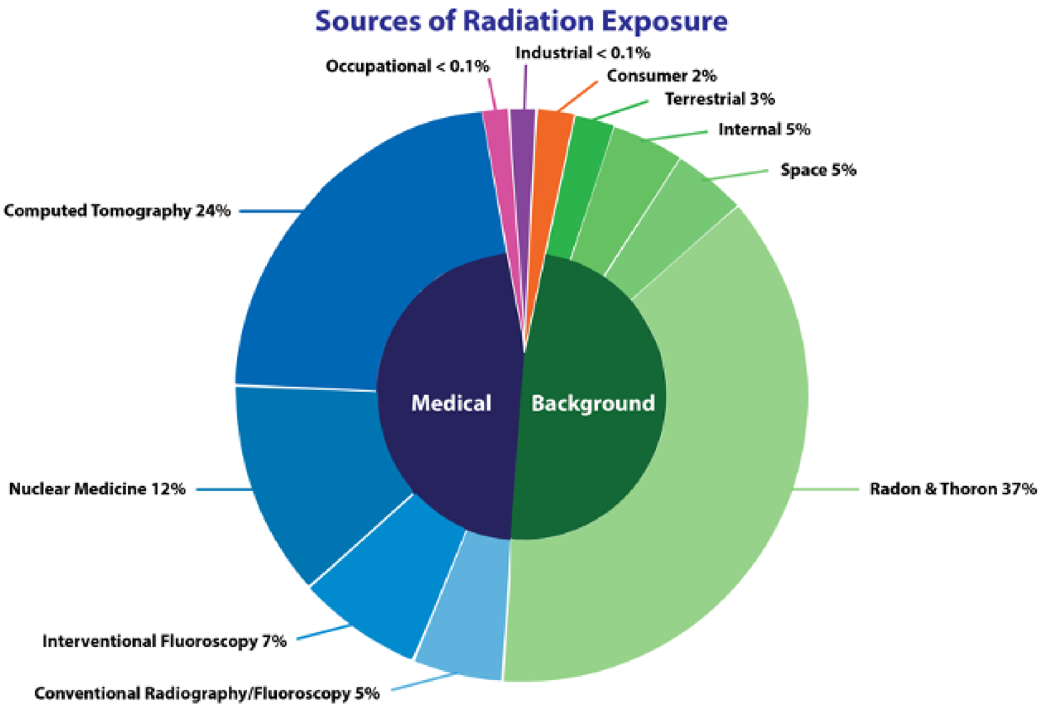
In accordance with the admission regulations of foreign students (meeting of the RTU Senate of 25 October 2021, Protocol No. 665), foreign applicants must pass the entrance exam in English and mathematics. Foreigners who wish to study in Latvian must submit a certificate of proficiency in the official language issued by the commission for the examination of proficiency in the official language. Language proficiency must be not lower than level two, grade B.

Upon graduation, students obtain a bachelor's professional degree in medical physics and qualification as an engineer: medical physical technology engineer. Prepare qualified specialists for professional activities in the fields of medical engineering and medical physics with professional knowledge of the structure of equipment, apparatus and instruments used in medicine, their physical and technical principles of operation, manufacturing technology, conditions of use and safety; with practical work skills for working with medical equipment – their purchase, installation, use, adjustment and quality management, as well as skills to carry out radiation technology planning and monitoring, patient and personnel dosimetry. Also prepares for experimental research activities, medical engineering and physics of the study programme meets the requirements of a medical physical technology engineer, the knowledge and competences acquired in the study programme are corresponding to the 6th level of the European Qualifications Framework (EQF) and the Latvian Qualifications Framework (LQF), the 5th level of the Professional Qualification of Latvia.

Duration of the study programme is 4.5 years or 9 semesters with 180 credit points. Graduates of the study programme are in demand in the labour market, graduates of the study programme work in medical institutions - hospitals, centers, where various medical services are provided, as well as in representations of manufacturers of medical devices, as well as in state administration institutions (accreditation, controlling) with special knowledge, competencies in the field of medical engineering and technology.

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

The study programme educates students by combining 2 slightly different fields – medical physics and medical engineering – into one study. The role of medical physics is the application of concepts and methods of physics for the prevention, diagnosis and treatment of human diseases with the specific aim of improving human health and well-being. According to the International Standard Classification of Occupations of the International Labour Organisation, the profession of medical physicist in 2008 is included as a health profession. A medical physicist is a health care specialist with specific education for the application of the concept of physics in technique in medicine and is competent to practice independently in one or several sub-branches of medical physics - radiation oncology or radiation therapy, diagnostic and invasive radiology, nuclear medicine and radiation safety. However, medical physicists also work in many other fields that use complex technologies such as equipment used in audiology, neurology, neurophysiology, cardiology, this would apply to the field of biomedical physics, engineering, which is accordingly also a wide field of activity. Specialists in medical physics and engineering must be highly qualified, one mistake of these specialists at work can lead to health problems, even death, these specialists must be highly motivated, responsible specialists of their trade. Medical physicists are united in the European Federation of Organisations of Medical Physics, whose mission is to maintain and improve the quality, safety and cost-effectiveness of health services through patient-centred measures related to the selection, acceptance, testing, quality assurance, control and optimised clinical use of medical devices in relation to patient risks and protection against various physical factors such as X-rays, electromagnetic field, laser light, radionuclide radiation. There is also the International Organization for Medical Physics (IOMP), which is represented by more than 27,000 medical physicists worldwide and 87 who respect national member organizations as well as 2 related organisations. The mission of IOMP is to promote medical physics practices around the world by disseminating scientific and technical information, promoting the education and professional development of medical physicists, and promoting the highest quality medical services for patients. The above mentioned organizations are actively working to develop the field of medical physics, facilitate the work of medical physicists on a daily basis. In accordance with the Radiation Safety Law and the laws and regulations subordinate thereto, there are approximately 500 medical institutions in Latvia, which use medical devices with sources of ionising radiation, only about half of medical institutions have been provided over these years. Radiation monitoring data show that ionising radiation devices are increasingly used both in diagnostics and medical treatment – in 2006 only 20% of all radiation exposure is generated by medical equipment, then today it can already be said that half of all radiation exposure is taken up by radiation generated by medical equipment due to the development of existing and nuclear equipment/methods that are more widely used in diagnostics and treatment (see diagram). This indicates that more and more professionals are needed to work with these devices.




There is a lack of specialists in medical physics in the world and also in Latvia, to improve the situation EFOMP has developed programs through which representatives of various technical specialties can retain as medical physicists. Graduates of the study programme are all employed, already in the last study courses students of the study programme are actively involved in the labour market - they also work in representations of medical device manufacturers (Siemens, Philips, GE), laboratories and other companies whose work is related to equipment in medicine. Such specialists are also needed in public administration, control and accreditation institutions.

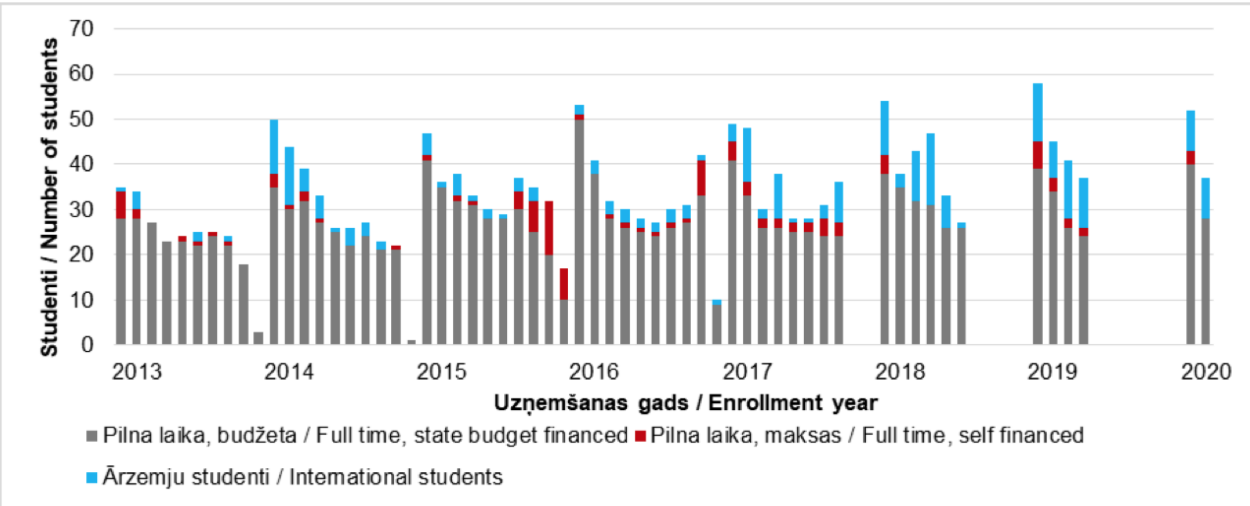
**3.1.4. Statistical data on the students of the respective study programme, the dynamics of the number of the students, and the factors affecting the changes to the number of the students. The analysis shall be broken down into different study forms, types, and languages.**

The number of the matriculated 1st year students has grown comparatively when realizing the study program started to be realized as a joint RTU-RSU study program. The competition for state-financed budged study seats is small, however, compared to the previous years, competition for state budget funded seats has decreased. This could be due to the increase of students to be admitted as well as desire of the secondary school graduates to study at foreign higher education institutions, it could be also the impact of the "demographic pit". Overall, the dynamics of student numbers is stable. The table below shows the number of students yearly on 1 October.

| Year | Number of students | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | year | | year | | year | | year | | year | | Total |
| | B | M | B | M | B | M | B | M | B | M | |
| 2013 | 31 | 1 | 23 | 3 | 13 | - | 13 | | 11 | | 91 |
| 2014 | 25 | 4 | 17 | 2 | 19 | | 13 | | 11 | | 85 |
| 2015 | 30 | - | 21 | 1 | 16 | | 20 | | 13 | | 100 |
| 2016 | 31 | | 27 | | 15 | | 18 | | 16 | | 107 |
| 2017 | 29 | 1 | 29 | 1 | 20 | | 11 | | 16 | | 105 |
| 2018 | 29 | 2 | 18 | 1 | 20 | | 16 | | 12 | | 95 |
| 2019 | 35 | 3 | 22 | 1 | 15 | | 20 | | 14 | | 106 |
| 2020 | 39 | 1 | 29 | 2 | 14 | | 17 | | 18 | | 117 |
| 2021 | 39 | 1 | 30 | | 14 | | 10 | | 15 | | 108 |

About 15% of students drop out in their first year due to various reasons – failed courses, the fact that they have started work, are unable to combine work with studies, the future profession they selected does not suit them. The number of expelled students varies over the years, there is no unambiguous trend for the reasons why some first-year students are expelled. Every year, 1-3 first year students pay for their studies, however, as there are students who leave their studies or there are last year students, who are expelled due to failure to complete the study plan, tuition fee paying students have the opportunity to qualify for the state-financed seats, the best students qualify for them. There is a trend for 4th year students to be expelled if the study plan is not completed, some students have difficulties to develop and present their Bachelor Paper in time, and, if there are additional academic arrears, the student is expelled. There are some students, who present their Bachelor Paper successfully, however, do not have the time to prepare their engineering project presentation, in such cases the student is often also expelled.

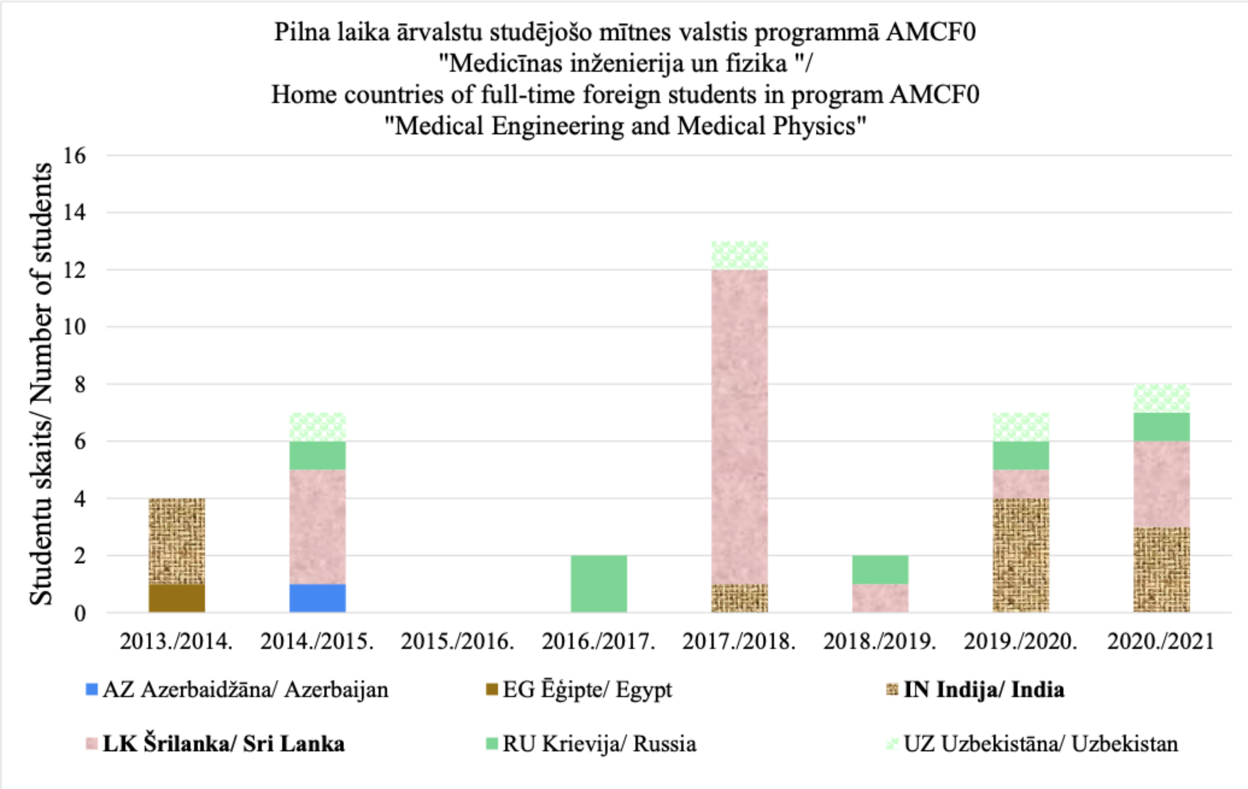
The graph below shows the student statistics by semester, both the number of state budget financed seats and tuition fee covered seats, as well as the number of foreign students by semester.



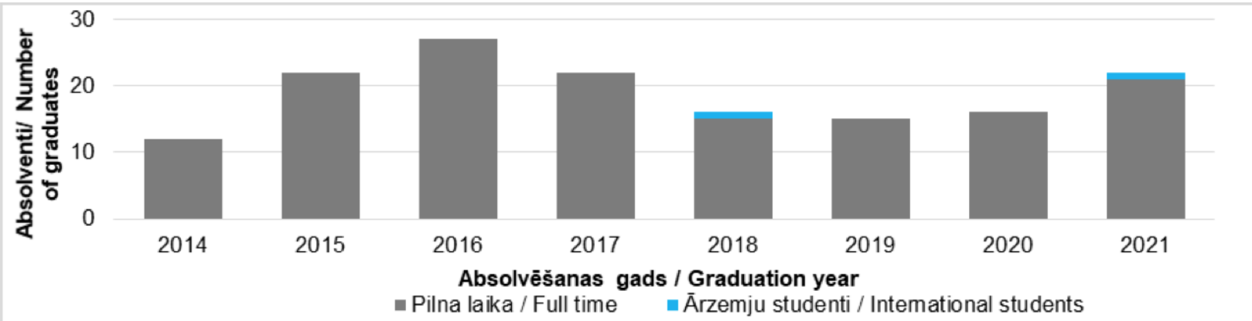

The graph shows that students continue completing their studies at the study program also in the 10th semester, here the academic years 2015/2016 and 2016/2017 stand out, where there was a large number of students who completed and publicly presented their graduate papers in the 10th Spring semester. This is due to the fact that many of the students who had been expelled wished to complete their studies, there were students who had studied some 8 years ago and returned to studies with a goal to acquire a degree and qualification, respectively, also the diploma for graduating the program.

The study program is also offered to foreign students, whose admission dynamics have increased over the years, although the number of students enrolled in the last 2 years is relatively low.

Foreign students pay for their studies. Students from different countries choose to study at the RTU Bachelor study program "Medical Engineering and Medical Physics" – from the former post-Soviet countries such as Uzbekistan, Russia, Azerbaijan, as well as from Asian countries, such as Sri Lanka and India.




The number of graduates of the study program can be seen in the graph below:




In the academic years from 2015 to 2017, the number of graduates increased, while only 2 students from the Foreign Students Department ended up graduating the study program - they presented their Bachelor Papers and engineering projects. The following students graduated the Bachelor study program "Medical Engineering and Physics" – Lev Stont, Karthikeyan Priya.

The most outstanding RTU alumni are included in RTU Golden Fund, judging by both academic achievements and public activities. Each year at least one graduate from each study program graduated by more than five students in the respective semester and whose average mark is at least 7 (good)[1] is included in the Golden Fund.

In academic year 2013/2014 **– Pāvels Kovaļovs**

In academic year 2014/2015 **– Sandra Bikova**

In academic year 2015/2016 **– Ksenija Huševa**

In academic year 2016/2017 **– Rūdolfs Latišenko**

In academic year 2017/2018 **– Diāna Viktorija Broka**

In academic year 2018/2019 – **Kristaps Paļskis, Igors Suharevskis**

In academic year 2019/2020 **– Baiba Kliemane, Laura Antra Grikke, Mārtiņš Ļuļļa.**

The following students graduated from the study program "Medical Engineering and Medical Physics" having received diploma with distinction **- Sandra Bikova, Kristaps Paļskis, Marija Raklinska**.

[1] "Regulation of RTU Golden Fund"
https://www.rtu.lv/writable/public_files/RTU_rtu_zelta_fonda_nolikums_2018.pdf

**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 origins of the joint RTU and RSU study programme "Medical Engineering and Physics" can be traced back many years, when RTU implemented its study programme medical study courses by RSU teaching staff with whom the Company's contracts were concluded. Of course, during this time there was a problem with how it would be possible to organize studies using RSU equipment, resources – in anatomy, physiology and microbiology classes. Most of this lesson was held only in theory precisely for this reason. Accordingly, the idea was to develop this study programme as a joint one, where medical study courses will be implemented by RSU as a tradition, an experienced university that prepares specialists in the field of medicine and health care – pharmaceuticals, industrial pharmacy, clinical pharmacy, medicine, health management, biomedicine, audiology, occupational therapy, physiotherapy, orthotics, prosthetics, nutrition, physiotherapy, art therapy, rehabilitation, etc., which has the necessary theoretical and material technical base and, in turn, engineering study courses – RTU. RSU provides not only a theoretical basis for medical study courses, but also an engineering base – equipment used by the RSU MF Department of Clinical Skills and Medical Technologies – simulated simulated simulated hospital wards with equipment. Students also gain practical experience in working with the use of various equipment in practical classes in hospitals. Joint cooperation between RSU and RTU takes place by organizing clinical internships for students, and some students are also developing their final works related to RSU issues and projects.

## 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 academic staff of the Institute of Biomedical Engineering and Nanotechnology collaborates with professional organizations in Latvia, such as Latvian Medical Engineering and Physics Society (LMIFB), the Association of Mechanical Engineering and Metalworking Industries of Latvia (MASOC), etc., as well as international professional organizations (associations) such as the International Federation of Medical and Biological Engineering (IFMBE), European Association of Nuclear Medicine (EANM), the International Organisation for Medical Physics (IOMP), etc. The objectives and tasks of the study program are designed considering recommendations from these organizations concerning the requirements of the profession worldwide and in Europe. The future vision of the professional Bachelor study program is implemented considering the professional opinion of students, graduates, and employers and in accordance with the mission and vision, aims and tasks of RTU. When a new study course is developed, the academic staff presents its content, learning outcomes to the methodological meeting of BENI, the content and volume of each study course corresponds with the specified content for acquiring the relevant skills and knowledge. The content and requirements of each study course are defined in the study course descriptions. Each study course plays an important role in achieving the goals of the whole program. Mapping of the study courses has been developed, which is necessary to ensure that the learning outcomes of the study courses would correspond to the learning outcomes of the study program, as a result, students would be provided with the necessary knowledge, skills and competences that are specified in the professional standard of Medical physical technology engineer.

The study program is structured to ensure logical and sequential acquisition of knowledge, skills and competences, starting from mastering the general study courses and continuing with field specific study courses that focus on creating new products.

The program includes study courses that allow developing and educating highly qualified and socially responsible specialists in the field of medical engineering and physics, who possess relevant knowledge, skills and competences for professional work with medical devices, equipment and instruments used in medicine and understanding of their construction, physical and technical principles of operation, production technology, conditions and safety of use; with practical work skills for using medical devices - their purchase, use, adjustment and quality management, as well as skills for performing technology planning and management, dosimetry of patients and personnel.

Medical physicists and medical physical technology engineers must have an idea, general knowledge of the structure of the human being, its peculiarities, physiology. An important role is played by the acquisition of medical study courses provided by the partner institution of the study programme Rīga Stradiņš University and its lecturers.

The academic staff constantly carries out the identification of new trends in the field and follow the trends of the labor market development. Academic staff with sufficient experience in the field of medical engineering and physics is involved in the realization of the study program. Regularly invited guest lecturers have a significant impact on the changes in the study course curriculum. These are the experts in the field and company representatives whose work is related to medical technologies and innovations. Guest professors from other countries are also invited. All of the above-mentioned activities ensure integration of the topical experience and specific knowledge into the study process, the relevance of the study course curriculum and compliance with industry development trends are maintained.

The members of the Bachelor Paper Examination Committee provide an opinion of the students' knowledge and the conformity of students' works to the newest trends in the relevant field after the presentation of the papers. The Bachelor Paper is a scientific and practical work that shows the student's theoretical knowledge in medical engineering and medical physics, the analyzed literature sources and statistical data, assessment of the efficiency of realization variants and offered alternative solutions. Students demonstrate strengthened ability to publicly present and defend their research and solutions. In order to ensure the conformity of the study program to the newest scientific achievements, students actively participate in scientific research, take part in RTU students' scientific conference where they present their research results.

Since the last accreditation, the curriculum of the study program has been updated in order to make study content topical, complementary, conforming with the program aims and ensuring the achievement of learning outcomes, as well as conforming with the requirements of the profession of a medical physical technology engineer and the newest scientific trends. Work was carried out to improve the curriculum of the study program in accordance with modern requirements and requirements of profession standards, the decision made by RTU Senate on March 23, 2015 "On the unified requirements for Riga Technical University programs", in collaboration with employer representatives and program advisers, improvements of the program structure were made by adding new study courses, as well as making curriculum related changes in the study courses in order to ensure that they meet the requirements of the current market and profession standards. More voluminous study courses have been created at the study program, which also include the information from the previous study courses which has been updated according to the current trends, for example, 3 study courses have been combined into one - "Medical Instruments, Equipment and Systems", "Physiological Measurements", "Measurement Technologies in Medicine". The curriculum of the study program was improved in collaboration with the industry representatives so that students gain comprehensive knowledge in the professional field and will be able to use it in practice, and would be competent to independently analyze information, make decisions and demonstrate that they understand professional ethics.

Riga Technical University is a state-founded derived public person with self-governing rights. Its development strategy states the role of the university as a higher education institution in society, its mission, vision, aims and tasks. In the course of development of the RTU development strategy, awareness of the university's role in the growth of the Baltic Sea region and shaping the future of Latvia, European Union priorities as well as the guidelines of the national and regional level education and innovation policy planning documents have been considered. The study program meets the main premises of Riga Technical University Strategy and Development Program.

In order to realize RTU vision to become the leading science and innovation university in the Baltics, the strategy defines three aims of the university - high quality study process, excellent research, as well as sustainable innovation and commercialization activities. The mission of RTU is to provide the national economy of Latvian and society with internationally competitive high-quality scientific research, higher education, technology transfer, and innovation. The aim of high-quality study process is internationally competitive and creative specialists possessing analytical abilities that are trained in prestigious, internationally recognized high-quality studies, and who ensure the development of the economy of Latvia and who have the ability to study throughout their lives. The aim of excellent research is high-quality scientific research that meets the needs of the Latvian and international economies, implies wide involvement in international, state and field research programs, which is integrated in the study process. The aim of sustainable valorization is development of an effective environment for technology transfer and innovation development, which contributes to the creation of new technological companies and product creation.

The study process is organized so that the study and research work topics for students would include relevant issues in the field. The topics of the students' graduate papers, ideas for their realization come from the companies working in the field - medical institutions, medical equipment service centers. Guest lecturers from different Latvian companies regularly participate in the realization of different courses at the study program, guest lecturers from foreign countries are also invited. In collaboration with foreign higher education institutions, summer schools are organized on the most important topics in the field. This way for several years in a row BENI academic staff took part in organizing the summer schools – RTU and University of Trieste organized a summer school for any student from the European Union, who is interested in innovation in the field of medical engineering and physics "Nonlinear life”.

### 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).

Not 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 professional Bachelor study program is carried out in the form of lectures, practical classes, company visits, as well as independent studies, students master the basics of medical engineering and physics, their relevance to other related fields. All courses included in the study program are linked to the aims and tasks of the studies, as well as the learning outcomes. By mastering the study courses, students shall obtain knowledge, skills and competences specified by the profession standard.

Analyzing the connection between study program aims and learning outcomes with the information included in study courses, learning outcomes, aims and other indicators, and their compliance with Cabinet Regulations No. 512 "Regulations on the state standard of the second level professional higher education", approved on 26 August, 2014, it can be concluded that:

- The strategic goal of the study program has been developed to ensure professional studies based on the theoretical foundations of the research field and applicable in practice, appropriate for economic, cultural, state defense and safety, as well as public needs;
- The curriculum of the study program provides a body of knowledge, skills and competences in accordance with the knowledge, skills and competence specified in the framework of Level 6 of the Latvian educational classification. The main parts of the program are: study courses;

internship outside the educational institution; state examination, which included the presentation of the Bachelor Paper and engineering project;
- The tasks of the study program are designed to educate students, ensuring Level 5 qualification, which corresponds to Level 6 EQF, facilitating their competitiveness in the changing social-economic conditions in the international labor market.

The tasks of the program are:

- To provide students with a broad, professional, practically oriented education that ensures easy adaptation to the labor market as well as the ability to carry out scientific research;
- To provide students with theoretical and practical training in accordance with Level 5 of professional qualification that provides the opportunity to obtain qualification as well as to continue their education at the Master level studies;
- To ensure acquisition of modern general knowledge, develop economic and professional thinking, to facilitate the analytical abilities of students, to develop student skills for solving professional problems and tasks, project development that would allow graduates to be involved in solving business problems;
- To develop students’ ability to work in a team and cooperate with professionals from different fields, to develop foreign language skills that would provide opportunity to collaborate with colleagues from other countries.

The content and scope of the examinations comply with the curriculum specified in the course descriptions and requirements towards professional qualification skills and knowledge. All conditions for obtaining credits points are described in the description of each study course.

The study system is developed in accordance with the Education Law, Law on Higher Education Institutions, and Vocational Education Law in a way to maximally facilitate the achievement of aims set in the study programs and to facilitate the performance of tasks. The study system in a higher education institution is governed internally by the documents regulating the relations between the students and the university, the documents regulating the course and organization of studies.

The professional Bachelor study program "Medical Engineering and Medical Physics" has been developed in accordance with Cabinet Regulation as of 26 August, 2014 No. 512 "Regulations on the state standard of the second level professional higher education" and the decision of RTU Senate of 23 March, 2015 "On the unified requirements for Riga Technical University programs". The volume of the study program and its structural distribution are in accordance with the state education standard. The volume of the study program and study courses is expressed in credit points. The structure of the study program is as follows.

| Components of the study program | Volume CP | % of the total volume of the study program |
|---|---|---|
| **A. Compulsory study courses** | **118 CP** | **65.56** |
| A1. General education study courses | 14 CP | 7.78 |
| A2. Field specific theoretical basic study courses and IT study | 42 CP | 23.34 |
| A3. Field specific professional study courses | 62CP | 34.45 |
| **A. Compulsory elective study courses** | **19 CP** | **10.56** |
| B1. Field-specific study courses of professional specialization | 11 CP | 6.12 |
| Specialization "Medical Equipment" | 11 | |
| Specialization "Medical Physics and Nanomedicine" | 11 | |
| Specialization "E-Medicine" | 11 | |
| Specialization "Medical Electronics" | 11 | |
| Specialization "Biomechanics and Assistive Technologies" | 11 | |
| Specialization "Medical Materials" | 11 | |
| Specialization "Medical Engineering Business" | 11 | |
| B2. Humanities and social sciences study courses | 4 CP | 2.23 |
| B6 Languages | 4 CP | 2.23 |
| **B. Free elective study courses** | **6 CP** | **3.34** |
| **C. Practical Placement** | **25 CP** | **13.89** |
| **D. Final examination** | **12 CP** | **6.67** |
| **Total** | **180 CP** | **100 %** |

At the start of their studies, students receive a short informative material that contains the most important information for the student on the organization of studies and their practical realization. In order to ensure the achievement of the aims and tasks of the program, during the first and second year, compulsory study courses, general education study courses and joint field study courses are carried out, they make up the foundations for acquiring special knowledge and skills throughout further studies.

In order to ensure interaction between graduates' knowledge, competences and skills, during the realization of the study courses, special emphasis is made on:

- Reflection of the current problem situations in the curricula of the study courses (at lecture, practical work level),
- The use of modern teaching methods (specialized computer software solutions, solution-focused methods, etc.);
- Method development in collaboration with foreign experts.

Individual approach is provided to the students:

- study materials are provided for each of the courses, both handouts and electronic materials and presentations;
- each lecturer has a specific tutorial time, which students are informed about when starting the course or the student may apply for an individual tutorial in Ortus system.
- individual approach is considered when choosing the applied methods - individual topic for independent work, study project, as well as Bachelor Paper;
- regular communication with students via e-mail and Ortus environment.

During the realization of the study program, mutual feedback is regularly provided. Students receive regular feedback from the lecturers on submitted credit tests, courses, exams, study projects, reports, internship reports and presentations. In turn, academic staff at the end of the course may conduct a survey on the students' satisfaction with the course content, their desires as well as hears out proposals. Students can realize their participation in the improvement of the study process by expressing their opinion to the academic staff of a particular study course or the administration of the study program. The study courses included in the study program are student-centered as different previous knowledge, skills, and experience of the students are considered, thus applying individual learning methods to each student. The academic staff works with the students in small groups, which makes it possible to use the most appropriate pedagogical methods. The study process is organized in such a way that students acquire both theoretical knowledge and practical skills. Various forms of training are used during the study process: lectures, seminars and discussions, business games, individual and group works, presentations, guest lectures and seminars. Classes are interactive, students are invited to discuss different aspects of the topic of the lecture, take part in decision making and problem solving.

Evaluation of the study courses takes into account active participation of students during classes by working individually and in groups, taking part in discussions, completing independent work, their ability to present their research result. In accordance with the decisions made by RTU Senate, summative performance evaluation method is used for evaluating studies. Within all study courses, the evaluation structure consists of the student's work throughout the semester, their independent work and examination work component shall not exceed 50 % in the evaluation structure. When starting a new study course, students are introduced to the evaluation criteria and methods of the respective study course. The evaluation results are designed to achieve the learning outcomes of the study course, and students receive feedback.

The learning outcomes are evaluated in accordance with Paragraph 1 of Section 15 of the Law on Higher Education Institutions and RTU Regulation on the Assessment of Learning Outcomes. Evaluation is carried out according to the 10-point grading scale.

The implementation of the study courses of the RSU part of the study programme is carried out in accordance with the RSU Internal Rules of Procedure and the RSU Code of Ethics. The student has the opportunity to take the examination, course examinations 2 times during the current session, or during the session extension, moreover, when taking the examination for the second time it is evaluated by the invited composition of the commission. If the exam is not passed, the student must re-acquire the study subject at the next offered study period for a fee.

**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).**

Internship is an integral part of the study program; its goal is to develop student's professional skills and competences in a professional environment, as well as to strengthen the knowledge in accordance with the requirements included in the profession standard. Internship within the professional Bachelor study program "Medical Engineering and Medical Physics" amounts to 25 CP. According to the Law on Higher Education Institutions, 1 CP is equal to 40 hours of workload. The internship is organized in accordance with RTU Senate decision of 28 January, 2019 on the new edition of the "Internship Management Procedure at Riga Technical University" and BENI institute General Internship Guidelines. As a result of the internship, the student must be trained for the development of an engineering project and the Bachelor Paper. In order to gradually achieve this goal and combine the theoretical knowledge acquired during the studies with problems solved in real life situations, in accordance with BENI institute General Internship Guidelines, the Internship is organized in 4 stages (the planning is provided in the Appendix):

1) ***Internship for basic skill acquisition*** (the student acquires the basic skills in material mechanical processing and assembly of electronic/electrical circuits, the internship is planned for the 2nd year students of the Bachelor program, internship duration - 4 weeks). The tasks and methodological instructions of this stage are specified in the "Methodological instructions of the basic skill acquisition internship". Place of internship: mechanical workshops, the laboratory of the Institute of Biomedical Engineering and Nanotechnology. The basic internship is organized at Riga Technical College, where access to workstations is provided for all students simultaneously.

2) ***Clinical internship*** (the student acquires basic skills for working with diagnostic and therapeutic equipment and systems in a clinic, the internship is intended for 3–4-year Bachelor program students, internship duration - 8 weeks). The tasks and methodological instructions of this stage are specified in the "Methodological instructions of the clinical internship". Place of internship: diagnostics departments of medical institutions, radiation therapy department of medical institutions.

3) ***Research internship*** (the student learns the basic skills of research development, the internship is intended for 4th year Bachelor program students, internship duration - 5 weeks). The tasks and methodological instructions of this stage are specified in the "Methodological instructions of the research-scientific internship". Place of internship: companies or organizations that provide the development opportunities for the Bachelor Paper research.

4) ***Design-engineering internship*** (the student acquires basic skills in the design and maintenance of mechanical, electrical, electronic systems of medical equipment as well as the completion of the relevant technological processes and implementation in the production technology, upon the completion of the internship, the student shall select the topic for the engineering project, the internship is intended for 4–5-year Bachelor program students, internship duration - 8 weeks). The tasks and methodological instructions of this stage are specified in the "Methodological instructions of the constructor-technological internship". Place of internship: construction and manufacturing companies, medical equipment service companies, medical equipment maintenance departments at medical institutions.

***Bachelor's professional study programme "Medical Engineering and Physics" practice plan by semester***

<table>
<tr><th>Title of internship</th><th colspan="3">Basic skills practice</th><th colspan="2">Clinical practice</th><th colspan="2">Research-scientific practice</th><th colspan="2">Constructor-technological practice</th></tr>
<tr><td>Type of traineeship</td><td colspan="2">Mechanical practice</td><td>Electrical/Electronic practice</td><td>Use of diagnostic equipment</td><td>Use of equipment involved in radiation therapy</td><td colspan="2">suicidal work</td><td>Practice of design and manufacture of mechanical equipment</td><td>Practice of design and manufacture of electrical/electronic equipment/devices</td></tr>
<tr><td>Year of study</td><td colspan="3">2</td><td colspan="2">3</td><td colspan="2">4</td><td>4./5.</td><td>5</td></tr>
<tr><td>Semester</td><td>3</td><td colspan="2">4</td><td>6</td><td colspan="2">7</td><td colspan="2">8</td><td>9</td></tr>
<tr><td>Duration of internship, weeks</td><td>2</td><td>1</td><td>1</td><td>4</td><td>4</td><td>2</td><td>3</td><td>4</td><td>4</td></tr>
<tr><td>Place</td><td colspan="2">Practice at RTK</td><td>BINI Electronics Lab.</td><td>Medical institution diagnostic department</td><td>Medical institution radiation therapy department</td><td colspan="2">Companies or organisations providing research unit development opportunities</td><td>Construction and production companies</td><td>Construction and production companies</td></tr>
</table>

As a partner institution, RSU promotes, helps to solve problems related to the organisation of clinical practice.

The head of the BENI institute selects the internship coordinator at the institute. The place and time of the internship is determined by the internship coordinator, and it is confirmed by the head of the BENI institute. The student may also search and choose the place of practice independently, having agreed with the internship coordinator. The internship coordinator sends the necessary information for preparing the internship contract - the details and tasks of the place of internship to the head of the FMETA faculty training office. The internship coordinator also prepares the internship log, which the student fills out during the internship. The internship log is signed by the RTU internship coordinator, the student and the internship supervisor at the place of internship. The supervisor at the place of internship is an employee of the company, who has higher education in the specific field and/or work experience in the specific field. Students can get acquainted with the internship regulatory documents at the BENI institute website in section Training/Internship Guidelines (http://bini.rtu.lv/prakses-vadlinijas/). At the end of the internship, the student submits a filled out and signed internship log, as well as an internship report, which has been drawn up in accordance with the requirements specified in the methodological instructions to the internship coordinator. The internship is presented publicly, in accordance with the requirements specified in the methodological instructions of the internship stage and RTU Senate decision. The internship reports and logs are kept at the BENI institute until the exmatriculation of the student. The student may also undertake internship abroad, for example, during ERASMUS mobility. Possible internship places for BENI students:

- State LTD “Paul Stradins Clinical University Hospital”, Reg. No. 40003457109, Radiation therapy, medical equipment service and maintenance at the hospital;

- LTD “Riga Eastern Clinical University Hospital”, Latvian Oncological Center, Reg. No. 40003951628, Radiation therapy, medical equipment service and maintenance at the hospital;
- LTD "Daugavpils Regional Hospital", Reg. No. 41503029600, Radiation therapy, medical equipment service and maintenance at the hospital;
- LTD “Liepaja Regional Hospital”, Reg. No. 42103041306, Radiation therapy, medical equipment service and maintenance at the hospital;
- State LTD “Children Clinical University Hospital”, Reg. No. 40003457128., Radiation therapy, medical equipment service and maintenance at the hospital;
- LTD “Rēzekne Hospital”, Reg. No. 40003223971, Medical equipment service and maintenance at the hospital;
- LTD "Medicīnas sabiedrība ARS", Reg. No. 40103021886, Diagnostical radiological procedures, medical equipment service and maintenance at the medical establishment;
- LTD Stereotaktiskās radioķirurģijas centrs "SIGULDA", Reg. No. 40103771667, Radiation therapy, radiosurgery;
- Riga Stradins University Medical Education Technology Centre (METC), Reg. No. 90000013771, Medical simulation technologies;
- JSC "Latvijas Jūras medicīnas centrs", Reg. No. 40003306807, Radiological diagnostics, doze monitoring in the radiological diagnostics labs;
- LTD "Medicīnas sabiedrība Gaiļezers", Reg. No. 40103019330, Kidney disease curing technologies, kidney replacement technologies;
- LTD "VIA UNA", Reg. No. 40003120404, Applications of the diagnostic ultrasonography equipment and X-ray equipment in the medical clinic, work of a clinical laboratory;
- LTD “INLAB”, Reg. No. 40103522689, Dosing for the patients in X-ray diagnostics and computer tomography manipulations;
- LTD "Kodolmedicīnas klīnika", Reg. No. 40103852116, Manufacturing of radiopharmaceuticals;
- Society "For Latvian Children with Disabilities", Reg. No, 40008063822, Physiotherapy for the children with movement disabilities;
- JSC "Protezēšanas un ortopēdijas centrs", Reg. No. 40003012251, Manufacturing technologies of orthoses and mechanical auxiliary means and their applications in therapy/rehabilitation;
- LTD “Medicīnas sabiedrība ARS”, Reg. No. 40103021886, Technical maintenance and service of the medical equipment at the hospital, sterilization of the surgical tools;
- LTD “INLAB”, Reg. No. 40103522689, Testing of the electric safety and functionalities of the medical equipment, its calibration, verification, testing of ionizing radiation sources;
- LTD “A.Medical”, Reg. No. 40103599415, Medical device sale, assembly, repair, maintenance;
- LTD “Arbor Medical Korporācija”, Reg.,No. 40003547099, Medical device sale, assembly, repair, maintenance;
- LTD "NMS Elpa", Reg. No. 440003348336, Medical device sale, assembly, repair, maintenance;
- LTD "KJ Serviss", Reg. No. 40003634216, Medical device sale, assembly, repair, maintenance;
- LTD "Medeksperts", Reg. No. 50003336771, Medical device sale, assembly, repair, maintenance;
- Siemens Healthcare Oy department in Latvia, Reg. No. 40103906527, Medical device sale, assembly, repair, maintenance;
- LTD "Baltic Scientific Instruments", Reg. No. 40003176361, Design of radiation detectors;
- LTD “REHAD”, Reg. No. 40103854615, Manufacturing technologies of orthoses and mechanical auxiliary means;
- LTD “Quantum Latvija”, Reg. No. 40003418012, Laboratory equipment sale, repair,

maintenance, calibration and testing, provision of laboratory equipment software support

- LTD "Baltic3dEU", Reg. No. 42103066210, 3D printing technologies;
- LTD “MASS PORTAL”, Reg. No. 40103538800, 3D printing technologies, 3D printer manufacturing;
- LTD “Vizulo”, Reg. No. 40103590897, LED luminaire design and production;
- LTD "IPS Optics Latvia", Reg. No. 40103009686, Production of optical instruments;
- LTD “BIO NAMS”, Reg. No. 41503028889, Design and production medical furniture;
- LTD "Baltijas Dialīzes Serviss", Reg. No. 40003651502, Sale, installation, maintenance and repair of haemodialysis equipment;
- LTD “InterMed”, Reg. Nr. 0203044527, Planning of medical technologies in state and municipal or private medical institutions.

RTU FMETA, place of internship and the student enter into a tripartite internship agreement (the sample of the agreement is available in RTU Senate decision of 28 January, 2019 on the new edition of the "Internship Management Procedure at Riga Technical University ", where duties, rights and liability of all parties are specified. If the agreement is concluded with an internship place abroad, a tripartite agreement in English and in Latvian is concluded. Annex 1 of the agreement shows internship tasks. Internship tasks are developed for each student individually, considering the field of the internship place. The internship tasks are developed by the BENI internship coordinator in coordination with the student and the internship supervisor at the place of internship. The tasks of the internship are shall also be written in the internship log.

### 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.

Upon completion of the studies, the graduate of the professional Bachelor higher education program must, using the theoretical basis and skills, be able to perform professional, innovative, and research activities, as well as be able to formulate and analytically describe information, problems and solutions. Upon completion of the program, student shall develop a Bachelor Paper devoted to a topical problem in the field, it must be innovative.

A large part of the topic of the final theses stems from the problems that have been noticed during the Clinical Practice. About 80% of the topics of bachelor's and engineering projects are issues raised by medical physicists, various doctors-clinicians

Students acquire research skills by regularly working with literature and internet resources in order to successfully develop various study papers, internship reports. Thus, the scientific-research work of the students is also promoted i.e., the work with international scientific data bases that are available at RTU Library with electronic access from ORTUS environment, the information sources and materials necessary for Bachelor Papers are also compiled during the Scientific Research Internship. When presenting the Clinical Internship Reports, the student must have a clearly formulated Bachelor Paper topic, which throughout further development of the topic and conducting the first experiments is "adjusted", clarified.

Graduation papers - both Bachelor Papers and engineering projects, are developed in accordance with "Regulation on Final Examinations at Riga Technical University" of 26 April 2021 and detailed methodological guidelines developed by BENI. These documents are available at Ortus portal at the relevant study course pages - "Bachelor Paper" or "Engineering Project". The student is informed about these requirements when starting work on the relevant graduation paper. 1 year is devoted to the development of each graduation paper. During the first half of the year, the student shall select a topic they are interested in, plan how much time is necessary for writing each chapter, experiment planning, etc. In order for the student to complete the graduation paper - Bachelor Paper or engineering project - the student shall fill out two documents, one of which is the justification of the topic and tasks of the Bachelor Paper or engineering project and a Bachelor Paper or engineering project work task that is signed by the student, scientific adviser, consultants, and the head of the study program. When developing the Bachelor Paper, students are able to present their specialized knowledge and skills necessary for the profession.

Bachelor Papers and engineering projects are presented publicly, and a State Examination Committee appointed by the Rector of RTU is created, which includes professionals in the field of medical engineering and physics. The papers are evaluated by reviewers approved by the Dean of FMETA.

After each Bachelor Paper presentation, the SEC provides a report, joint evaluation of the developed Bachelor Papers and engineering projects, their quality, topicality in the field and mean student assessment. The Presentation Minutes are filled out during the presentation of the Bachelor Papers, in which the questions and the resulting assessment are reflected.

At least one representative from the RSU partner institution is invited to join the State Examination Commission, who will contribute to the final evaluation.

The topics of the graduation papers of the students are topical, meet the aims of the program, ensure the achievement of the learning outcomes and meet the needs of the field. The State Examination Committee notes the high quality and usefulness of works in the professional sphere. Information on the presented Bachelor Papers and engineering projects (see Annex for the BP themes).

## 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.

RTU funding from the State basic budget shall be formed according to the list of study programmes and the number of students in the programmes - basic funding for studies, which consists of funds for utility payments, taxes, maintenance of infrastructure (i), the purchase of equipment and equipment and staff salaries, as well as funding for scientific activities. The number of study places is determined by the Ministry of Education and Science. The financial reference amount of studies from the State budget funds shall be allocated to full-time studies. The amount of the study base funding is determined by justifying the number of study places specified by the State of RTU, as well as the basic costs of the study place and the coefficients of study costs in the thematic fields of education.

RTU funding from the State basic budget for the provision of study places in the relevant study year shall be distributed in accordance with the decision of the RTU Senate "On methodology for the distribution of basic budget, performance funding and paid student funds, etc. RTU structural units “the procedure established in the relevant academic year. This methodology has been revised in a new version in the light of the necessary changes.

The financial security of the Bachelor's professional study programme "Medical Engineering and Physics" takes place using the budget of the BINI State grant, contributions from deductions of "paid students" and "other funds" research projects in proportion:**78%/14%/8%** (total 342 kEUR). The research budget consists of RTU, LZP, ERDF, ESF, European Commission and service projects. A full-fledged material base has been provided for the implementation of the programme, which is located at both RTU and RSU. The material-technical base of the study courses, which are also implemented for other study programmes (for example, mathematics, physics.c, etc.) are located in RTU institutes and departments. The base includes: textbooks, methodological materials, audiences equipped for the implementation of lectures, practical and laboratory work. RSU provides its own material and technical base for the implementation of RSU courses, which is also used for other programmes students and their training.The material base includes: textbooks, methodological materials, equipped for lectures and practical classes audiences. For the implementation of professional specialization study courses (A3) of the field, the material base located at RTU Institute of Biomedical Engineering and Nanotechnology (BINI) includes: textbooks, methodological materials, equipped for lectures and practical classes audiences and laboratories (courses Radiation and environmental safety in medicine, Physical basics of medical display, Medical instruments, equipment and systems, Spectroscopy methods in medicine, Electronics in medicine, Micro- and nanotechnologies, Biomaterials).

BINI is located in:

- the only medical diagnostic equipment laboratory in the west-north region of Europe, equipped with the widest range of equipment;

- laboratory for the characterization of materials and nano-objects, including pantry photoelectron and exoelectron spectroscopy, infrared and FTIR spectroscopy, FTIR ATR spectroscopy surface analysis; XPS, Oze, SIMS spectroscopy; AFM, STEM and optical microscopy; micro and nano indentation methods;

- radiation dosimetry apparatus;

- apparatus for the assessment of the quality and safety of medical diagnostic equipment;

- apparatus for the measurement of bioelectric signals for analysis;

- biochip laboratory;

- powder materials laboratory;

- machine tools and 3D printing equipment for prototyping;

- electronic components and tools for assembling and testing electronic devices;

- and others.

The equipment is being renovated with grants from the ERDF, the International Atomic Energy Agency, as well as with donations from various medical companies and private persons. The material base for ensuring professional specialisation study courses in the sector is located in RTU institutes and departments. The base includes: textbooks, methodological materials, equipped audiences and laboratories equipped for lectures and practical classes (basics of biomaterials and biomechanics, Electronics in medicine, Heat training, Biological signal analysis, Technical mechanics, Material resistance, Image recognition and image processing methods in medicine, Computerized decision-making in medicine; Basics of artificial intelligence in medicine; Computer graphics basics, Electronic elements and electronic equipment design, Basics of biomaterial technology, Medical textiles, Functional medical implants, Health care organization and economics). The material base is also used to train students of the study field. For internships, students use a material-technical base for the development of bachelor's thesis/engineering project, which is located at the place of development of the work/project (enterprises, scientific laboratories, health care systems institutions (hospitals, etc.)). All mentioned technologies are available to students and academic staff on a daily basis. For improvement of methodological and informative provision, teaching staff develop methodological materials. Equipment, tools are purchased and serviced in accordance with procurement procedures. Similarly, the purchase of books takes place. Given the budget shortfall, internet resources are used, which can be used thickly in such a way that only "read from the screen" is allowed. The digitisation of existing teaching aids and the production of study films are taking place, demonstrating the burst of laboratory work. Moodle environment (ORTUS interface), rtu.lv, bini.rtu.lv and others are widely used. Pandas and elevators are provided for students with special needs.

Considering that RSU is a partner university, part of the funding is also used for the implementation of the study programme "Medical Engineering and Physics". The funding of RSU Study Programmes is also made up of State funding for higher medical education and revenue from students studying at the expense of natural or legal persons. Due to high demand, the share of private funding has increased significantly in recent years, much of which is made up of English-language programmes. Along with the increase in the number of students, the total amount of funding has also increased in recent years. Stable revenue growth provides opportunities to invest in further improvement of the study process by directing additional funding to attract guest lecturers and upgrading infrastructure. In order to ensure the balance of the RSU budget and to maximize the efficient use of the university's resources and the availability of the material and technical base, the available material and technical support for the implementation of study programmes is EUR 14.6 million. excluding buildings and general IT infrastructure. Almost a third of these fixed assets have been purchased in the last 5 years, which indicates that the material and technical base is being updated regularly enough. The RSU Library and its branches have books on the total value of the library's collections of EUR 1 408 032 and equipped computer classes and office equipment for a total of EUR 187 815, students have access to electronic catalogues: the RSU Library Electronic Catalogue and the Electronic Catalogue of Libraries of National Significance, as well as a database of publications and doctoral theses of RSU academic staff, which can also be used by students of the joint study programme "Medical Engineering and Physics". Materials technical support of the RSU Medical Education Technology Centre at 26a Anninmuiza Boulevard Clinical Skills Training Centre offers to acquire clinical skills using various mannequins and simulation devices – from simple medical manipulations to complex simulations of operations that develop the skills and skills of prospective medical practitioners, thus improving the medical care of patients. Clinical skills training centre is a modern, prestigious and internationally recognized project that allows to provide high-quality medical education and consultations and where scientific research is carried out. The Centre is established with the aim of developing, implementing and evaluating clinical skills training programmes for medical students, residents, doctors and medical physicists and engineers that meet European standards.

Simulators are available, analogues of which are not found elsewhere in Latvia, for example, 3D training tables (dissection tables). More than 1.5 million euros have been invested in the modernisation of the Anatomical Order complex over the last two years. In addition to the renovation of the building, RSU has introduced a new concept in its anatomy studies, which envisages the use of modern IT technologies in the study process – for the first time a digital 3D anatomy study table has been installed in the Baltics, which allows to dissect the human body of both sexes in electronic form with a database of more than 60 000 pathologies.

**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).**

RTU finansial funding from the state basic budget consists of a study base funding corresponding to the list of study programs and the number of students, consisting of funds for utility payments, taxes, infrastructure maintenance (including data for the Register of Students and Alumni), purchase of inventory and equipment and staff salaries, fi funding for research activities. Funding for the study base is allocated from the state budget for full-time studies. The amount of funding for the study base is determined on the basis of the number of study places determined by the state at RTU, as well as the base costs of the study place determined by the state and the study cost coefficients for the thematic areas of education. RTU fi funding from the state basic budget for the provision of study places in the respective academic year is distributed in accordance with the RTU Senate decision “On the Methodology for Allocation and Use of Basic Budget, Performance Funding and Paid Student Funds to RTU Structural Units” in the respective academic year. This methodology is annually reviewed and approved in the light of the necessary changes. RTU has a decentralized budget and a separate budget is planned for each structural unit. For RTU structural units, the financial or budget year is from October to September of the following year, for this period the calculation and distribution of funding is performed:

- grant or basic budget funding (training of state budget students) is allocated as a monthly limit - 1/12 of the calculated annual funding is allocated to the structural unit per month;
- paid student funding (paid student training, including debtors' fee funds) is allocated twice a year (October and April) as a monthly limit - 1/6 of the calculated semester;

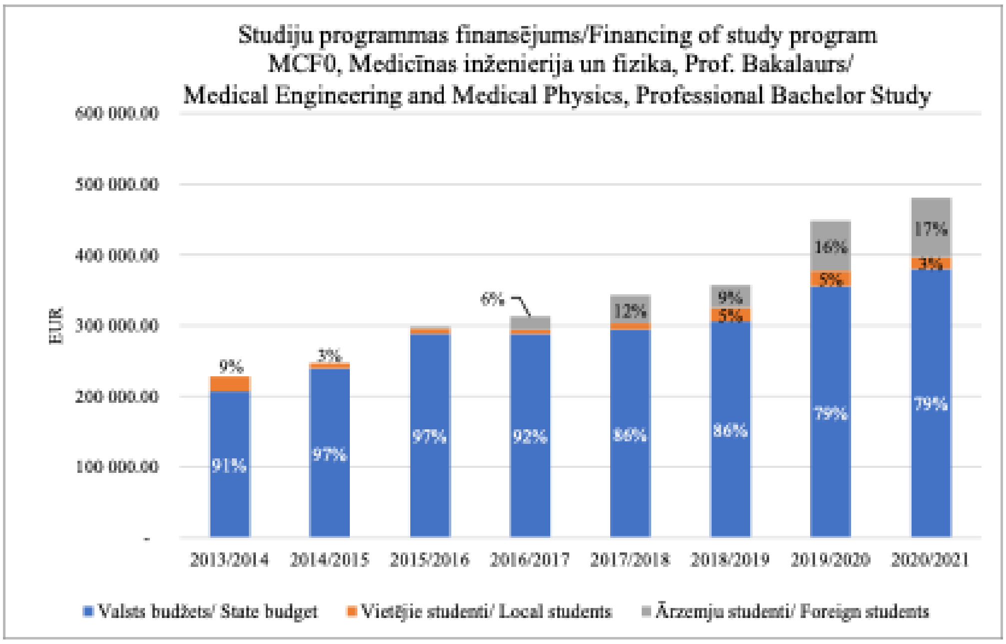
- fi funding is allocated to the structural unit per month - funding for scientific support is allocated as a monthly limit - 1/12 of the calculated annual funding is allocated to the structural unit per month.

In the process of determining the amount of funding, both the study cost coefficients of the thematic areas and the values of the study cost coefficients according to the level of the study program, as well as the number of students in the study program and the corresponding study courses are taken into account. Using the study cost coefficients of the thematic areas of education, it is possible to determine the amount of funding required for the implementation of the specific study program and study course. The RTU Senate confirmed that in the future the study cost coefficients of the thematic areas of education are applied individually to each study course included in the study program, thus ensuring an even more adequate amount of funding for the implementation of the study courses included in the study programs.

| Total | Total grant for the study program in EUR | Paid student funding | Research funding | Financing of 1 budget place |
|---|---|---|---|---|
| 341700 | 267000,00 | 48000 | 26700 | 1420 |

The table shows that approximately 78% of the total BINI funding is made up of state budget grant contributions, 14% of the total BINI funding is paid student fees, which make up both foreign students 'and local students' fees, the largest part of this funding is made up of foreign student fees. , 7% of the total BINI funding is Science funding. The cost per budget place in the bachelor's professional study program is 1420 EUR, for foreign students 1411 EUR. The minimum number of places financed from the state budget to ensure the profitability of the study program is 137 students.

Costs per student within the study program are calculated by the Office of the Vice-Rector for Finance. Costs per student 2013-2020. averaged € 4,075.28. The number of study places is allocated after negotiations with the Ministry of Education and Science. The amount of study funding is determined on the basis of the number of study places determined by the state at RTU, as well as the base costs of the study place determined by the state and the study cost coefficients of the thematic areas of education.




Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

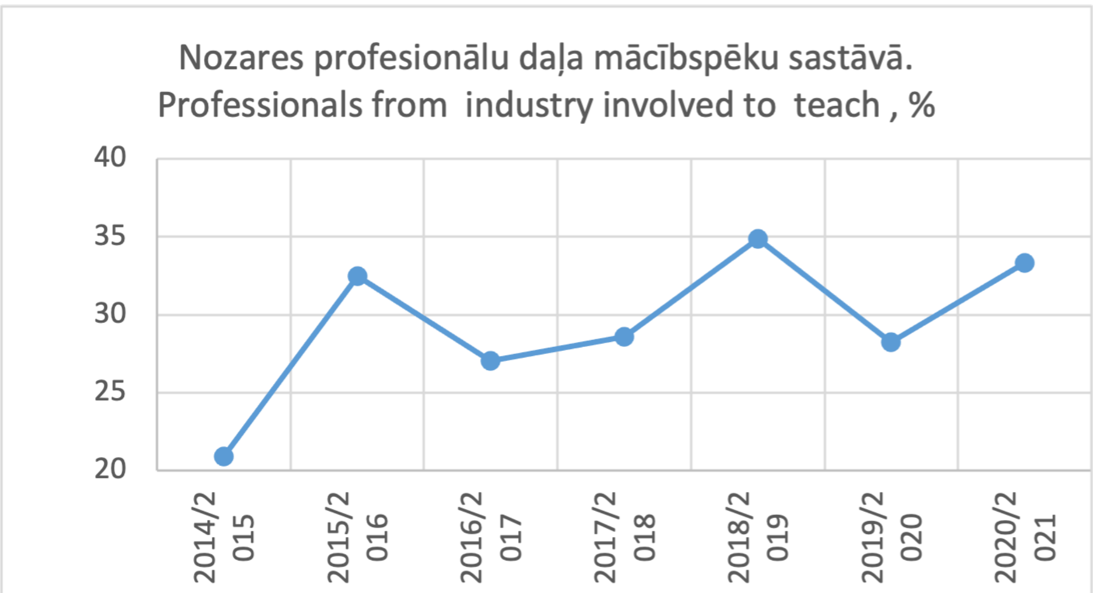
Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

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

The professional Bachelor study program is implemented by academic staff holding a degree of Doctor of Science and highly qualified professionals with relevant work experience, whose characteristics are reflected in their CVs and resumes. The list of academic staff and their curricula vitae and career development are included in the Annex. The academic staff shall meet the requirements for the implementation of the study courses. This is evidenced by the indicators of their characteristics in their resumes and CVs, as well as the scientific and methodological developments of the academic staff, their participation in international scientific and methodological conferences organized by RTU.

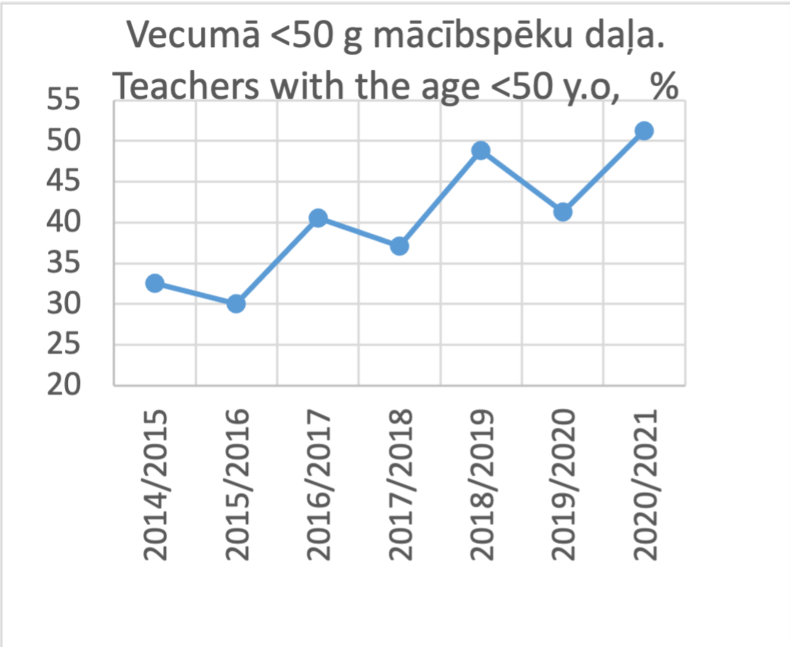
Professionals from the industry, combining their work at the company and academic activities, are invited to deliver individual professional specialization study courses in order to provide for implementation of the professional Bachelor study program. The participation of such professionals in the implementation of the study program has been increasing over the years (see the figure below).



The participation of such professionals in the study process helps improve the content of the study courses and, thus, the study program as a whole. Industry experts are also invited as guest lecturers or guest professors to present topics within a study course. The qualifications of the academic staff involved in the implementation of the study program comply with the conditions for the implementation of the study program and the requirements of the regulatory enactments. RTU academic staff, guest lecturers and PhD students are involved in the implementation of the study program. The study program is also implemented by employees who are involved in various scientific projects, so that the knowledge acquired in the projects can be transferred to the study program, improving the content of the study courses.

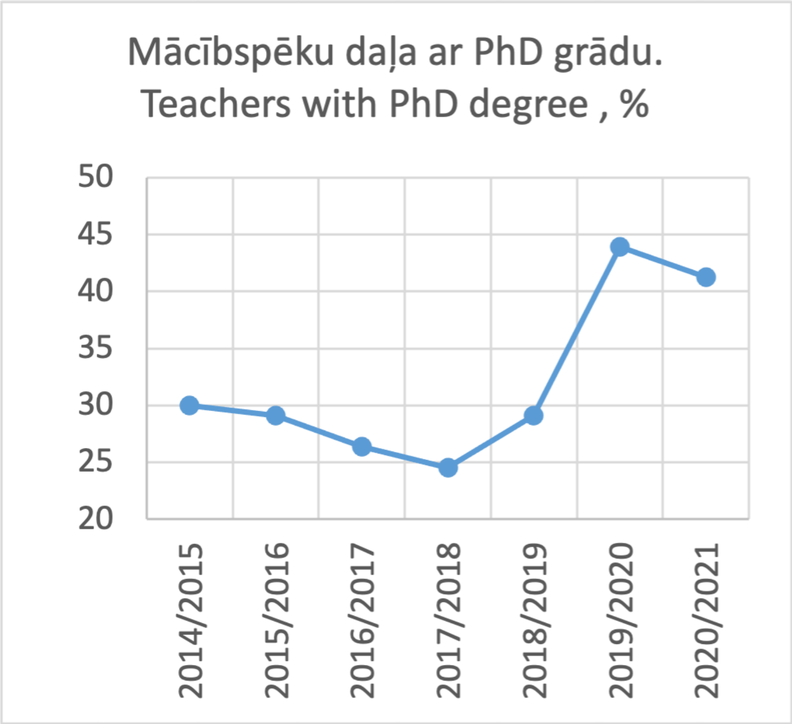
**3.4.2. Analysis and assessment of the changes to the composition of the teaching staff over the reporting period and their impact on the study quality.**

The average age of the academic staff is decreasing, with an effort to attract PhD students, specialists with a small but very rich experience in medical engineering and physics (see the figure below):

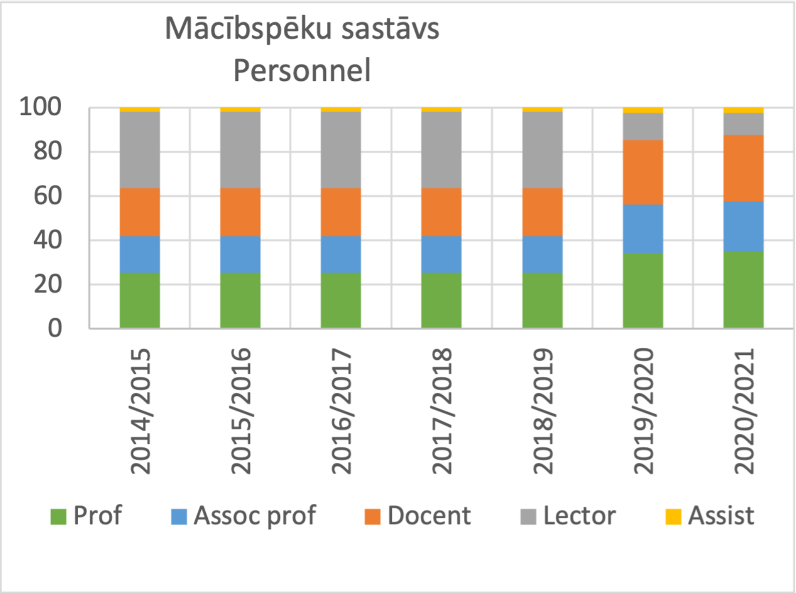



This is a testimony to the continuous improvement of the quality of training and the long-term perspective of the development of the study programme.

The qualifications of the academic staff are improving, with an increase in the level of education of the visiting and elected academic staff, leading to the award of PhDs.




The proportion of elected professors (including associate professors) is increasing.




Qualification of the academic staff is continuously advanced; the proportion of professors and associate professors is increasing. This attest continuous improvement in the quality of teaching.

Academic staff are actively involved in scientific research both in Latvia and internationally. The proportion of professors and associate professors is increasing. This attest continuous improvement in the quality of teaching. Around 42% of the academic staff are involved in research activities. Academic staff are engaged in ERDF, ESF, LCS and Horizon projects. They also participate in RTU "small" grants.

The results of each project are used for student training. For example:

- ERDF project MULTILAYER SILICON NANOCAPACITOR WITH IMPROVED DIELECTRIC LAYERS (2017-2020), 1.1.1.1/16/A/203, the achievements are used in the course MEE406 “Spectroscopic Methods in Medicine” (AFM and XPS measurements of multilayer nanostructures).

- The project SYNTHESIS OF TEXTILE SURFACE COATING MODIFIED IN NANO-LEVEL AND ENERGETICALLY INDEPENDENT MEASUREMENT SYSTEM INTEGRATION IN SMART CLOTHING WITH FUNCTIONS OF MEDICAL MONITORING (2017-2020), 1.1.1.1/16/A/020 involved students in the development of the graduation papers.
- In the HORIZON, ERA-NET project, BIODEGRADABLE AND NON-BIODEGRADABLE ORTHOPEDIC IMPLANTS WITH BACTERICIDAL COATINGS AND CONTROLLABLE DEGRADABILITY (2018-2021), students participated with graduation papers.

### 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).

To achieve the learning outcomes of the study program, the interrelation of study courses and their logical, sequential acquisition are of great importance. To foster cooperation among academic staff at the Faculty and at the University as a whole, a system has been established which ensures the organization of regular academic conferences and professional development seminars for the improvement of teaching methodological competences.

The sequence of study courses is followed, so that there is a progression from the simplest and general to more complex and professional level, which makes it possible to ensure professional development. After each semester, the study process and the learning outcomes are evaluated. The questionnaires filled in by the students on the quality of the implementation of the study courses play an important role in this process. The following aspects are taken into consideration for improvement of the study process:  the results of the employers' survey and the public presentations of the Bachelor Papers and Engineering Projects that take place every semester. After each viva voce examination, the members of the State Examination Commission make an overall assessment and provide proposals for improvement of the study process, which are taken into account when improving the respective study courses. Based on the analysis of the current situation, solutions are mutually found – adjustments are made in the structure of study courses to avoid partial duplication and to improve interconnection of study courses, as well as changes are proposed in the content of the study programme.

The cooperation among academic staff takes place through:

- participation in the joint discussion of new and improved courses/modules;
- regular consultations among RTU-RSU programme leaders;
- supervision of the study projects.

The following mechanisms are in place to facilitate cooperation:

- joint discussion of new and improved courses/modules takes place at BINI seminars and council meetings of the Institute of Biomedical Engineering and Nanotechnology;

- RTU-RSU programme managers' consultations take place in managers' meetings, inviting stakeholders involved in the issues under discussion, including RTU/RSU administration;
- supervision visits take place according to a set schedule; results are discussed at seminars and Board meetings of the Institute of Biomedical Engineering and Nanotechnology.

Around 100 academic staff members are involved in the study process, teaching ~160 students annually (1.6 students/1 academic staff member). Competitive tendering and auditing are used to maintain staff competitiveness.

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

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

The interlinking of study courses and their logical, sequential acquisition are essential for achieving the results of the study programme. The sequence of study courses is followed in order to move from the simplest and mainstream to a more complex and professional level, which allows to ensure mutual connection and sequence of development development. After every semester, the results achieved by the study process and the progress of the study process are expanded. A large badge in this process for questionnaires completed by students for the quality of implementation of study courses. The results of the survey of employers participating in the defense of the final works contribute greatly. After each defense procedure, the members of the State Examination Commission provide an assessment in general and proposals for improvement of the learning process, which are accordingly taken into account when improving the relevant study courses, according to analyses of the current situation, as soon as solutions have been found together – corrected in the structure of individual studio courses, to avoided partial duplication and improved study course interconnection, changes in the content of the study programme have been proposed by the Cooperation between the teachers of inter-university schools is also being established – on the basis of the results of student questionnaires methodological meetings are organized, with the aim to improve the content of the implemented study courses, meetings of the Joint Study Programme Council are regularly organized, in which study plans for the new study year are accepted, current problems related to study work are solved. A hospitation of study courses is organized – a plan of hospitation visits is drawn up, according to which the teaching staff go on mutual visits, in which the content of lectures, the way of teaching, the contact of the teaching staff with the student audience are evaluated. The results of the hospitation are discussed in the meetings of the Joint Study Programme Council.

# 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 | MCF0_dipl_dipl_supple.zip | MCF0_diploms_dipl_pielik.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) | | |
| Compliance of the joint study programme with the provisions of the Law on Higher Education Institutions (table) (if applicable) | MCF0_joint_stud_progr.zip | MCF0_kop_progr.zip |
| Statistics on the students in the reporting period | MCF0_stud_statist_ENG.docx | MCF0_stud_statist_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 | MCF0_StEdSt_6_annex.docx | MCF0_Valsts_St_6_pielik.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) | MCF0_ProfSt_7_annex.docx | MCF0_ProfSt_7_pielik.doc |
| 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 | MCF0_CoursMapp_8_annex_1.xlsx | MCF0_KursKart_8_pielik.xlsx |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MCF0_CurricStProgr_9_annex_2.docx | MCF0_StudProgrPL_9. pielik.docx |
| Descriptions of the study courses/ modules | MCF0_DescriptStud_cours.zip | MCF0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | MCF0_Descr_org_internsh.pdf | MCF0_Prakse_Apr.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Railway engineering (42526)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Railway engineering* |
| Education classification code | *42526* |
| Type of the study programme | *Professional bachelor study programme* |
| Name of the study programme director | *Mihails* |
| Surname of the study programme director | *Gorobecs* |
| E-mail of the study programme director | *mihails.gorobecs@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., profesors* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study program is to provide students with the opportunity to acquire professional skills in the field of railway engineering, in accordance with the professional standard, providing theoretical knowledge and competencies in transport information, communication and artificial intelligence (ICT), in driverless vehicle technologies and in programming, design and development of computerized and robotic transport control systems.* |
| Tasks of the study programme | *1. To ensure competitive training in the railway sector at the level of Bachelor's studies and in accordance with international standards;*<br>*2. To ensure the development and changes of the study content, study process and research in line with developments in the field of rail transport, international practice, science and didactics practices;*<br>*3. To promote the interest of students in further vocational development, supplementing academic knowledge, and continuing studies at the Master's level, developing research skills and promoting their use;*<br>*4. To develop students' ICT and programing skills in line with the current and future trends in railway digitalization, computerization and self-driving train management;*<br>*5. To promote students' interest in community processes, stimulate student development into a positive, modern, responsible, ethical and capacity-building personality that can act independently and make decisions;*<br>*6. To develop the practical use of research work and its results in the field of rail transport by academic staff and students;*<br>*7. To promote international mobility and participation in the projects.* |

| | |
|---|---|
| Results of the study programme | *Graduate of the study programme is:*<br>*1. Able to improve an integrated and balanced railway system, design and develop advanced railway transport engineering systems and technologies, which can be incorporated in the existing railway system, thus promoting transport integration processes;*<br>*2. Competent to promote introduction of newest technologies at a railway transport enterprise and carry out research, implement development and improvement measures and innovations;*<br>*3. Able to analyze the functioning of the engineering and technical processes in railway transport and evaluate efficiency of technological processes in the railway transport systems;*<br>*4. Competent to promote efficient use of internal logistics and IT in the management of engineering railway transport systems and technologies, and model the functioning of the railway transport systems and analyze work processes with the help of relevant hardware;*<br>*5. Able to develop and improve long-term and mid-term railway transport systems and their technical development strategies, plans and programs, as well as to develop strategic and operative plans of railway traffic organization;*<br>*6. Competent to develop and improve functional railway transport infrastructure systems, which ensure efficient and safe freight and passenger transportation, to develop advanced traffic organization solutions, automation and computerization tools in railway transport and promote development of multi-modal solutions and their integration in the railway transport systems;*<br>*7. Able to design railway transport infrastructure and technical means, improve maintenance and repair technologies in accordance with the requirements of the regulatory enactments and technical documentation, develop technical and design documentation in accordance with the requirements of the regulatory enactments and technical documentation;*<br>*8. Competent to participate in the completion of the tasks related to installation, launch and adjustment of the railway automatics and car equipment, to take part in the maintenance and repair of railway transport infrastructure, technical equipment and means, to improve organizational and management structures of a company dealing with maintenance, repair and service of railway technical means and equipment, to supervise the work of railway transport infrastructure, technical means and specialized equipment in accordance with the requirements of the regulatory enactments and technical documentation;*<br>*9. Able to complete tasks in accordance with the work organization principles of an enterprise and focusing on the achievement of the common goals, observing the requirements of the normative documents on labor protection, electrical safety and fire safety, labor legislation norms, professional ethics principles, civil defense rules, taking care of the environment and sustainable development;*<br>*10. Able to plan and implement their own professional development.* |

| | |
|---|---|
| Final examination upon the completion of the study programme | *Bachelor's Thesis including Project* |

# Study programme forms

**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) | *160* |
| 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) | *Professional bachelor degree in railway transport* |
| Qualification to be obtained (in english) | *Railway transport engineer* |

**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) | *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 railway transport* |
| Qualification to be obtained (in english) | *Railway transport engineer* |

**Places of implementation**

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

**Part time extramural studies - 5 years - latvian**

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *5* |
| 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 railway transport* |
| Qualification to be obtained (in english) | *Railway transport engineer* |

### Places of implementation

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

### Part time extramural studies - 5 years - english

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *5* |
| Duration in month | *0* |
| Language | *english* |
| Amount (CP) | *160* |
| 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) | *Professional bachelor degree in railway transport* |
| Qualification to be obtained (in english) | *Railway transport engineer* |

### 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 professional Bachelor study program “Railway Engineering” was established in 2020 by Decision of RTU Senate of 27 January, Minutes No. 636. The study program was created on the basis of the existing RTU professional Bachelor study programs “Railway Transport” and “Electrical Railway Systems”, as a continuing education program in railway transportation engineering. “Railway Engineering” is included in the Accreditation Sheet No. 2020/43 of the study field “Mechanics and Metal Processing, Heat Power Engineering and Mechanical Engineering” and is licensed by SKK decision no. 2020/49-L of 27 July, 2020.

On 11 August, 2021 (the meeting of the trilateral cooperation Sub-council for Professional Education and Employment, Minutes No. 5), the occupational standard “Railway Transportation Engineer” (PS-166) was updated and approved, and appropriate changes have been made to the study program structure.

According to the requirements of the occupational standard, a railway transportation engineer performs technical repairs and operation of railway transportation technological systems and railway infrastructure related processes, provides, effectively designs, maintains and upgrades technical, organizational and control management of freight and passenger transportation, manages technical, technological and operational processes of railway transportation systems and promotes innovative upgrading and transition processes. The updated standard does not envision professional specializations. Thus, future engineers have to be well-skilled in automation of railway transport, in construction and operation of the rolling stock, in organization of train traffic and passenger transportation, in railway communication systems, and in information technologies, and electrification systems within each of the mentioned railway subsystems. Therefore, nowadays railway electrification systems make an integral part of railway transport. Moreover, analysis of statistical data revealed that students are more interested in the study program “Railway Transport” and much fewer students enroll in the study program “Electrical Railway Systems”.

Therefore, the following changes have been made to the parameters of the professional Bachelor study program “Railway Engineering”:

- one implementation variant has been taken out of the program and a professional Bachelor degree in railway electrification systems and railway electrification system engineering (EQF/LQF Level 6/PQL Level 5) will no longer be awarded;
- the aim of the study program has been updated according to the occupational standard and perspectives of railway transportation development;
- the tasks of the study program have been updated according to the occupational standard and perspectives of railway transportation development;
- learning outcomes of the study program have been updated according to the requirements of the occupational standard
- the description of the final examination has been revised

To ensure compliance to the standard and to enhance the changes the program, the changes to the structure of the study courses have also been made:

1. all the existing individual fields of specialization including the study courses included therein have been excluded from the curriculum of the study program:
    - Study courses common for all areas of specialization 8 CP,
    - Railway Automatic and Telemechanic Systems 30 CP,
    - Electrical Transport 30 CP,
    - Railways Rolling Stock 30 CP,
    - Railway Traffic Technology 30 CP,
    - Rail Tracks and Vehicles 30 CP;
2. two new fields of specialization have been established in order to broaden the knowledge in engineering or railway traffic organization:
    - Rolling stock, automation, telemechanical and control systems 20 CP,
    - Railway transportation and traffic organization 20 CP;
3. several study courses have been excluded from the block of obligatory study courses:
    - General Course of Railway 2 CP,
    - Probability Theory and Mathematical Statistics 2 CP,
    - Supplementary Mathematics (for mechanical engineering) 2 CP,
    - Transportation Equipment Computer Design 3 CP,
    - Transportation Equipment Computer Design (study project) 2 CP,
    - Railway Transport 4 CP,
    - Railway Transportation Microprocessor Systems 3 CP,
    - Safety of Railway Technical Systems 3 CP,
    - Railway Tansportation Microprocessor Systems (study project) 2 CP,
    - Railway Technical Systems Safety (study project) 2 CP,
    - Electrical Machines 5 CP,
    - Automatic and Telemechanic Systems Maintenance 2 CP,
    - Railway Transport Economics 2 CP,
    - Visual Programming for Transportation Tasks 3 CP,
    - Rolling Stock and Rail Track Interaction 2 CP,
    - Fundamentals of Train Traffic Organization 2 CP,
    - Fundamentals of Freight Transportation and Commercial Operations Organization 2 CP,
    - Study of Freight Transportation 3 CP,
    - Cargo Reloading Technology (study project) 2 CP,
    - Logistics of Railway Transport (studies project) 2 CP;
4. to ensure compliance to the occupational standard and to cover all aspects of railway transportation, such as railway transport microprocessor systems, rolling stock construction and traction, railway infrastructure and operation, communication systems in transport, technology and management of operation, railway stations, communication nodes and train movement organization, technologies in logistics systems, as well as electrical machines and equipment of rolling stock, new study courses have been developed, registered and included in the study program:
    - Railway Infrastructure and Operations 6 CP,
    - Rolling Stock Structure and Traction 5 CP,
    - Transport System Computer Design and Programming (study project) 8 CP,
    - Railway Microprocessor Systems (study project) 5 CP,
    - Railway Communication Systems 5 CP,
    - Railway Stations, Hubs and Train Traffic Organization 5 CP,
    - Technology of Transport Logistic Systems (study project) 5 CP,

- Electrical Machines and Electrical Devices of Rolling Stock 5 CP,
- Railway Safety, Signalling and Interlocking 10 CP,
- Rolling Stock Repair and Technical Maintenance Technology 10 CP,
- Railway Telecommunication Systems 10 CP,
- Freight Transportation and Commercial Activity Organization 10 CP,
- Transport Information Technology Systems 10 CP,
- Autonomous Vehicle Systems Design 10 CP.

5. the study course Numerical Methods and Engineering Programs for Transport Tasks 4 CP was included in instead of the excluded study courses Probability Theory and Mathematical Statistics 2 CP and Supplementary Mathematics (for mechanical engineering) 2 CP. The course not only covers the main sections of the above-mentioned courses in mathematics, it also focuses exactly on the transportation tasks and implies acquisition of engineering software, which is essential for a contemporary engineer;
6. the course Operation Technology and Management 5 CP has been included in the section of obligatory study courses;
7. in order to ensure compliance with the requirements of the area of specialization, such courses as General Metrology 3 CP and Materials Science 2 CP have been included;
8. in order to ensure involvement of junior students in research, the study course Introduction into Speciality was expanded and now is delivered as Introduction to Speciality and Research.
9. in 2021, in accordance with the Resolution of RTU Senate as of 30 March 2020 on the changes in the General Requirements to the Study Programs, the study courses Environmental Protection 1 CP and Environment and Climate Roadmap 1 CP have been included in the study program.

All mentioned changes were confirmed and approved on 27 September, 2021, by the decision of RTU Senate, Minutes No. 653.

The newly designed study courses and the updated structure of the program allow avoiding overlapping of the offered learning resources and fragmentation of the study program. The design of the program structure and new courses used the best practices of the universities worldwide both in transportation and other fields, which suppose fewer study courses, but increased volume of each course. To that end, the compulsory part of the new study courses has the volume of at least 5 credit points, but the elective part – 10 credit points for the whole course.

In order to improve the situation and to increase the number of students, the study program in railway engineering has applied the most progressive methodology in the world – project-based learning and problem-based learning elements. They fit well the programs with a limited number of students and are oriented at training of high-quality specialists capable to define problems and elaborate an individual project already from the first year of studies. While developing a project, study courses must be acquired to develop knowledge and skills allowing to noticeably join the theory and its practical application. The study program implies delivery of the transport-related study courses from the very first year.  Every student is assigned a supervisor-mentor, who supervises, assists and consults them during elaboration of the projects. The number of study courses to be completed within one study terms was decreased, which reduces stress in students and have a positive impact on the student morale.

**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 study field “Mechanics and Metal Processing, Heat Power Engineering, Heating Engineering and Mechanical Engineering”, together with mechatronics and transport, cover all study programs of the field at RTU, including the newly established study program “Railway Engineering”. Implementation of the programs of the study field is fully in line with the tasks of the core activities of RTU, specified in Paragraph 6 of RTU Constitution: “The task of RTU is to train scientists, engineers, economists, administrative and management specialists, architects and academic staff members of international qualification, ensure indivisibility of studies and research and develop academic fields related to RTU profile, paying special attention to the priority scientific fields of Latvian economy.”

Riga Technical University is the only higher educational establishment in Latvia that educates and trains railway engineers. The study program ensures compliance of future transport engineers to modern and future requirements in the sector.

In addition to mechanical and electrical engineering the program includes large number of IT and programming related study courses, which allows increasing the range of the knowledge of the specialist, not limited only to the railway sector, their competitiveness in the labor market, give an opportunity in future to work not only in the railway industry, but also as IT and programming experts at transportation related companies, special attention is paid to the practical part, to develop not only the student knowledge, but also the skills.

The study program complies to the requirements of the field “Mechanics and Metal Processing, Heat Power Engineering, Heating Engineering and Mechanical Engineering” (further – the study field) towards the study courses:

- theoretical field-specific basic courses included in the section of compulsory study courses: Technical Mechanics 4CP, Theoretical Mechanics 2CP, Strength of Materials 2CP shall amount to at least 4 CP. Within the study program “Railway Engineering” they amount to 4 CP;
- the course included in the section of compulsory study courses Descriptive Geometry and Engineering Graphics 2CP, Computer Graphics 2CP, Chemistry for Engineers or General Chemistry 2CP, Computer Science 2CP, Electrical Engineering and Electronics 2CP, General Metrology or Metrology 3CP, Material Science 2CP, Materials Technology / Material Processing Technology 2CP, Machine Elements 2CP, Basis of Design 2CP or the competences included in the learning outcomes of the study courses included in other study programs with a similar name. The volume of the study courses in credit points included in the study program shall be not less than 12CP. Within the study program “Railway Engineering”, they amount to 19 CP;
- of the included study courses Heat Study 2CP, Fundamentals of Quality Control and Monitoring 3CP, Micro- and Nanotechnologies 3CP, Industrial Design Quality Assurance 2CP, Prototyping and Research in Mechanical Engineering 3CP, Logistics 2CP, Non-destructive Testing Methods 3CP, Internal Combustion Engine Fundamentals 3CP or the competences included in the learning outcomes of these courses there shall at least 3CP. Within the study program “Railway Engineering”, they amount to 10 CP.

RTU identification code of the professional Bachelor study program “Railway Engineering” is MCH0, educational qualification code – 42526. Graduates of the study program are awarded a Bachelor degree in railway transportation of 6th professional level and qualification of the railway engineer of 5th level according to the European Qualification Framework (EQF) and the Latvian Qualification Framework (LQF).

The professional Bachelor education obtained within the study program will help students develop the necessary level of culture and intelligence, allowing to start social activities, communicate with Latvian and foreign professional circles.

The aim, tasks and learning outcomes of the study program are interrelated – to train professional experts in the field, providing them with the capacity to develop research and scientific works, develop the field of engineering, motivate graduates to build career and continue education. Organization and implementation of the study program will be ensured by the academic staff, employing materials and resources, which will allow achieving the set aims, accomplish the tasks and achieve the learning outcomes. The main conditions for the start of studies is general or vocational secondary education with good background knowledge of mathematics and physics.

The aim of the study program is to educate and train competitive engineers possessing comprehensive understanding of the modern railway systems related processes, knowledge of ICT and programming, AI and unmanned transportation technologies that will be introduced in the railway and other transportation systems in the coming 30 years, who are able to evaluate the existing transport systems, identify weaknesses, diagnose problems, improve, modernize and offer new solutions using cutting-edge technologies, develop and program computerized and robotic transport management systems and ultimately become the leading specialists in transport possessing ICT and programming skills. The program also aims at providing students with sufficient level of knowledge and skills so that they can continue their studies at the Master's level.

The tasks of the study program are coordinated with the aim of the study program:

- to ensure competitive training in the railway sector at the level of Bachelor's studies and in accordance with international standards;
- to ensure the development and changes of the study content, study process and research in line with developments in the field of rail transport, international practice, science and didactics practices;
- to promote the interest of students in further vocational development, supplementing academic knowledge, and continuing studies at the Master's level, developing research skills and promoting their use;
- to develop students’ ICT and programing skills in line with the current and future trends in railway digitalization, computerization and self-driving train management;
- to promote students' interest in community processes, stimulate student development into a positive, modern, responsible, ethical and capacity-building personality that can act independently and make decisions;
- to developing the practical use of research work and its results in the field of rail transport by academic staff and students;
- to promote international mobility and participation in the projects.

The learning outcomes are subordinated to the aims and tasks of the study program to ensure that upon completion of the study program, the graduates are able to:

- improve an integrated and balanced railway system, design and develop advanced railway transport engineering systems and technologies, which can be incorporated in the existing railway system, thus promoting transport integration processes;
- promote introduction of newest technologies at a railway transport enterprise and carry out research, implement development and improvement measures and innovations;

- analyze the functioning of the engineering and technical processes in railway transport and evaluate efficiency of technological processes in the railway transport systems;
- promote efficient use of internal logistics and IT in the management of engineering railway transport systems and technologies, and model the functioning of the railway transport systems and analyze work processes with the help of relevant hardware;
- develop and improve long-term and mid-term railway transport systems and their technical development strategies, plans and programs, as well as to develop strategic and operative plans of railway traffic organization;
- develop and improve functional railway transport infrastructure systems, which ensure efficient and safe freight and passenger transportation, to develop advanced traffic organization solutions, automation and computerization tools in railway transport and promote development of multi-modal solutions and their integration in the railway transport systems;
- design railway transport infrastructure and technical means, improve maintenance and repair technologies in accordance with the requirements of the regulatory enactments and technical documentation, develop technical and design documentation in accordance with the requirements of the regulatory enactments and technical documentation.
- competent to participate in the completion of the tasks related to installation, launch and adjustment of the railway automatics and car equipment, to take part in the maintenance and repair of railway transport infrastructure, technical equipment and means, to improve organizational and management structures of a company dealing with maintenance, repair and service of railway technical means and equipment, to supervise the work of railway transport infrastructure, technical means and specialized equipment in accordance with the requirements of the regulatory enactments and technical documentation;
- complete tasks in accordance with the work organization principles of an enterprise and focusing on the achievement of the common goals, observing the requirements of the normative documents on labor protection, electrical safety and fire safety, labor legislation norms, professional ethics principles, civil defense rules, taking care of the environment and sustainable development.
- plan and implement their own professional development.

Graduates of the study program will become skilled specialists in modern computer technologies and information technologies in the field of transportation and will be able to work both for railway companies and for transportation and IT companies in Latvia and abroad.

Graduates can continue studies at the one-year professional Master study program “Railway Engineering” or at other RTU Master study programs, as well as Master and professional study programs of other universities envisioned as postgraduate studies upon awarding of a professional Bachelor’s degree.

The study program is offered in one version for 4-year (full-time) or 5-year (extramural) studies with the volume of 160 credit points.

The study program comprises the following sections:

- General education study courses - 12 CP,
- Field specific theoretical basic study courses and IT study - 36 CP,
- Field specific professional study courses – 46 CP,
- Compulsory elective study courses – 28 CP, t.sk.
    - Field-specific study courses – 20 CP,
    - Humanities and social sciences study courses – 4 CP,
    - Languages – 4 CP,

- Free elective study courses – 6 CP,
- Practical Placement – 20 CP,
- Final/ State examination – 12 CP.

Relevance of the study program implemented by RTU can be determined analyzing and comparing it with the study programs implemented at other EU and international universities. Study programs of Kaunas University of Technology (KTU) and University of Birmingham (UoB) were selected for comparison with the RTU study program “Railway Engineering”. Each foreign university uses its own system of credit points, so these were converted into Latvian credit points for comparison and it was made by modules of study courses – in percent:

- General education and field specific theoretical basic study courses: RTU 48CP (30%), KTU 64CP (41%), UoB 60CP (38%);
- Compulsory elective study courses of professional specialization: 66CP (41%), 58CP (37%), 66CP (41%);
- Study courses in humanities and social sciences, languages: 8CP (5%), 8CP (5%), 0CP (0%);
- Free elective study courses: RTU 6CP (4%), KTU 8CP (5%), UoB 7CP (4%);
- Practical Placement: RTU 20CP (13%), KTU 10CP (6%), UoB 7CP (4%);
- Final/ State examination: RTU 12CP (7%), KTU 10CP (6%), UoB 20CP (13%);
- Total: RTU 160CP (100%), KTU 160CP (100%), UoB 160CP (100%).

Analysis of the study programs allows concluding that they have both similarities and differences, but all of them have the same main aim – training of highly qualified specialists.

The study program of the University of Birmingham focuses on more professional specialization study courses, fully renouncing general study courses, courses in humanities and social sciences, as well as language training courses.

The study program of Kaunas University of Technology is rather focused on the theoretical study courses and less on professional specialization study courses. The study program offers two specializations, so during the first two academic years, theoretical fundamentals of engineering are taught, and only during the third academic year the specialization Railway can be chosen.

In turn, the most obvious difference from other study programs is the volume of internship, specified by state regulatory documents of each country or by a university resolution, based on the requirements of the profession.

To sum up the points of comparison, the common characteristics include:

- all study programs envision development of the study papers;
- all study programs include internship;
- study programs are implemented also in English;
- many theoretical and professional specialization study courses have similar curricula;
- the same duration of studies – 4 years.

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

Global trends, priorities, activities and trends of sustainable development in the railway sector are stipulated in such Latvian and European mid- and long-term strategical documents as National Development Plan of Latvia 2027 (NAP2027), Sustainable Development Strategy of Latvia until

2030 (Latvija 2030), the Rail Strategic Research and Innovation Agenda (SRIA) of the European Railway Research Advisory Council (ERRAC), ERRAC: Rail 2050 Vision, Research and innovation priorities (Rail 2030), etc.

For instance, NAP2027 considers modernization of railways, development of new ICT solutions and services, improvement of the core data transmission network and arrangement of “next generation” networks in remote areas, 5G – along all main roads, as well as smart technologies in traffic flow management. One of NAP2027 strategical milestone tasks is arrangement of a multimodal public transportation network with the railway transport as a “spine”, with multimodal transport and passenger transfer nodes, promoting better access to the regions, mobility of population and accessibility of environment through continued railway electrification, convenient train-bus connections, all these activities ensuring transport accessibility.

These considerations set the railway in Latvia as the priority means of transportation, the development of which requires railway engineers to master modern technologies in order to ensure synergy of the digital railway transformation (digitalization, automation, robotization, artificial intelligence, Industry 4.0, etc.) and transport infrastructure with IT solutions and their safety aimed at making the transportation system customer-oriented and ensuring that smart transport services become an integral element of everyday life of every person.

The vision of railway sector development in Latvia is in line with European and global trends. ERRAC Rail 2050 Vision and Rail 2030 define the tasks of the railway sector for digitalization and automation of the railway transport through design and operation of autonomous trains, automated train functions, artificial intelligence and robotics. Fully automated train functions, autonomous transport vehicles and intelligent remote-control systems guarantee unprecedented level of safety. To achieve the targets of 2050 Vision, the railway sector is supported by technical and scientific research in Europe and around the world in the following fields [ERRAC Rail 2050 Vision]:

- Digitalization: information and communication technologies (ICT) that can receive, identify, process, transmit and analyze digital information via safe, reliable “internet of things” networks;
- Distributed cognitive computerization: ability of machines to cognize and understand the surrounding environment, recognize models, provide significant insights from the distributed Big Data, and learn;
- Robotics: ability of machines to fulfil the targeted tasks autonomously.

To attain this objective, the study program offers an increased number of study courses related to information and communication technologies, programming, microcontrollers and computerization and also introduces a new study course of AI-based design of autonomous transport vehicle systems.

Already now in Latvia and Europe there is shortage of highly qualified rail transport specialists in the railway infrastructure and related industries. Taking into account the new railway line “Rail Baltica” to be designed and built in the near future, the demand for specialists will only grow. The study program is envisioned to provide the railway sector with the qualified specialists and their training in Latvia.

Graduates of the study program will become skilled specialists in modern computer technologies and information technologies in the field of transportation and will be able to work for both railway companies and transportation and IT companies in Latvia and abroad.

Despite the fact that there have not been any graduates from the study program “Railway Engineering” yet, annual student survey results demonstrate railway engineers’ training level and applicability of the acquired knowledge and skills to the labor market. Numerical values are calculated using “1” for the evaluation “fully disagree” and “5” for the evaluation “fully agree”, respectively, followed by the calculation of the average numerical values.

For example, the survey among the graduates of academic year 2019/2020, which involved 63% of the program graduates, obtained the following values:

- satisfaction with the decision to study at RTU – 4.24;
- satisfaction with the chosen study program – 4.33;
- would recommend this study program to those wishing to study – 3.95;
- satisfaction with the acquired theoretical knowledge – 4.05;
- satisfaction with the acquired practical skills– 4.24.

Good survey results allow concluding that graduates are satisfied and the mastered study program “Railway Transport” in general complies to the sector’s requirements, but it is possible and necessary to improve the identified deficiencies when implementing the study program “Railway Engineering”.

It should be also noted that the majority of graduates could find employment at the only at that time railway concern SJSC “Latvijas Dzelzceļš” (LDZ), and this is why the study program “Railway Transport” was oriented at training of specialists exactly for the needs of LDZ.

In turn, entry of a new player in the railway sector - “Eiropas dzelzceļa līnijas” with the project “Rail Baltica” and the new occupational standard for rail engineers required to extend and generalize the knowledge and competences of railway engineers, allowing them to work both with 1520 Latvian railway and 1435 European rail systems.

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

At the moment, the study program is available only for full-time students. As the program was designed, approved and licensed in 2020, the first enrolment in the study program took place on 1 September, 2020. Also, the 2nd year students of the study program “Railway Transport” were transferred to the study program.

At the beginning of the academic year 2020/2021, 5 first-year students were enrolled and 13 students were transferred to 2nd year of studies.

At the end of the academic year 2020/2021, only one of the first-year students was transferred and one more student went on a sabbatical leave. In turn, 11 students were transferred from the 2nd year to the 3rd year of studies.

At the beginning of the academic year 2021/2022, 5 students were admitted – 4 students to the first year of studies, and 1 student, who was a 2nd-year student in 2020/2021, started 2nd year again. 11 students were transferred to the study program “Railway Engineering” from the study program “Railway Transport” (180 CP) (with the appropriate alignment of the study courses), thus the 5th-year students were registered at the study program, which is not envisioned by program settings. 18 extramural students also were transferred to the study program “Railway Engineering” from the study program “Railway Transport” (180 CP) to the 4th year of studies.

Thus, the dynamics in the number of students is as follows:

Commenced studies in 2020/2021:

1st academic year – 5

2nd academic year – 13

In 2020/2021 successfully completed studies:

1st academic year – 1, on sabbatical leave - 1

2nd academic year – 11

Commenced studies in 2021/2022:

1st year – 4

2nd year – 2 (+1 sabbat.)

3rd year – 11

+4th year – 18

+5th year – 11 (only for viva voce examination of graduation papers in January, 2022)

The informal survey among the underachieving students allowed concluding that 1st-year students having graduated secondary school were not ready to acquire large volume of fundamental theoretical study courses, and to pass 8-10 study courses per academic term, they were not satisfied with the small volume of professional specialization study courses during the 1st academic year, too large number of study courses per academic term and as a result did not show interest in professional training, because 1st-year students felt lack of contact with the academic staff of railway related study courses. Taking into account this situation, changes to the program have been made, which are described in sections 3.2.1. and 3.2.3.

#### 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 complies to the requirements of the state regulatory enactments and has been developed according to the decision of RTU Senate on “Uniform Requirements for the Study Programs”. The volume of the study program is 160 credit points and its duration is 4 years of full-time studies and 5 years of part-time studies. Upon completion of the study program, students are awarded a professional Bachelor degree in railway transportation and the qualification of a railway transport engineer.

Learning outcomes of the study courses are closely related to the common tasks of the study program and results of their fulfilment in achieving the set goal.

Learning outcomes in study courses Numerical Methods and Engineering Programs for Transport Tasks, Railway Microprocessor Systems (study project), Railway Safety, Signalling and Interlocking, Railway Telecommunication Systems, and Autonomous Vehicle Systems Design promote graduates’ ability to improve the integrated and balanced railway system, to design and develop advanced railway transportation technological systems and technologies that fit in the existing railway, thus fostering integration processes in transport.

Successful completion of the study courses Development of Innovative Products and Entrepreneurship, Introduction to the Speciality and Research, Computer Technologies in Transport, Railway Microprocessor Systems (study project), Rolling Stock Structure and Traction, Railway Infrastructure and Operations, Transport Communication Systems, Electrical Machines and Electrical Devices of Rolling Stock, as well as one elective course from the courses Railway Safety, Signalling and Interlocking, Rolling Stock Repair and Technical Maintenance Technology, Autonomous Vehicle Systems Design and Railway Telecommunication Systems will allow railway engineers to boost implementation of advanced technologies at a railway transportation company and carry out research, development and optimization activities and innovations.

The skill to analyze functional processes of technological and technical facilities of railway transport and evaluate performance of technological processes in railway transportation systems will be trained through mastering of the study courses Mathematics, Physics, Numerical Methods and Engineering Programs for Transport Tasks, Technical Mechanics, Rolling Stock Structure and Traction, Railway Infrastructure and Operations, Operation Technology and Management, Railway Stations, Hubs and Train Traffic Organization, General Metrology, Materials Science, Electrical Machines and Electrical Devices of Rolling Stock, as well as of one of the courses Railway Safety, Signalling and Interlocking, Rolling Stock Repair and Technical Maintenance Technology or Railway Telecommunication Systems.

Capabilities and skills to effectively apply inland logistics and information technologies to the management of railway technological systems and technologies and to make computerized simulations of railway system functioning and analyze operation processes are mastered at the study courses Computer Technologies in Transport, Transportation Systems Computer Design and Programming (study project), Technology of Transport Logistic Systems (study project), Railway Microprocessor Systems (study project), as well as the results of two of the courses Autonomous Vehicle Systems Design, Freight Transportation and Commercial Activity Organization or Transport Information Technology Systems.

Furthermore, mastering of the study courses Transportation Systems Computer Design and Programming (study project), Operation Technology and Management, Technology of Transport Logistic Systems (study project), Railway Stations, Hubs and Train Traffic Organization and also of the elective course Freight Transportation and Commercial Activity Organization will train student capability to develop and optimize long-terms and middle-term railway systems and strategies, plans and programs of their technical development, as well as develop strategic and strategical and operational plans for railway train movement organization.

In order to develop competence in development and optimization of functional systems of the railway infrastructure, which ensure effective and safe transportation of freights and passengers, as well as to develop advances transportation organization solutions, automation and computerization equipment in railway transport and promotion of development and integration of multimodal solutions in railway systems, it is necessary to successfully master the study courses Computer Technologies in Transport, Railway Infrastructure and Operations, Transport Communication Systems, Railway Stations, Hubs and Train Traffic Organization, Technology of Transport Logistic Systems (study project), as well as one of the courses Railway Safety, Signalling and Interlocking, Autonomous Vehicle Systems Design, Railway Telecommunication Systems Transport Information Technology Systems

The railway transport engineer competence in design of railway infrastructure and technical facilities, optimization of operation and repair technologies according to regulation and requirements of the technical documentation and development of technological and design documentation according to regulation and requirements of technical documentation is trained through acquisition of knowledge and skills at the following study courses: Physics, Computer Technologies in Transport, Technical Mechanics, Transportation Systems Computer Design and Programming (study project), Railway Microprocessor Systems (study project), Railway Infrastructure and Operations, Railway Stations, Hubs and Train Traffic Organization, General Methodology, and the course Rolling Stock Repair and Technical Maintenance Technology or Autonomous Vehicle Systems Design will help advance these skills.

Future railway engineers gain their skills in installation, start-up and adjustment of railway automation and on-board equipment, in operation and repair of railway infrastructure, technical facilities and equipment, in optimization of organizational and management structures for operation, repair and maintenance of technical railway facilities and equipment, in supervision of performance of railway infrastructure, technical facilities and special equipment according to the regulatory enactments and requirements of the technical documentation at the study courses Electrical Engineering and Electronics, Railway Microprocessor Systems (study project), Rolling Stock Structure and Traction, Railway Infrastructure and Operation, Transport Communication Systems, Operation Technology and Management, Railway Stations, Hubs and Train Traffic Organization, Materials Sciences, Electrical Machines and Electrical Devices of Rolling Stock, as well as two supplementary courses selecting from Railway Safety, Signalling and Interlocking, Rolling Stock Repair and Technical Maintenance Technology, Autonomous Vehicle Systems Design and Railway Telecommunication Systems.

The ability to fulfil tasks based on a company's work organization principles and achievement of the common goal by complying to the requirements of the regulatory enactments with regard to labor protection, electrical safety and fire protection, the norms of employment relationship, the principles of professional ethics, the requirements of civil protection, being in concern of the environment protection and sustainable development, can be trained through successful mastering of the study courses Development of Innovative Products and Entrepreneurship, Civil Defense, Basics of Occupational Safety, Engineering Chemistry, Environment and Climate Roadmap, Mathematics, Physics, Railway Infrastructure and Operations, of at least two of the following courses in humanities and social sciences: General Sociology, Sociology of Management, Sociology of Personalities and Small Groups, Polititology, Communication Skills or Fundamentals of Law, and one of the language courses: English or German.

But the ability to plan and implement own professional advancement will be promoted through the study courses Introduction to the Speciality and Research, at least two courses in humanities and social sciences: General Sociology, Sociology of Management, Sociology of Personalities and Small Groups, Polititology, Communication Skills or Fundamentals of Law, as well as one of the language courses: English or German.

All competences, knowledge, skills, and practical abilities mentioned above focusing on the individual interest in certain railway sub-sectors can be optimized through Internship and Bachelor Paper with a project design, which will allow completing the program successfully as a railway transport engineer fully complying with the occupational standard.

The curriculum of the study courses has been examined and will be regularly updated in case of necessity and according to the needs of the industry, labor market and scientific trends.

According to the trends in the transport sector, the long-term priority areas of development are as follows:

- “green” technologies, electrification and electrical traction;
- digitization and computerization technologies;
- wireless communication (5G/5G-R,...) and satellite systems (Global Navigation Satellite System);
- AI-based infrastructure and vehicle control systems and autonomous driverless vehicles.

Also, general globalization trends, such as, for example, Integration of Latvian transport and railway systems into trans-European transport network (TEN-T) requires that at the study courses establish the knowledge and develop the skills being common or similar to different railway systems, so that a future railway engineer could easily integrate both into the Latvian 1520 mm and the European 1435 mm system, and in other existing railway systems in the world differing not only by gauge, but also by all other railway components – structure of the rolling stock and infrastructure, electrical machines and electrical equipment, alarm systems, interlocking and locking systems, telecommunication systems, organization of transportation and movement and railway operation.

In line with global trends, new study courses have been developed and included in the study program:

- Rolling Stock Structure and Traction, Electrical Machines and Electrical Devices of Rolling Stock, Rolling Stock Repair and Technical Maintenance Technology;
- Transportation Systems Computer Design and Programming (study project), Railway Microprocessor Systems (study project), Technology of Transport Logistic Systems (study project), Transport Information Technology Systems;
- Transport Communication Systems, Railway Telecommunication Systems;
- Autonomous Vehicle Systems Design.

In order to make the study courses up-to-date and conforming to the railway sector trends, the curricula of the lectures and practical placement are regularly supplemented with the latest advancements in the sector, which are published in:

- New books, for example:
    - Lucas, Callen Railway Transportation Systems and Engineering, New York : Clanrye International, 2020, 237 p.
    - Railway Signalling and Interlocking : international compendium / editors: Gregor Theeg, Sergej Vlasenko ; authors: Enrico Anders [and other 26 authors]. 3rd edition. Leverkusen : Eurail Press : PMC Media House, 2020. 562 p.
- In the international scientific journals, for example:
    - International Journal of Railway Technology, Civil-Comp Ltd.

    - International Journal of Rail Transportation, Taylor and Francis Ltd.
- In the conference proceedings, for example:
    - International Conference on Railway Technology: Research, Development and Maintenance
    - Symposium on the Dynamics of Vehicles on Roads and on Tracks
- In other reliable information sources, for example:
    - World Congress on Railway Research

Or are presented and demonstrated at the world-level international exhibitions, for example:

- InnoTrans: Future of Mobility – exhibition of the leading international transport technologies that takes place every two years in Berlin, divided into five segments: Railway Technology, Railway Infrastructure, Public Transport, Interior and Tunnel Construction and occupies all 42 exhibition halls, available at the Berlin Exhibition Centre.
- Eurasia Rail – innovative engineering, products and services both in the state, and in the private railway sector, organized every two years in Istanbul.

The employees of the state concerns JSC "Latvijas dzelzceļš", JSC "Pasažieru vilciens" and "Eiropas dzelzceļa līnijas" Ltd were involved in the updating of the study program, these experts expressed their suggestions on improvement of professional specialization. Recommendations of the stakeholders in the sector, study courses for appropriate specialization and discussed internship opportunities were taken into account in the development of the structure and curriculum of the study program.

Employers are interested to take part and make their proposals on enhancement of the study program, as a result, RTU will train the required specialists and employers will fill their vacancies.

In order to enhance and develop the study program, annual student surveys are carried out to let them express their opinion about the acquired study courses and academic staff, as well as to evaluate organization and implementation of the study program.

The Transport Institute (TI) maintains active contacts with the graduates and specialists in the industry in order to organize guest lectures and workshops for the students, academic staff and other stakeholders.

International cooperation of RTU involving specialists in the industry and academic staff from foreign partner universities ensures exchange of experience and development of technology. Cooperation partners of the TI: Kharkov State Railway Transport University, Silesian University of Technology, Deutsche Bahn Academy, Rail Baltica Academy, etc.

RTU is a member of the international association EURNEX - the European Rail Research Network of Excellence that represents European research and education institutions. It unites 33 research institutions operating in the field of railway transport and mobility across Europe, Morocco and China. The goal of the association is to promote research and development of the railway system, to improve cooperation in research and education, as well as ensure knowledge transfer across the association members, European universities and research institutions, interested in railway research, including multidisciplinary facilities, in order to facilitate joint planning and implementation of research projects of the member-states and to establish sustainable research environment for the railway sector, to develop the links between the association members, industrial partners and operators in the railway sector, to improve understanding about special high quality research needs and cooperation opportunities with the railway sector, to promote railway contribution to sustainable transport policies, to improve competitiveness and economic stability of the railway sector and industry.

Cooperation and internationalization policies of RTU FMETA in the context of the study field implementation relates mainly to students of the Foreign Students Department. The students and academic staff are offered opportunities to participate in the international mobility programs. Erasmus/Erasmus+ is the most popular is the mobility program, which has been functioning for many years and the interest in its scholarship is only growing year by year. Upon completion of studies abroad, the information about positive outcomes reaches organizational units of RTU, in turn, foreign students, upon return back to their home countries inform their fellow students about opportunities to study in Latvia. The effect of the study program implementation on the studies and research is extremely positive.

RTU advancement activities:

- Open Days for the students, at Researchers' Night, visits to schools;
- RTU Student Initiative Fund supported the establishment of the student laboratory "DaVinci", which will give students an opportunity to fulfil their technical and creative ideas in R&D works, as well as to acquire practical skills in operation of electrical equipment and their prototyping;
- field trips to different sites;
- consideration of students' evaluations and opinion through student surveys;
- involvement of Latvian specialists and former RTU graduates in the organized events;
- promotion of the academic staff mobility in the framework of Erasmus+ project;
- organization of events to inform the public about the opportunities to study in Daugavpils: participation in various exhibitions; organization of visits to Latgale schools in the framework of Career Days; excursions of pupils and teachers of Daugavpils college; Open Door Days; Shadowing Days, Researcher's Night.

Already at preset, in training of specialists, the TI cooperates with such companies and organizations as Railway Department of tthe Ministry of Transport of the Republic of Latvia, Latvian Transport Development and Education Association (LaTAIA), the Latvian Association of Railway Workers (LDzB), Engineering Association of Latvian Railway Workers, the Latvian Association of Welding Specialists (LMSA), as well as with the industrial companies – Eiropas dzelzceļa līnijas (EDZL) and State JSC "Latvijas Dzelzceļš" and its organizational units (freight transportation, Infrastructure and rolling stock administrations), JSC "Rīgas vagonbūves rūpnīcu", JSC "Lokomotīve", Traction Rolling Stock Repair Centre JSC "Zasulauks", JSC "Pasažieru vilciens", JSC "Starptautiskie pasažieru pārvadājumi", as well as with the offices of foreign companies in Latvia "Deutsche Bahn Engineering&Consulting GmbH", "Weidmuller Interface GmbH & Co. KG" and other production, railway freight transportation and forwarding companies.

### 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).

Not 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.**

After thorough analysis of the existing situation with drop-outs and accumulation of academic arrears after the 1st academic year, developers of the study program have come to a conclusion that the main reasons of those are:

- low level of preparedness on completion of the secondary education;
- large volume of general and theoretical knowledge study courses during the 1st academic year, without their practical application to transportation and railway sector tasks and case studies, as these courses are offered to many groups from different study programs at once and they involve many RTU organizational units:
    - Institute of Humanities;
    - Institute of Labour and Civil Protection,
    - Department of Probability Theory and Mathematical Statistics;
    - Department of Material Physics;
    - Department of Chemistry;
    - Department of Innovations and Business Management;
    - Department of Social Sciences
    - Department of Language for Special Purposes;
    - Department of Electrical Physics, etc.

For these reasons, first year students, in addition to a general stress from change of study environment and routines after school, hesitate about the necessity of these courses, and students are not prepared for such volume of general theoretical knowledge. After enrolment in the University, students wish to see interconnection between the curricula and railway engineer specialization and professional qualification, which may not be ensured by the academic staff of other RTU organizational units, because due to a small number of students at the program “Railway Engineering”, the general education study courses are delivered to the students of various study programs simultaneously.

Following the assessment, changes to the sequence of the study courses in the study program were made and the principles of inductive learning were applied, i.e., to let students acquire the theoretical knowledge, first of all they have to be given some practical inputs (facts, examples) – often this occurs indirectly, at the preceding classes, from life experience or in other ways. Without this knowledge, the summarization of deductive learning theory will not function, because deductive learning means wealth of knowledge, which students have already acquired before presentation of deductive input. The outcomes show that the knowledge in the majority of the first-year students is not sufficient.

This is why the goal of the changes to the sequence of study courses is to let students feel that they have been enrolled in RTU exactly to pursue the qualification of a railway engineer and professional Bachelor degree in railway engineering, and to train students for large volumes of general theoretical knowledge and the necessity of its learning in the terms of the acquired area of specialization.

For this purpose, during the first year of studies, railway and transport related basic courses, languages and humanities are delivered in the autumn term, starting from the courses:

- Introduction to Speciality and Research
- Numerical Methods and Engineering Programs for Transport Tasks
- Computer Technologies in Transport
- Transportation Systems Computer Design and Programming (study project)
- Materials Science
- Sociology of Personalities and Small Groups or Communication skills or General Sociology
- The English or German language (Part 1) – for the local students or
- the Latvian and English language (Part 1) – for the foreign students.

In the spring semester, the following courses are delivered:

- Rolling Stock Structure and Traction
- Railway Infrastructure and Operations
- General Metrology
- Sociology of Management or Politology or Fundamentals of Law
- The English or German language (Part 2) – for the local students or
- the Latvian language (Part 2) – for the foreign students.

During this period, in the autumn academic term, the main task of the academic staff at the first-year study courses of the Department of Railway Engineering is to develop the basic skills of future engineers in application of computer technologies, computerized design, programming and quantitative methods. Completion of these courses allows providing the knowledge about the basic elements of railway transport in the spring academic term – rolling stock and railway infrastructure, to demonstrate examples of railway problems and tasks, which require engineers possess general knowledge and skills in calculus, physics, technical mechanics, electrical engineering, chemistry, demonstration of certain solution methods, developing problem-solving skills.

Upon completion of the first year of studies, students are ready to summarize the previously acquired knowledge, facts, examples and tasks, to undertake theoretical study courses. In the second academic year, in the autumn academic term, the study program envisions implementation of the following study courses:

- Innovative Product Development and Entrepreneurship (Part 1)
- Basics of Occupational Safety
- Mathematics
- Physics
- Technical Mechanics
- Technology of Transport Logistic Systems (study project)

But in the spring semester:

- Innovative Product Development and Entrepreneurship (Part 2)
- Chemistry for Engineers
- Mathematics
- Physics
- Electrical Engineering and Electronics
- Technical Mechanics
- Operation Technology and Management

In the third study year in the fall semester, students acquire the compulsory field-specific study courses of professional specialization:

- Railway Microprocessor Systems (study project)
- Railway Communication Systems
- Railway Stations, Hubs and Train Traffic Organization
- Electrical Machines and Electrical Devices of Rolling Stock

and in the spring academic term, students have opportunity to select one out of two areas of specialization in order to deepen their knowledge and improve skills in a definite field of railway transport industry and Practical Placement (8 weeks):

- Study course in the specialization:
- From the specialization Rolling stock, automation, telemechanical and control systems - Railway Safety, Signalling and Interlocking or Rolling Stock Repair and Technical Maintenance Technology;
- From the specialization Railway Transportation and Traffic Organization - Freight Transportation and Commercial Activity Organization
- Civil Defence
- Environment and Climate Roadmap
- Practical Placement

At the end of the studies, the autumn term of the 4th year includes one more course of specialization, the block of elective study courses with the volume of 6 credit points and development of a Bachelor Paper comprising an engineering project:

- A study course in the field of specialization:
    - Rolling stock, automation, telemechanics and control systems - Autonomous Vehicle Systems Design or Railway Telecommunication Systems
    - Organization of railway transportation and traffic - Autonomous Vehicle Systems Design or Information Technology Systems in Transport
- Elective study courses
- Bachelor Paper with an engineering project

In the spring term of the fourth year of studies, students undergo Practical Placement (12 weeks) and complete and present their Bachelor Paper with an engineering project:

- Practical Placement
- Bachelor Paper with an engineering project.

All study courses within the program are interrelated. Thus, the study program will ensure gradual learning and will allow students to acquire theoretical and practical knowledge, develop necessary competencies and skills applicable in the contemporary labor market. Course mapping is cross-referenced within the curricula of the study courses and will ensure achievement of learning outcomes of the study program.

Assessment of student learning outcomes is carried out in accordance with the “Regulation on the Assessment of Learning Outcomes”, (https://www.rtu.lv/writable/public_files/RTU_studiju_rezultatu_vertesanas_nolikums.pdf (in Latvian) and Regulation of the Final Examination at Riga technical University) (https://www.rtu.lv/writable/public_files/RTU_nolikums_par_noslguma_prbaudjumiem_.pdf). Pedagogical methods for the implementation of study courses, their structure, as well as assessment methods, are selected by the academic staff responsible for the study course, in accordance with the specific nature of the course content and study program, as well as the needs of students. Courses and seminars on the latest teaching and pedagogical methods are organized for the academic staff, the attendance of professional advancement courses is encouraged both at the internal events of the faculty, at the RTU level and internationally. RTU Center for Academic

Excellence organizes professional advancement events for academic staff.

The academic staff has to inform students about specific assessment criteria for each course at the first lecture, these requirements are published in the e-learning environment of the course.

Assessment of learning outcomes is made through exams or tests. The 10-grade scale is used for assessment of knowledge. Positive knowledge at exams is assessed with the grades 4 through 10. If knowledge of a study course is assessed with grades from 1 to 3, a repeated assessment of knowledge is organized. In case the repeated assessment of knowledge does not give any positive outcomes, a student's knowledge is assessed for the third time by the administrative committee organized by the institute. Tests are not assessed with grades. Tests usually finalize study courses in humanities and social sciences, as well as elective study courses. Exam questions are prepared by a member of the academic staff, who has been delivering the appropriate study course, they are based on the approved program.

Information about all passed tests, research papers and exams is specified in the individual study plans (transcripts of records), which are approved by the Head of Transport Institute. Individual study plans are prepared based on the study field programs within the study field and student-elected study courses from the blocks of compulsory and elective study courses.

Upon the completion of internship, students present an internship report drawn up according to the requirements of methodological guidelines for Internship, which afterwards is checked by an Internship supervisor from the Institute according to the 10-grade scale. In turn, an Internship Supervisor from an industrial company draws up a reference letter about the internship completed by the student.

Study projects are developed in close cooperation with the academic staff, supervisors and professionals in the field, who not only consult students in the course of the development of term and Bachelor Papers, but also take part in organization and completion of internship, implement study projects and take part in research projects. Functioning of this system is integrated and will allow achieving the goals and outcomes set by the study program. Presentation of the study projects also done in the oral mode presenting a summary of the project content and results, it is followed by answers to supervisor's questions and assessment of the work.

Viva voce examination of the Bachelor Papers is held in the form of oral presentation, it consists of a content summary, answers to the questions of the members of the Final Examination Committee, assessment of the information and the paper. The Bachelor Paper is assessed by the Final Examination Committee consisting of the chair person, secretary and at least of three members. The chair of the qualification committee is selected among the leading specialists of a corresponding railway transport field, but half of the members are highly qualified railway specialists.

This is not a joint study program.

The study program is also offered in English. According to RTU guidelines for development of the study courses, the content, requirements and methods of assessment is an identical version of the program offered in Latvian. As long as English-speaking students need literature in English, preferably in the digital format, the academic staff also includes into the description of a course the compulsory literature in English, which is done in most cases, if needed, with help of the program head. Implementation of each program course involves members of the academic staff with a C1 CEFR level of English proficiency, confirmed by an appropriate certificate.

During the studies, a variety of student-centered learning (SCL) principles are observed. The student contingent and the diversity of their needs are taken into account and respected.

Concluding that the study program is chosen by many students with insufficient post-secondary school knowledge, an additional study course of Elementary Mathematics was organized at RTU level to be acquired by students according to test results.

As long as teaching methods applied at each study course are chosen by the responsible instructors and certain teaching methods are not centralized, sufficiently high diversity of teaching methods is possible.

Strife for autonomy in students is encouraged, at the same time, they are provided with guidance and support from the academic staff. Mutual respect between students and the academic staff is supported, even if senior members of the academic staff may feel it is excessive.

There are appropriate procedures for handling students’ complaints. It can be stated that complaints occur quite seldom. Still, not all complaints can be solved at the level of the study program.

All evaluators are informed and familiarized with the testing and examination methods, and receive assistance in improvement of their evaluation skills. RTU requires that the evaluation criteria and methods, as well as grading criteria, are published preliminarily in the e-learning environment ORTUS.

Student appeals can be considered, still none have occurred, as due to low interest of employers to study grades, students are not interested in higher grades in many cases, but those who want a higher grade are informed about the system of assessment already at the beginning of the term.

**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 study program includes Internship/Practical Placement amounting to 20 CP.

The guiding principles of Internship at the study program are as follows:

- TI Internship coordinator deals with organization of Internship;
- Internship is managed on the job by a company’s internship supervisor;
- Internship is implemented according to the Internship program;
- Students receive individual Internship tasks;
- During Internship inputs to a Bachelor Paper and an engineering project are summarized.

Internship will be organized in cooperation with the existing TI partners and employers in Latvia and in Europe:

- organizational units of SJSC “Latvijas dzelzceļš”;
- Infrastructure for the company’s sub-departments (gauges, vehicle depots);
- Sub-departments of the freight transportation units (maintenance workshops, railway stations);

- Locomotive Repair Center “Lokomotīvju serviss”;
- Rail Wagon Repair Centre “Vagonu serviss”;
- JSC “Pasažieru vilciens”;
- JSC “Starptautiskie pasažieru pārvadājumi”;
- Traction Rolling Stock Repair Center “Zasulauks”;
- Riga rail wagon-building plant; JSC “Lokomotīve” and other companies;
- “Eiropas dzelzceļa līnijas” Ltd and companies taking part in the project “Rail Baltica”;
- “Deutsche Bahn AG” – one of the largest European railway corporations offers students of the program “Railway Engineering” to undergo their internship in Latvia or in Germany, under the cooperation agreement.

Internships is normally carried out in two stages: specialization internship and pre-diploma internship.

Specialization internship is aimed at strengthening the acquired theoretical knowledge, development of professional skills and application of practical knowledge. Specialization internship is planned in the 6th academic term with the duration of 8 weeks.

The task of pre-diploma internship is to help acquire knowledge needed for development of a Bachelor Paper with an engineering project. During internship, students can receive consultations from a company’s specialists, use available literature and documentation exactly in the field of professional activities, and broaden their knowledge in the framework of the chosen theme of the diploma paper. Pre-diploma internship lasts 12 weeks and is planned in the 8th academic term.

As it is well-known, the railway infrastructure project “Rail Baltica” is being implemented in order to integrate the Baltic states into the European railway network. This is one of the priority projects of the EU transport network. Thus, new specialists will be in demand, and in connection with the offered opportunity, foreign students studying in English will be able find a fair place of internship and a job.

The aim of internship is directly related to the aims of the study program – to train qualified specialists, offer opportunities of practical knowledge acquisition, which will allow them to start immediately working and applying the skills at railway companies and organizations. Internship is planned to familiarize students with real processes and works on railway sites, to acquire team work and autonomous work skills, and fulfil assigned tasks. At the end of studies, graduates will be awarded a professional Bachelor degree and a professional engineer qualification, thus their employability will improve.

According to the internship organization procedure at RTU, students are assisted by the coordinator of the organizational unit in search for places of internship. If they need additional assistance, they have an opportunity to apply to the Career Support and Service Department, where career consultant and project supervisor help students in search for a place of internship and outreach, as well as support development of career management skills through different activities that can ensure successful outcomes of internship. Once a year, the Career Support and Service Department organizes at RTU the Career Day, whereby students also have a chance to meet personally with representatives of companies and discuss future opportunities. More about the event and its participants in the previous years: http://karjera.rtu.lv/projekti/karjeras-dienas-arhivs/.

An additional resource existing since 2015 is the web-site where companies are encouraged to place vacancy announcements, relevant to RTU students (https://ekarjera.rtu.lv/). Students can connect to it with a university username and follow up internship and job opportunities in the sector.

Additional support in enhancement of practical skills is offered by RTU Development Fund (https://www.rtu.lv/lv/attistibasfonds). Over the years, many hundreds of practical skills training competitions have been organized in cooperation with companies offering students a chance to acquire practical skills.

### 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.

Themes of the Bachelor Papers with an engineering project, suggested by supervisors – the academic staff of the Department of Railway Engineering with a PhD and Master degree, offer to solve the most relevant railway problems and tasks.

A Bachelor Paper with an engineering project includes both theoretical research and technical design. The work on the paper requires investigation of the existing situation and items under research – a certain station, section, element of the rolling stock, etc. – definition of shortcomings, description of problems and tasks. The existing technical solutions and methods have to be studied and a project with a technical solution has to be prepared, including technical documentation and large format drawings. Descriptive part of the diploma should contain calculations, computer modelling and experimental data to prove workability of the solution and enhancement in operation of an item under research.

At the time of drawing of the self-assessment report, the most relevant railway system upgrade and enhancement projects are connected with upgrade of the existing railway, procurement of new trains, improvement of performance of railway sections, linkage of the transport system with Rail Baltica, construction of Rail Baltica and planning of transportation, new telecommunication systems, process digitalization, computerization, etc., for example:

- Analysis of suburban traffic organization based on operation of new “ŠKODA VAGONKA” electric trains on the line Rīga-Krustpils;
- Analysis and optimization of freight train technical and commercial inspection at Daugavpils marshalling yard;
- Analysis of shunting in Šķirotava station parks “B” and “J”;
- Analysis of shunting in Šķirotava station park “A” and hump yard;
- Analysis of documentation circulation and filing at Šķirotava station;
- Analysis of upgrade of the freight terminal at Daugavpils marshalling yard;
- Analysis of freight train breaking up and collecting at the railway station <name of the station> based on different capacities of rail cars;
- “Smart” system design in a railway service building;
- Wireless networks in intelligent transport systems for railway transport sector;
- nstallation of a new reinforced concrete turnout with the frog (1/11, 1/14, 1/18) and hydraulic drive in station tracks;
- A-type overhaul of the line Istalsna-Nerza on the section Rēzekne II – Zilupe;

- upgrade of <chosen line/station> microprocessor control system;
- organization of regional passenger train operation and maintenance on the line Rail Baltica in Latvia;
- Regional Rail Baltica train depot in Jaunmārupe;
- Technology of access track maintenance at regional Rail Baltica stations;
- Development of synchronous reactive traction motors design;
- Development of a project of Skulte railway line throughput capacity improvement;
- Train movement organization project <in a chosen line> aimed at enhancement of energy efficiency;
- Development of a project of <chosen line> throughput capacity enhancement;
- Project development for enhancement of <chosen line and process> performance characteristics;
- Analysis of freight wagon bogie frame repair;
- Extension of traction motor safety resource in electric trains ER2 and ER2T at AS "Pasažieru vilciens" depot;
- Damages of electric train wheel pairs, their causes and possible methods of defect prevention;
- Use of natural gas in the railway rolling stock;
- Analysis of the rolling stock <chosen nodes> ;
- Prediction of residual lifetime of the rolling stock;
- Design of the rolling stock (locomotives/wagons) depot;
- Prediction of residual lifetime of electric trains;
- Turnout replacement - study of new technologies;
- Study of piggy-back transport;
- Analysis of organization of piggy-back transport and opportunities of its development in Latvia;
- Analysis of piggy-back transport organization and its development at Rīga port stations;
- Comparative analysis of failures of fuel equipment and fuel system in diesel locomotive 2M62 and 2TЭ116 and design of a fuel workshop;
- Organization of repair workshop flow for electrical machinery in electric trains and analysis of damages;
- Organization of repair workshop flow for wheel pairs of electric trains and analysis of damages;
- Analysis of diesel locomotive 2M62(U) 2TE10M and 2TE116 compressor KT-7 failure to operate and design of the train-stop equipment repair workshop;
- Safety analysis and repair of an automated railroad coupling SA-3;
- Analysis of basic failures of diesel locomotive traction motors and design of a mechanical workshop;
- Analysis of water system failures in diesel locomotives 2M62U; 2TE10U; 2TE116 in the design of diesel unit workshop;
- Redesign of the locotractor LL-1101 suspension.

No Bachelor Papers with an engineering project have been publicly presented within this study program so far. Still, analysis of the presented professional Bachelor papers at the study programs predecessors of the program "Railway Engineering" – "Railway Transport" and "Railway electrical systems" – allows concluding that higher grades are awarded to the papers about most relevant problems.

As long as the Final Examination Committee consists of representatives of the railway industry, one of the important paper assessment criteria is the contribution to the railway sector and its development and upgrade that derive from the diploma.

| Publicly presented Bachelor Papers | Year | Grade |
|---|---|---|
| Digital video systems in railway transport | 2021 | 8 |
| Research of possible application of innovative solutions for rolling stock control | 2021 | 8 |
| Development of the Dobele station reconstruction design | 2021 | 8 |
| Development of training materials for usage of the "Phoenix Contact" controllers in rail transport | 2021 | 8 |
| Development of universal LED signal module with intergraded self diagnostics capabilities | 2021 | 10 |
| Modernization of the point protection system from switching under the rolling stock in Ventspils hump yard | 2021 | 7 |
| Modernization of the level crossing automatic signalling system | 2021 | 7 |
| Remote monitoring of impulse track circuit equipment parameters | 2021 | 8 |
| Development of Vecaki railway station lighting system modernization project | 2021 | 8 |
| Electrification of Zasulauks–Bolderāja railway section | 2021 | 6 |
| Development of an innovative railway crossing signaling system | 2021 | 7 |
| Development of Daugavpils marshalling yard pneumatic station modernization project | 2021 | 6 |
| Digitization of maintenance of railway signaling, interlocking and blocking (SIB) systems | 2021 | 9 |
| Change of type R65 inventory rails to new 60E1 type continuously welded rails on section Skasta-Niedrica | 2021 | 6 |
| Provision of mixed transportation expedition at VAS "Latvijas dzelzceļš" Daugavpils Station | 2021 | 5 |
| Grain freight carrying by rail transport | 2021 | 9 |
| Electric trains traction motor repair flow organization and damage analysis | 2021 | 6 |
| The branch of the Rail Baltica line to Limbaži to provide regional traffic | 2021 | 7 |
| Impact of Rail Baltica construction works on passenger train timetable in Riga | 2021 | 8 |
| Development and optimization of the railway passenger transport organisation in section Riga-Valga-Tartu | 2021 | 9 |
| Measures for the prevention of malfunctions and damage to components and aggregates of the DR1AC series DMU, and an analysis of the effectiveness of the measures taken | 2021 | 7 |
| Design and inclusion of the narrow-gauge train line in the city environment of Alūksne region | 2021 | 9 |

As long as Bachelor Papers are assessed by the Qualification Committee, its chair being a relevant leading railway specialist, but the Committee includes highly qualified railway specialists and representatives of the university, the very assessments of papers speak for the quality and relevance of the developed papers in the market. The average grade is 7.54, and the distribution of grades is as follows:

- Outstanding – 1 (4.5%)
- Excellent – 4 (18.2%)
- Very good – 7 (31.8%)
- Good – 5 (22.7%)

- Almost good – 4 (18.2%)
- Satisfactory – 1 (4.5%).

## 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 program is implemented using the available infrastructure and material supplies, due to a high level of digitalization, it provides an opportunity to improve competitiveness of the university, quality of work and effectiveness, as well as availability of information through integration of IT solutions into administrative, learning and research processes of the university, ensuring students, administration and academic staff with modern, reliable, safe and joint IT infrastructure and qualitative IT services. All IT users are provided with the centralized intranet portal ORTUS (https://ortus.rtu.lv/), which functions as a joint digital portal accumulating information from all hubs of RTU information system and provides users with convenient and user-friendly interface and easy access to all IT services catalogue on one site.

For an effective learning Moodle e-learning environment is used to process automatically all binding information (study courses, users, groups, access rights, etc.). This system ensures student-tutor communications. The academic staff posts learning e-materials, knowledge assessment tests, homework tasks, information about a certain study course, etc., in the system. On ORTUS portal students can also see their financial information, apply for a document (statements, transcripts of academic records, copies of the agreement, etc.). For remote online teaching RTU academic staff is provided with Zoom and Microsoft Teams video conference platforms. Students can connect and get access to electronic learning tools at any time and location.

Effective use of classrooms and planning of studies is provided based on digitalization of the classrooms and the schedule (https://telpas.rtu.lv; https://nodarbibas.rtu.lv/). Every RTU student and member of the academic staff can see their class schedules with the specified place and time of a class, name of a tutor, name of an activity and the type of a class. In addition, for users' benefit, the system significantly facilitates planning and scheduling of the classes, as well as optimizes classroom seat occupancy and use efficiency.

For quality control purposes, the digital student surveying system is used, which helps control the quality of the study program and study courses in every academic term. Based on the quality control results, regular activities for optimization of the study programs and learning processes are organized.

For extra benefit of RTU students, academic staff and employees, RTU has purchased rental rights for Microsoft Windows and Microsoft Office software, which provide all users with access to the latest and up-to-date Microsoft software, RTU students for learning purposes also can use RTU licensed operating system Windows and Microsoft Office productivity pack. All RTU users have access to Microsoft Office 365 cloud platform with 1TB disk space per person for data storage and access to different supplementary teamwork and productivity tools (Microsoft Teams, SharePoint Online, Forms, OneNote, OneDrive, Outlook, etc.). RTU students, academic staff and employees have access to the university e-mail boxes.

RTU offers fast optical internet and a vast wireless network infrastructure with more than 400 access points, including the international service Eduroam.

The University library plays a major role in providing methodological and information support to the students. The Scientific Library of RTU (https://www.rtu.lv/en/studies/scientific-library) 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 1.3 million printed documents and e-resources in the databases relevant to RTU fields. In 2016, significant investment was made in the development of the library infrastructure, with the construction of an additional 2240 m2 of space for the Central Library. The total area of the library premises is 6393 m2, of which 3417 m2 are for reader services. There are 713 workstations for library users. The library has four group rooms and six individual cubicles, a Western reading room and a conference room. The library is accessible to users with reduced mobility.

When RTU provides funding for the library, the funding for information resources for each study program is calculated. The collection is replenished according to the recommendations of the heads of study program, researchers, and the allocated funding.

The database subscriptions maintained by RTU Scientific Library (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazes-eresursi/abonetas-datubazes):

- ProQuest Ebook Central, Academic Search Complete EBSCOhost, Applied Science & Technology Source EBSCOhost, Business Source Ultimate EBSCOhost, EBSCOhost eBook Academic Collection, Wiley Online Library, SpringerLink, The International Monetary Fund.
- Databases financed by the Ministry of Education and Science available to RTU Scientific Library: ScienceDirect, SCOPUS (Elsevier), Web of Science.
- Latvian databases: LETA, Letonika, the Database of Latvian Standards (available on the premises of the Library).

Database usage at the Scientific Library of RTU has been growing since 2016.

The new library premises have allowed to extend the range of services. Since the opening of the new premises in 2018, the number of visits to the library has increased from 103,825 to 691,200. The Central Library is open to users from Monday to Saturday. (https://www.rtu.lv/lv/studijas/biblioteka/darba-laiki-un-kontakti). There is a 24/7 reading room. During the summer period, the Central Library is open every weekday with reduced opening hours.

The library provides students, academic personnel and other stakeholders with various levels of individual consultations and group training in information literacy (https://www.rtu.lv/lv/studijas/biblioteka/lietotaju-apmacibas). Publications not available in the library are delivered via an interlibrary loan or an international loan. Internet access is available throughout the library. The library has copying, scanning, printing, binding services and a self-service dining room. Methodological, informative (including the library resource) and material and technical support comply with the requirements of the regulatory enactments for the regulated professions.  Moreover, new facilities are offered in Ķīpsala Campus, where a newly built shared use FMETA faculty laboratory building starts its work.

Over the past years new literature in the field of railway engineering was purchased, including 22 books in English published mostly in 2018-2020.

Resource support to the study program can be considered as sufficient, as RTU appears to be developed and updated in the information environment. Methodological support includes study books, computer typesetting of courses of lectures, methodological guidelines for laboratory works, journal publications in English, German and Russian, catalogues of equipment, regulatory documents for railway transport, EU directives, international standards, etc.

The lectures within the study program "Railway Engineering'' are delivered in the classrooms equipped with advanced presentation equipment providing all kinds of access to audiovisual learning and information materials, including direct access to the internet.  Computer science related courses are delivered in the shared-use RTU and specialized TI computer classrooms/labs, where workstations are equipped with computers and necessary office hardware and software.

Laboratory works usually are held in the specialized laboratories, but for the study courses that cannot provide them, on-site visits to railway companies will be organized. During the visits, students will be able to get familiarized with real technological processes of the respective companies. During the past years, supply of lab equipment and devices to the specialized laboratories has been sponsored by the state public company "Latvijas dzelzceļš", as well as by EU structural funds:

- In cooperation with "Phoenix Contact", 10 working places were equipped with modern controllers.  An opportunity to carry out extended research of the transport sector.
- In cooperation with "Weidmuller Interface GmbH & Co" – 10 workplaces were equipped with modern controllers integrated in one industrial network. An opportunity to develop practical skills and competences in design, development, programming, imaging of transport control systems and in application of network technologies to tasks in the transport sector.
- In cooperation with WAGO „Kontakttechnik GmbH & Co", 5 workstations were arranged using the company solutions.
- In cooperation with the company „Bombardier Transportation Baltics" the study laboratory "EBILCOK mikroprocesoru sistēma" and a simulator of Šķirotava park BOMBARDIER EBILOCK microprocesor system were established. "Bombardier" technicians installed and put into operation "CPU and environment simulator", which can be considered as the first step in creation of an integrated laboratory.  Further development of the laboratory envisions the connection of the new simulator to the central processor EBILOCK 950 R4 operated in real conditions, as well as to the CPU of system components, which comprises the necessary terminal equipment of bundles of interface equipment – to provide operation of the switch mechanism, traffic light, track circuits, level crossing signals and other equipment. It is planned to install the terminal equipment in the laboratory. Along with that, the laboratory will allow for acquisition of practical skills for maintenance, repair and upgrade of the whole range of "Bombardier" equipment and systems.
- The laboratory of railway SCB, automation and telemechanics is equipped with Siemens PLCs, railway switches, traffic light, elements of level crossings and of other system components, BOMBARDIER track circuit test bench, National Instruments LabView laboratory devices, work benches and software.
- The creative student laboratory offers a wide range of instruments and measurement devices, including the National Instruments LabView educational laboratory module of automated and electrical systems ELVIS comprising replaceable learning modules and optional hardware units including a prototyping plate, a fiber optics learning module Fotex, A DC motor control module, a digital electronic Fpga plate, a mechatronic sensor module, etc.
- The laboratory of physical railway simulation (train movement modelling) is equipped with a

railway model 1:87 for movement design, programming, testing of different trains using microcontrollers and PLCs.
- The wheel pair testing laboratory located in the laboratory building is equipped with various instruments for damage detection and evaluation - an optical emission analyzer PMI – Master PRO, an ultrasound testing (UT) unit Krautkramer, an electronic microscope for inspection of metal structures, etc., as well as a pneumatic braking system bench.

In summer 2022, the Transport Institute is planning to permanently move its laboratories from the faculty of Electronics and Telecommunications at 12 Azenes Street to the building of FMETA at 6B Ķīpsalas Street with new refurbished premises, designed for installation of specialized railway engineering laboratories.

**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 compliance to the conceptual report approved by the Cabinet on 29 June, 2015, “Implementation of a new higher education financing model in Latvia”, the structural reforms are being gradually implemented in the sector in order to ensure establishment of an effective and sustainable system of higher education.

Basic financing is channeled to state budget funded seats. The number of state funded seats is regulated by the Law on Higher Education, Paragraph 51 and Paragraph 52. The detailed procedure of financing allocation and calculation of one seat is available in the Cabinet Regulations No. 994 “Procedures for Financing Institutions of Higher Education and Colleges from the Funds of the State Budget” adopted on 12 December, 2006.

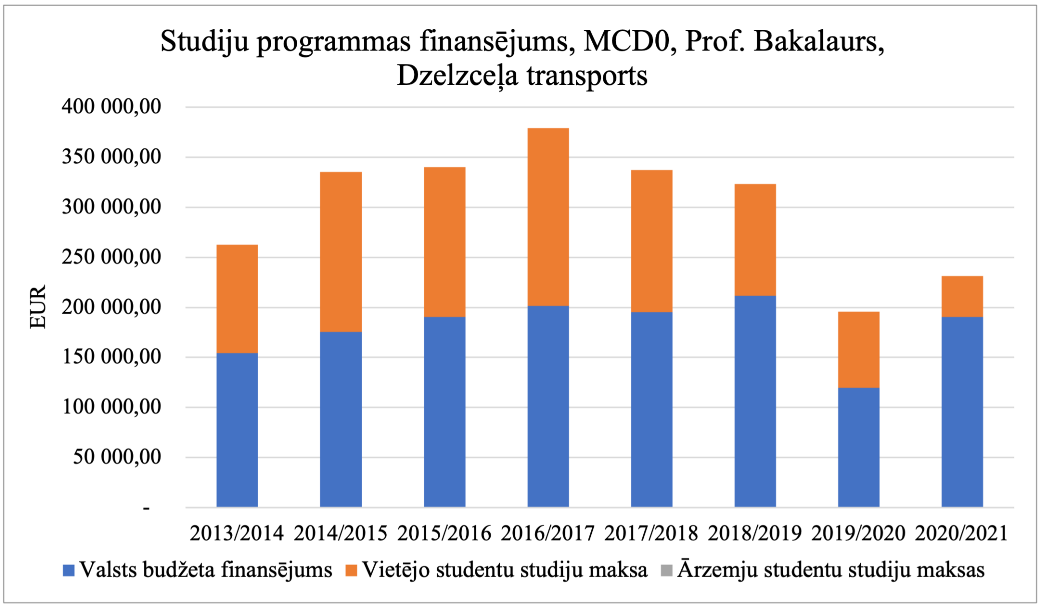
RTU financing in a corresponding academic year is distributed according to the RTU Senate decision “On the Methodology of Distribution and Allocation of Basic Financing, Performance-based Financing and Tuition Fees to Organizational Units of RTU”.

In addition to the basic state budget financing, the program is also financed from the tuition fees of local and foreign students.

The professional Bachelor study program “Railway Engineering” is financed mainly from the basic state budget, the amount of basic financing is based on the number of students. During the reporting period, the total financing to the Bachelor study program has been EUR 2,404,810.50, of them EUR 967,139.88 is made of the local student tuition fees, but EUR 1,437,670.62 is the state budget financing. As derives from the figures below, starting from the academic year 2017/2018, the volume of financing from local tuition fees has been decreasing. This is explained by the fact that the number of students under the cooperation agreement between RTU and Latvian Railways on training of specialists has been decreasing too. Taking into account the fact that due to the long-term cooperation, the demanded specialists have been trained, as well as the fact that "Latvian Railway" has been experiencing significant changes in the last two years (significant reduction of the number of employees, as well as the start of the Rail Baltica project in Latvia), the demand for training of new employees has declined.

| Period | State budget subsidy | Tuition fee by local students | Tuition fee by foreign students | Total financing of the study program | Costs per 1 student, EUR |
|---|---|---|---|---|---|
| 2013/2014 | 154 090.00 | 108 725.00 | - | 262 815.00 | 3 866.00 |
| 2014/2015 | 175 587.60 | 159 588.33 | - | 335 175.93 | 3 866.02 |
| 2015/2016 | 190 564.54 | 149 772.94 | - | 340 337.48 | 3 866.02 |
| 2016/2017 | 201 225.94 | 177 834.30 | - | 379 060.24 | 3 866.02 |
| 2017/2018 | 195 275.61 | 141 903.76 | - | 337 179.37 | 4 040.66 |
| 2018/2019 | 211 385.72 | 111 781.00 | - | 323 166.72 | 4 229.68 |
| 2019/2020 | 119 372.29 | 76 492.00 | - | 195 864.29 | 4 405.04 |
| 2020/2021 | 190 168.92 | 41 042.55 | - | 231 211.47 | 4 462.81 |

Proportional distribution of funding of the professional Bachelor study program "Railway Engineering" is shown in the Figure:




State budget funding is calculated on an annual basis, after reduction of amounts covering total costs of the university according to the number of students and credit points and many other criteria. Yearly changing and unpredictable funding allows for limited flexibility in development planning.

Costs per student at the study program are calculated by the Office of Vice-Rector for Finance. As the implementation of the study program involves a variety of RTU organizational units and central offices, the management of the study program cannot specify the costs and the items included in the cost calculation, as well as proportional distribution of the funding among certain items. Likewise, the minimal number of students in the study program in order to ensure cost-effectiveness of the study program cannot be calculated.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

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

The academic staff involved in the implementation of the study program advance their professional qualification according to conditions of the study program implementation and requirements of the regulatory enactments.

**Mihails Gorobecs**, Dr.sc.ing., Professor, Head of the Department of Railway Engineering, has acquired his professional competence in the following fields of science: Management and optimization of transport movement using AI-based equipment and methods, Computer control in transport¸ Embedded intelligent electrical equipment, computer control and software packs in industrial processes, decision support methods in transport systems, adaptive systems and methods, genetic and evolutionary algorithms, neural networks, fuzzy logic control methods, railway management, safety and optimization methods, computer control of unmanned electrical vehicles, numerical and simulation modelling of systems. More than 10 years of experience in management of different international and national projects in the field of electrical and railway transport, the author of a variety of study books and methodological aids, the author of many patented inventions for railway transport and of more than 120 scientific publications in the international journals and collections of scientific articles. Takin Delivers the study course “Computer technologies in transport”, “Numerical methods and engineering programs for transport tasks”, “Computer design and programming of transport systems (study project)”, “Design of autonomous vehicle systems”, “Information technologies in transport systems”, “Technology of Transport Logistic Systems (study project)”.

**Edmunds Kamoliņš**, Dr.sc.ing., Assoc. Professor, Head of the Transport Institute, the leading researcher, is a Doctor of technical sciences in the sub-field of Electrical Engineering “Electrical machinery and equipment”, in 2001 was awarded an engineer qualification at RTU Institute of Railway Transport in the specialization “Computer control, information and electronic systems”. More than 12 years of experience in management of studies, research and different research projects. Participates regularly in international conferences, seminars and training courses. The acquired skills and knowledge are conveyed in the study courses, engaging students in different research and educational activities. In 2012 was awarded a qualification of an international welding engineer (IWE). Since 2007 has been an expert in energy related fields at the German company

TÜV Rheinland Industrie Service GmbH and has taken part in technical inspections for a variety of international projects, which contribute to manufacturing of different equipment for thermal power stations, water supply and waste water treatment, oil refineries, food production, funfairs, etc. Delivers the study courses “Introduction to speciality and research” and “Electrical Machines and Electrical Devices of Rolling Stock” in Latvian.

**Pavel Gavrilov**, Dr.sc.ing., Associate Professor, Researcher, Head of the Metallurgy Laboratory of the Transport Institute has professional competencies and qualifications in the field of repair and modernization of rolling stock locomotives and wagons, analysis of damages and corrosion of rolling stock and track elements, metallographic research. He obtained his doctoral degree in 2010 with the doctoral dissertation "Study of derailment of wagons moving on winding sections and lowering from a sorting hill". He has participated in several scientific research projects and expertise in the structure of metal parts of SJSC “Latvijas dzelzceļš”. Research interests include analysis of metal structure, damages of cracks and defects. He obtained a diploma of “European welding engineer” and “International welding engineer” and participated in the periodic certification of electric and gas welders of SJSC “Latvijas dzelzceļš”. He also works for the railway engineer JSC “Pasažieru vilciens” and uses his experience in implementation of the study course “Rolling Stock Repair and Maintenance Technology” in Latvian.

**Viesturs Bražis**, Dr.sc.ing., Associate professor, leading researcher has acquired his professional competencies in the following fields: power storage systems, electric drive and automation, DC traction networks, computer control of industrial processes, automatic control methods, computer control of electric vehicles, electric transport and power electronics computer modeling of systems. He has more than 15 years of experience in managing various international and local projects in the field of electric transport and energy storage systems, 20 years of experience in teaching and development several textbooks and handbooks, has patented several inventions in the field of asynchronous electric drive and has more than 40 scientific publications in international journals and articles. Within the framework of research activities, scientific work was also performed as a leading researcher at the Institute of Physical Energy. Ensures the implementation of the study courses “Electrical Machines and Electrical Devices of Rolling Stock” and “Railway Safety, Signaling and Interlocking”.

**Jānis Eiduks**, Dr.sc.ing., Assistant Professor of RTU Department of Railway Engineering and Head of the Technical Department of “Eiropas Dzelzceļa līnijas” Ltd. Professionally significant experience in the field: Courses in the field of railway rolling stock in Japan (2000), Chief Technologist of LDZ Rolling Stock Administration (1997-2004), Chief Technical Expert of “Eiropas dzelzceļa līnijas” Ltd. (since 2016), functions in various international formats Deputy Head of the EU Council Land Transport Group on Railways (2015), Latvian Representative to the Administrative Board of the European Railway Agency (2004-2014), Latvian Representative to the OTIF Administrative Committee (2012-2015), Latvian Representative to the European Commission in the Railway Development Committee (2004-2015), Latvia's representative in the European Commission's Railway Interoperability and Safety Committee (since 2004). Research was carried out in traction theory and traction calculations, railway rolling stock braking and safety equipment, rolling stock construction, locomotive power transmission, rolling stock maintenance and operation, railway station and hub theory, train running planning and organization, European Union railway policy, in particular particularly in the field of interoperability and safety, in the regulation of international rail transport. In the study program with his qualification he participates in the coordination of the internship, as well as participates in the implementation of the study courses “Rolling Stock Structure and Traction”, “Railway Stations, Nodes and Train Traffic Organization” and “Rolling Stock Repair and Technical Maintenance Technology” for foreign students.

Fyodor Mikhailov, Dr.sc.ing., Assistant professor, researcher has professional competencies in the following railway areas: optimization of operation, railway technical operation regulations, freight and commercial work organization, freight optimization. He also works as the head of the technical department of JSC "Pasažieru vilciens". Professional interests also concern the interaction of the 1435 and 1520 railway systems and the field of emission-free technologies (hydrogen, hybrid traction, gas diesel) for use in rail transport. More than 15 years of experience in managing various international and national projects in the field of railway transport (including rolling stock, railway infrastructure and staff training), development of methodological tools and more than 20 scientific publications in international journals and articles, more than 10 presentations in international railway transport conferences. Delivers the study courses “Introduction to Speciality and Research” in English and “Railway Infrastructure and Operations”, “Operation Technology and Management” in English and “Cargo and Commercial Work Organization”.

**Andrejs Potapovs**, Dr.sc.ing., assistant professor, in 2014 was awarded a doctor degree for the theme “Research of embedded intelligent equipment and development of railway adaptive management”, leading researcher. Results of research are published in different international scientific volumes and journals and refer to adaptive management, embedded railway microprocessor systems, adaptive, automated control and wireless sensor systems, programmable controllers of industrial control systems and 3D-modelling. Takes part in different national and international projects and is the author of some study books, various scientific publications and the patented invention “Smooth and precise adaptive train braking system” and “Device for safe passing of motor vehicle over level crossings using satellite navigation systems”. At the study program he delivers the course “Railway Microprocessor Systems (study project)”, as well as takes part in delivery of the study courses “Transportation Systems Computer Design and Programming (study project)”, “Railway Safety, Signalling and Interlocking”, “Autonomous Vehicle Systems Design” and “Information Technology Systems in Transport”.

**Viktors Ivanovs**, Dr.sc.ing., lecturer, has defended his doctoral thesis “Analysis of the effect of rail grinding on their condition” in 2021. He has acquired professional competencies in the following areas of railway transport: research of damage to rails and switches, research of the impact of different types and materials of welding and grinding of different types of railway rails. Successfully supervised 12 bachelor's theses. He is the author of 12 scientific publications. Research of reinforced concrete sleepers of SJSC “Latvijas dzelzceļš” and development of recommendations for repair of cracked, delamination and other defects of reinforced concrete bearings and selection of materials to be used participated in the project and the European Social Fund project. More than 13 years of experience in the Railway Administration of SJSC “Latvijas dzelzceļš”, Jelgava operation department, as a track fitter and foreman. For the last 7 years, the Railway Administration of SJSC “Latvijas dzelzceļš”, management of technical training of Jelgava operation department. The implementation of the trackside-related part of the study course “Railway Infrastructure and Operation” for the flow of Latvian students uses their professional work experience.

**Pāvels Stankēvičs**, Dr.sc.ing., Researcher, Department of Railway Engineering, RTU, Head of the Traffic Safety and Technological Process Supervision Department of SIA “LDZ CARGO”, risk Manager. He defended his doctoral thesis “Technology of Production of Antifriction Parts for Rolling Metal Powders and Increasing Tribotechnical Properties” in 2020. Pavel Stankevics has a doctoral degree in construction and transport engineering as well as a professional master's degree in transport management. Since 2014 performs pedagogical as well as scientific research work, has more than 20 years of practical experience in railway transport, gained while working in the railway sector in various positions related to the operation of rolling stock, work organization and planning, traffic safety supervision and risk management. Extensive practical experience and qualification level allow to provide students with up-to-date and in-depth knowledge in the field of railway transport, ensuring the achievement of full-fledged study results. He is the author and co-author of more than twenty scientific articles in the fields of transport and materials science. Research interests: railway transport brake systems, transport safety, composite metal powder materials. Conducts the study course “Rolling Stock Structure and Traction” for Latvian students.

**Aleksejs Vasiljevs**, M.sc.ing., Researcher. Applicant for the degree of Doctor of Engineering Sciences, researcher at the RTU Transport Institute and Head of the technological systems control department of SJSC Latvijas dzelzceļš. Research and work interests include mathematical modeling of radio wave propagation, railway signaling, centralization and interlocking, methods for increasing the safety and security of communication systems, automation of hill control systems and equipment, application of industrial Internet solutions in the field of railway automation and telematics. More than 5 years of experience in launching, servicing and ensuring the operability of railway microprocessor control systems, raising the professional competence of SJSC "Latvijas dzelzceļš" employees, development of study institute study course materials, laboratory work, practical tasks; supervisor of more than 10 final theses. The study program provides study courses “Transport communication systems” and “Railway telecommunication systems”, as well as conducts the course “Railway transport microprocessor systems (study project)” for foreign students and participates in the implementation of the study course “Railway safety, signaling and interlocking”.

**Katrīne Otersone**, M.sc.ing., Assistant, research assistant. Her bachelor's thesis "Perspective 5G mobile communication network in railway transport" was defended in 2019 and "Modern mobile communication systems in high-speed railways" was defended with excellence in 2021. Fields of research activity are telematics systems, real-time transport radio systems, railway telecommunication systems, wireless communication networks, intelligent transport networks, network security. She has experience in developing study materials, practical tasks, giving lectures and conducting practical works in study courses of transport communication systems and railway telecommunication systems. Participates in the implementation of the study courses “Transport Communication Systems” and “Railway Telecommunication Systems” for Latvian students

**Oksana Iščuka**, M.sc.ing., researcher has acquired professional competencies in the following fields of science: organization and management of passenger transport, operation technology and management, design of railway stations and junctions, transport logistics, traffic management and optimization, decision support methods in transport systems, statistical methods, railway transport management, optimization methods , mathematical and simulation modeling of technological processes of railway station work. It is planned to develop an energy efficiency technology project for sorting station logistics in the near future. More than 5 years of experience in the management of various bachelor's theses in the field of railway transport, development of several study handbooks and 15 scientific publications in international journals and paper proceedings and other publications. She works at the Latvian Railway and uses the practical experience of train movement and shunting work in the sections equipped with automatic and semi-automatic blocking, dispatching centralization; provision of principal services, execution of customs procedures (transit) in the Computerized Transit Control System, examination and execution of railway transport documents, preparation of reports on open and closed transit declarations, automated charging for transportation fees, etc. Implements study courses “Operational Technology and Management” and “Railway Stations, Nodes and Train Organization” for Latvian students.

In general, the data attest the academic staff qualification and their ability to ensure the quality of the study courses. A range of tutors in parallel are employed in the railway sector, so their practical skills and competences are conveyed to the study program.

It is evident that in parallel with the process of studies, the academic staff also takes active part in research, which promotes sharing experience with the students during the studies. Students are familiarized with field-related innovations, problems and goals. Tutors tell about real projects, research, methods, developments and results, and students can see the interrelation between the course content and on the job tasks and understand the necessity of its learning, as well as try to find solutions themselves, thus developing their skills and competencies. Continuous advancement and optimization of the learning content according to the industry trends and requirements allows avoiding stagnation.

Training and improvement of qualification of the academic staff is carried out with help of conferences and seminars, learning at different courses, participation in work of other organizations as consultants, or on the job experience. Every year the tutors take active part in methodological seminars organized by RTU and other universities.

FMETA has established a long term and reliable cooperation with foreign lecturers, who are involved in the implementation of the study program. The professional Bachelor study program “Railway Engineering” also plans to invite visiting professors from other countries.

It is also planned to involve the specialists and representatives of companies in the sector, since they could convey specific knowledge and share experience in the corresponding study courses.

− On 30 September 2021, the online workshop was organized by the German state railway company “Deutsche Bahn” (DB) about the role and opportunities of railway in the future.

− On 23 April 2021, the online conference organized by Rail Baltica and the Ministry of Transport “21st century Railway in Latvia: Challenges and Opportunities in Education” envisioned for the current and future railway engineering students.

− The students of the study program “Railway Engineering” took active part in a series of lectures organized by a joint venture of Rail Baltica RB Rail JSC Rail Baltica Academy for the students in natural sciences and engineering (and for the general public in the Baltics) on 3-17 June 2021, and currently are taking part in the new lecture season starting from 5 November, 2021.

### 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 study program involves RTU academic staff members whose profiles are provided in their **curriculum vitae**. The academic and research staff and their qualifications comply with the requirements of the study course.

12 members of the academic staff form the Transport Institute are involved in implementation of the study program:

- 1 professor – Doctor of Science, whose academic and teaching qualifications meet the evaluation criteria for academic and teaching qualifications of the candidates to the position of a professor set by regulatory documents;
- 3 associated professors – Doctors of Science, whose academic and teaching qualifications meet the evaluation criteria for academic and teaching qualifications of the candidates to the position of an associate professor set by regulatory documents;
- 3 assistant professors – Doctors of Science, whose academic and teaching qualifications meet the evaluation criteria for academic and teaching qualifications of the candidates to the position of an assistant professor set by regulatory documents.

1 lecturer, 1 assistant, 3 researchers also take part in the implementation of the study program.

Among the academic staff from the Transport Institute involved 9 hold a PhD degree and 3 – a Master degree and 2 them are studying at a PhD study program.

The average age of the academic staff from the Transport Institute is 39.9 years. 1 is in the age group of 20-30 years old, 4 – 30-40 years old, 6 – 40-50 years old, 1 – 50-60 years old, and none – in the 60+ group.

In December 2020, Pāvels Stankēvičs, who specializes in construction and traction of the rolling stock, publicly presented his PhD Thesis, and in September 2021, Viktors Ivanovs publicly presented his PhD Thesis. He is involved in the delivery of the study courses on railway infrastructure and rail track operation and maintenance.

These results allow transferring the PhD research results to the study courses on the railway rolling stock (P.Stankevičs) and rail tracks (V.Ivanovs), increasing their value with relevant problems in the fields and their innovative solutions. Furthermore, the awarded scientific degrees provide the young doctors with an opportunity to apply for and manage research projects, which in turn will further increase the quality of studies due to continuous follow up of up-to-date trends in the railway sector.

A degree candidate Aleksejs Vasiļjevs is getting ready for his viva voce examination. He is working with railway automation, telematics and telecommunication systems and already now is taking an active part in the teaching and development of new study courses. This field of studies is supported by an assistant, PhD student Katrina Otersone, whose field is wireless communication networks GSM-R/5G-R, their safety and reliability. She is involved in teaching activities as an assistant and supplements the study course about communication systems in transport and railway telecommunication systems with information about these advanced technologies.

One of the most important modern requirements in the railway industry is the need for knowledge and skills in information technologies, design and programming of embedded equipment, microprocessors and railway electronic systems. In order to improve the quality of management of the study program, some new members of academic staff were invited in 2021 – Professor Mihails Gorobecs, who has vast experience in computer sciences (hardware and programming), information technologies (numerical modelling and simulation of logistics and transport systems, computer modelling, databases, web technologies), energy technologies in computer control (industrial systems, robotic systems, design and programming of embedded systems and their control algorithms for transport applications), and AI technologies (neuron networks, fuzzy logic, genetic and immune algorithms, intelligent agents) to be developed and adopted in many railway transport projects, and Assistant Professor Andrejs Potapovs, whose “niche” includes programmable controllers and microcontrollers, adaptive systems, systems of embedded sensors. These members of the academic staff will help raise the qualification level of future railway engineers and their competences to freely use information technologies in transport systems, to program railway control devices, as well as to design and upgrade the coming fast autonomous self-driving trains and their control systems.

In view of the fact that in the new future electrical energy, electrical traction and electrical systems will dominate in the railway sector as the most environmentally friendly and green, in order to improve the quality of the study process it was necessary to invite specialists with vast experience in electrical machinery and electrical equipment and in rail transport systems - Assoc. Professor Edmunds Kamoliņš and Assoc. Professor Viesturs Bražis.

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

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

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

The proportionality of the professional and academic teaching staff is ensured in the implementation of the study program, thus creating a balanced staff that helps to achieve the goal and results of the study programs.

The co-operation of the teaching staff is formed in the meetings of the methodological commissions, in individual talks with the director of the study program, in the talks with the teaching staff, as well as in the joint meetings of the teaching staff of the Department of Railway Engineering, discussing various issues.

The teaching staff of the study program cooperates in the implementation and updating of the content of the study courses, coordinates the topics in order to avoid duplication of the content. The teaching staff also cooperates within the research groups, offers ideas for the topics of qualification papers and improvement of study programs. At the same time, the teaching staff participates in the development of extracurricular activities for students, for example, to provide student study tours to employers, or to attract visiting lecturers in the field.

In accordance with the internal normative documents regulating the RTU study process, the Council of the Transport Institute operates within the study program, which is one of the elements of ensuring the quality of the implementation of the Program.

The main directions of the work of the council are:

1. Evaluation of study course descriptions for approval at the meeting of the Railway engineering department and approval by RTU Study Department.
2. Review and approval of study and methodological materials.
3. Organization of lesson observation and analysis of results.
4. Organization of methodological seminars on current events.
5. To provide proposals for the development and improvement of new study courses.
6. Coordination of bachelor thesis topics.
7. To discuss novelties in the use of information technologies in the study process and to provide recommendations to the management of the institute / faculty.

For the moment of the drawing of the self-assessment report:

- number of students is 46
- number of involved members of academic staff is 27

Therefore, the student-academic staff ratio is 1.7.

# 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 | MCH0_diploms_dipl_supple.zip | MCH0_diploms_dipl_pielik.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) | | |
| 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 | MCH0_stud_statist_EN.pdf | MCH0_stud_statist_LV.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 | MCH0_StEdSt_6_annex.pdf | MCH0_ValzSt_6_pielik.pdf |
| 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) | MCH0_ProfSt_7_annex.pdf | MCH0_ProfSt_7_pielik.pdf |
| 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 | MCH0_CoursMapp_8_annex.pdf | MCH0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MCH0_CurricStProgr_9_annex.pdf | MCH0_StudProgrPL_9_pielik.pdf |
| Descriptions of the study courses/ modules | MCH0_DescriptStud_cour.zip | MCH0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | MCH0_Descr_org_internsh.pdf | MCH0_Prakse_apr.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Railway engineering (47526)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Railway engineering* |
| Education classification code | *47526* |
| Type of the study programme | *Professional master study programme* |
| Name of the study programme director | *Mihails* |
| Surname of the study programme director | *Gorobecs* |
| E-mail of the study programme director | *mihails.gorobecs@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., profesors* |
| Phone of the study programme director | |
| Goal of the study programme | *The aim of the study program is to provide students with the opportunity to acquire professional skills in railway technologies, in accordance with the professional standard, providing theoretical knowledge and competencies in the organization of work in transport companies, optimization of control processes and project management of technological system research and development.* |
| Tasks of the study programme | *1. To ensure competitive training in the field of railway on the level of Masters' studies and in accordance with international standards;<br>2. To ensure the development of the content of the study program, study process, scientific research work and changes in conformity with changes in the field of rail transport, international practice, science and didactics practice;<br>3. To promote the interest of students in further vocational development, supplementing academic knowledge, to continue their education at the PhD studies, developing research skills and facilitating their use;<br>4. To promote students' interest in community processes, stimulate student development into a positive, modern, responsible, ethical and capacity-building personality that can act independently and make decisions;<br>5. To develop practical use of research work and its results in the field of rail transport by academic staff and students;<br>6. To promote international mobility and participation in projects.* |

| | |
|---|---|
| Results of the study programme | *Graduate of the study programme:*<br>*1. Is able to effectively plan and manage introduction of innovative management systems, promoting transport integration and EU railway integration processes and evaluate perspectives of railway transport system development;*<br>*2. Is competent to manage the railway transport system and their strategic engineering development plans and programs, implementation of strategic and operative plans of railway traffic organization, projects for modernization of railway transport system equipment and technical means, plan and organize the work of a team;*<br>*3. Is able to assess the general efficiency and safety of a railway transport system, as well as opportunities for its optimization;*<br>*4. Is competent to optimize operations and management of maintenance, repair and service of the railway transport infrastructure, technical means and special equipment, freight and passenger transportation and infrastructure maintenance related areas using innovative automation and computerization methods, efficiently use information technologies;*<br>*5. Is able to organize expertise testing of the technical railway means, equipment and services, risk management and certification and take part in the development and introduction of standards and norms and regulations in the field of railway transport;*<br>*6. Is competent to review research and analyses, develop publications and professional advancement training programs, improve informative, research and learning materials in railway transport and present them at the conferences/seminars in railway transport.* |
| Final examination upon the completion of the study programme | *Master's Thesis* |

# Study programme forms

### 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) | *Professional bachelor degree in 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) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

### Places of implementation

| Place name | City | Address |
|---|---|---|

| | | |
|---|---|---|
| Riga Technical University | RĪGA | KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050 |

**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) | *Professional Bachelor degree or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional Master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

**Places of implementation**

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

**Full time studies - 1 years - english**

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *1* |
| Duration in month | *0* |
| Language | *english* |
| Amount (CP) | *40* |
| Admission requirements (in English) | *Professional bachelor degree in railway electrical systems or professional bachelor degree in railway transport, 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) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

**Places of implementation**

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

**Full time studies - 1 years - latvian**

| | |
|---|---|
| Study type and form | *Full time studies* |
| Duration in full years | *1* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *40* |
| Admission requirements (in English) | *Professional bachelor degree in railway electrical systems or professional bachelor degree in railway transport, or comparable education* |

| | |
|---|---|
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

**Places of implementation**

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

**Part time extramural studies - 3 years - english**

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *3* |
| Duration in month | *0* |
| Language | *english* |
| Amount (CP) | *80* |
| Admission requirements (in English) | *Professional bachelor degree in 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) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

**Places of implementation**

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

**Part time extramural studies - 3 years - latvian**

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *3* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *80* |
| Admission requirements (in English) | *Professional bachelor degree in engineering or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

**Places of implementation**

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

**Part time extramural studies - 1 years, 6 months - english**

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *1* |
| Duration in month | *6* |
| Language | *english* |

| | |
|---|---|
| Amount (CP) | *40* |
| Admission requirements (in English) | *Professional bachelor degree in railway electrical systems or professional bachelor degree in railway transport, 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) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

**Places of implementation**

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

**Part time extramural studies - 1 years, 6 months - latvian**

| | |
|---|---|
| Study type and form | *Part time extramural studies* |
| Duration in full years | *1* |
| Duration in month | *6* |
| Language | *latvian* |
| Amount (CP) | *40* |
| Admission requirements (in English) | *Professional bachelor degree in railway electrical systems or professional bachelor degree in railway transport, or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

**Places of implementation**

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

**Part time studies - 1 years, 6 months - latvian**

| | |
|---|---|
| Study type and form | *Part time studies* |
| Duration in full years | *1* |
| Duration in month | *6* |
| Language | *latvian* |
| Amount (CP) | *40* |
| Admission requirements (in English) | *Professional bachelor degree in railway electrical systems or professional bachelor degree in railway transport, or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

**Places of implementation**

| Place name | City | Address |
|---|---|---|

| | | |
|---|---|---|
| Riga Technical University | RĪGA | KAĻĶU IELA 1, CENTRA RAJONS, RĪGA, LV-1050 |

**Part time studies - 1 years, 6 months - english**

| | |
|---|---|
| Study type and form | *Part time studies* |
| Duration in full years | *1* |
| Duration in month | *6* |
| Language | *english* |
| Amount (CP) | *40* |
| Admission requirements (in English) | *Professional bachelor degree in railway electrical systems or professional bachelor degree in railway transport, 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) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

**Places of implementation**

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

**Part time studies - 3 years - latvian**

| | |
|---|---|
| Study type and form | *Part time studies* |
| Duration in full years | *3* |
| Duration in month | *0* |
| Language | *latvian* |
| Amount (CP) | *80* |
| Admission requirements (in English) | *Professional bachelor degree in engineering or comparable education* |
| Degree to be acquired or professional qualification, or degree to be acquired and professional qualification (in english) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

**Places of implementation**

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

**Part time studies - 3 years - english**

| | |
|---|---|
| Study type and form | *Part time studies* |
| Duration in full years | *3* |
| Duration in month | *0* |
| Language | *english* |
| Amount (CP) | *80* |
| Admission requirements (in English) | *Professional bachelor degree in 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) | *Professional master degree in railway transport* |
| Qualification to be obtained (in english) | *Railway technology engineer* |

### 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 professional Master study program “Railway Engineering” was created in 2020 by RTU Senate decision of 27 January, Minutes № 636. The study program was created on the basis of the existing RTU professional Master study programs “Railway Transport” and “Railway Electrical Systems”. “Railway Engineering” is included in the accreditation page № 2020/43 of the study field “Mechanics and metalworking, heat engineering, heat engineering and mechanical engineering" and licensed by SKK decision № 2020/49-L of 27 July 2020.

On 27 October 2021 (meeting of Vocational Education and Employment Tripartite Cooperation Subcouncil, Minutes № 6) new professional standard “Railway Technology Engineer” was approved.

In accordance with the professional standard requirements, the railway technology engineer performs effective technical management of technological systems and processes of railway transport development projects; performs management of organizational processes of railway transport systems; develops operational strategies and implements action policy; encourages innovative processes of technology development and work optimization; carries out risk assessment; is engaged in scientific and research work. The professional standard does not provide for specializations. Therefore, when mastering this study program, it is not obligatory to go into specifics of the railway technical systems. The railway technology engineer complements their competence of the railway transport engineer with the skills of project and work management, optimization, risk assessment and technology development, while engineers without special education and qualification in the field of railway must additionally acquire specific relevant knowledge.

In this regard, the following significant changes were made in the structure of the study program:

1. The variant of the study program amounting to 60 credit points, for which the previous Professional Bachelor Degree in railway electrical systems and qualification of a railway electrical systems engineer or education comparable with it is required, has been excluded;
2. The variant of the study program amounting to 60 credit points [2], for which the previous professional Bachelor degree in Railway Electrical Systems and the qualification of a railway electrical systems engineer or education comparable with it is required, has been changed with regard to the following parameters:
    - Duration and volume: 2 years and 80 credit points;
    - Types and forms of studies: full-time intramural studies – 2 years, part-time extramural studies – 3 years, part-time intramural studies – 3 years;
    - the obtained degree / professional qualification: Professional Master Degree in railway transport / railway technology engineer (EQF -European Qualification Framework/LQF – Latvian Qualification Framework 7$^{th}$ level/PQL – Professional qualification level - 5$^{th}$ level);

    - Admission requirements: Professional Bachelor Degree in engineering or education comparable with it;
3. A new implementation version [1] with the following parameters is added:
    - Duration and volume: 1 year and 40 credit points;
    - Types and forms of studies: full-time intramural studies – 1 years, part-time extramural studies – 1 year and 6 months, part-time intramural studies – 1 year and 6 months;
    - the obtained degree / professional qualification: Professional Master Degree in railway transport / railway technology engineer (EQF -European Qualification Framework/LQF – Latvian Qualification Framework 7$^{th}$ level/PQL – Professional qualification level - 5$^{th}$ level);
    - Admission requirements: Professional Bachelor Degree in railway electrical systems or professional bachelor degree in railway transport, or comparable education;
4. All existing fields of specialization were removed from the list of the study courses within the study program. Some study courses were removed, some courses were replaced with newly created courses to ensure compliance with the profession standards;
5. The goal of the study program was updated in accordance with the professional standard and the prospects for the railway transport development;
6. The tasks of the study program were updated in accordance with the professional standard and the prospects for the railway transport development;
7. Learning outcomes of the study program were updated in accordance with the professional standard;
8. The description of the final examination provided for in the conclusion was specified.

In order to ensure the compliance with the standard and to improve the study program, changes were additionally made in the structure of the program study courses:

1. All existing separate specialization fields together with attached courses were removed from the course outline of the study program:
    - Railway Automatic and Telemechanic Systems 8 CP;
    - Electric transport 8 CP;
    - Railway Rolling Stock 8 CP;
    - Railway Haulage Operation Computer Aided Technologies 8 CP;
    - Railway track and road machines 8 CP;
2. The following study courses were removed from the compulsory section of the study program:
    - Monitoring and Diagnostics Microprocessor Systems of Dynamic Objects 4 CP;
    - Telemechanic Control Systems 4 CP;
    - Computer Design Systems in Transportation 3 CP;
    - Distribution Data Processing Systems 3 CP;
    - Railway Transport System Analysis 4 CP;
    - Digital Methods and Engineering Programs for Transport Tasks 4 CP;
    - Logistics Basics of the Railway Transport 3 CP;
    - Calculation of Traction Performance 3 CP;
3. In order to ensure compliance with the professional standard and to cover all aspects of the railway transport system, project management and optimization necessary for the railway technology engineer, new study courses were created and included in the study program:
    - Digitalized Optimization Methods of Transport Logistics 4 CP;
    - Transport Task Projects Planning and Management 4 CP;
    - Railway Commercial Activity Organization 4 CP;
    - Algorithmization and Optimization Methods in Transport Tasks 5 CP;
4. The improved study course Railway Enterprise Organization and Management 2 CP was

added to the section of compulsory study courses;

5. In order to provide technical knowledge of the railway to the students who have studied other engineering field at the previous professional Bachelor studies, Variant [2] of the study program “Railway Engineering” includes the Bachelor level courses of the program “Railway Engineering”, which the Master students will acquire together with the students of the Bachelor study program:
    - Transportation Systems Computer Design and Programming (Study Project) 8 CP;
    - Rolling Stock Structure and Traction 5 CP;
    - Railway Stations, Hubs and Train Traffic Organization 5 CP;
6. n order to provide technical knowledge of the railway to the students who have studied other engineering fields at the level of previous professional Bachelor studies, the section of the compulsory elective study courses in Variant [2] of the study program “Railway engineering” was also supplemented with the bachelor level courses of the program “Railway Engineering”, which the Master students will acquire together with the students of the Bachelor study program:
    - Railway Microprocessor Systems (study project) 5CP;
    - Transport Communication Systems 5CP;
    - Operation Technology and Management 5 CP;
    - Railway Stations, Hubs and Train Traffic Organization 5CP;
    - Technology of Transport Logistic Systems (study project) 5CP;
    - Electrical Machines and Electrical Devices of Rolling Stock 5CP;
7. In accordance with the requirements of the occupational standard,
    - study courses were removed from the section of study courses in humanities and social sciences:
        - Psychology 2CP;
        - Presentation Skills 2CP;
    - but the following courses, designed for both Variants [1] and [2] of the program were added:
        - Communication and Presentation Skills 2CP;
        - Pedagogy 2 CP
    - and the following courses, intended only for Variant [2] of the program were added:
        - Sociology of Management 2 CP;
        - Sociology of Personalities and Small Groups 2 CP;
        - Politology 2 CP;
        - Basics of Communication 2 CP;
        - Fundamentals of Law 2 CP;
8. According to the professional standard and the requirements of the railway industry, the language section with study courses was added to the program:
    - Special English 2 CP;
    - Special English 2 CP;
    - English 1 CP.

All abovementioned changes were supported and approved on 27th September 2021 by decision of RTU Senate Meeting, Minutes 653.

**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 conformity of the professional Master study program “Railway Engineering” (code MGH0) was approved by decision of the Study Field Committee “Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering” of 16 June 2021, Minutes № 3 and the decision of the Council of the Faculty of Mechanical Engineering, Transport and Aeronautics of 17 June 2021, Minutes № 60 and Resolution of RTU Senate meeting of 27 September 2021, Minutes № 653.

The identification code of the professional Master study program “Railway Engineering” RTU is MGH0, Education Classification Code – 47526. Graduates of the study program are awarded Level 7 professional Master degree according to the European Qualifications Framework (EQF) and Level 5 of professional qualification accruing to the Latvian Qualifications Framework (LQF) in Railway Transport and Railway Technology Engineer.

The professional Master education obtained at the study program will help students form the necessary degree of culture and intelligence, allowing them to start public activities, to network with the professional circles of Latvia and abroad.

The implementation of the study program, its goals, tasks and planned learning outcomes have an overall objective – to educate and train leading professional specialists in their field, who develop research and scientific works, contributing to development of engineering, to motivate students to build career and continue education. The organization and implementation of the study program will be ensured by academic staff and the presence of the relevant resource base that will allow implementing the goals, fulfill the tasks and achieve the learning outcomes. The main prerequisite for commencing studies is a professional Bachelor degree in engineering.

The aim of the study program is to educate and train competitive engineers with a Master’s degree, who possess thorough understanding of digitalized optimization and project management methods, as well as of the principles of transport enterprise work organization, and who will be able to conduct efficient technical management of the projects on development of railway transport engineering systems and processes, railway transport organizational process management, to develop general operation strategies and implement action policies, initiate innovative technology advancement and work optimization processes, to perform risk assessment and conduct scientific and research activities.

The tasks of the study program are coordinated with the aim of the study program:

- to ensure competitive training in the field of railway on the level of Masters' studies and in accordance with international standards;
- to ensure the development of the content of the study program, study process, scientific research work and changes in conformity with changes in the field of rail transport, international practice, science and didactics practice;
- to promote the interest of students in further vocational development, supplementing academic knowledge, to continue their education at the PhD studies, developing research skills and facilitating their use;
- to promote students' interest in community processes, stimulate student development into a positive, modern, responsible, ethical and capacity-building personality that can act independently and make decisions;

- to develop practical use of research work and its results in the field of rail transport by academic staff and students;
- to promote international mobility and participation in projects.

Graduates of the study program:

- are able to effectively plan and manage introduction of innovative management systems, promoting transport integration and EU railway integration processes and evaluate perspectives of railway transport system development;
- competent to manage the railway transport system and their strategic engineering development plans and programs, implementation of strategic and operative plans of railway traffic organization, projects for modernization of railway transport system equipment and technical means, plan and organize the work of a team;
- are able to assess the general efficiency and safety of a railway transport system, as well as opportunities for its optimization;
- are able to optimize operations and management of maintenance, repair and service of the railway transport infrastructure, technical means and special equipment, freight and passenger transportation and infrastructure maintenance related areas using innovative automation and computerization methods, efficiently use information technologies;
- are able to organize expertise testing of the technical railway means, equipment and services, risk management and certification and take part in the development and introduction of standards and norms and regulations in the field of railway transport;
- are able to review research and analyses, develop publications and professional advancement training programs, improve informative, research and learning materials in railway transport and present them at the conferences/seminars in railway transport.

Graduates of the study program will be specialists with modern skills in information technology and project management in the field of transport and will be able to take the leading positions in railway companies as well as in the companies related to transport and IT industry both in Latvia and abroad.

Graduates can continue their studies at PhD study program “Transport”, as well as at other PhD study programs of RTU or other universities, that are intended for study after obtaining a Master's degree.

The study program is implemented in two variants.

Variant [1] - 1 year (full-time) or 1.5 year (part-time) amounting to 40 CP.

Variant [1] of the study program comprises the following sections:

- Compulsory study courses 6 CP;
- Compulsory elective study courses 8 CP, including:
    - Professional specialization courses 4 CP;
    - Humanities and social sciences study courses 2 CP;
    - Languages 2 CP;
- Practical Placement 6 CP;
- Final / State examination 20 CP.

Variant [2] - 2 years (full-time) or 3 years (part-time) amounting to 80 CP.

Variant [2] of the study program comprises the following sections:

- Compulsory study courses 24 CP;
- Compulsory elective study courses 30 CP, including:

- Professional specialization courses 24 CP;
    - Humanities and social sciences study courses 4 CP;
    - Languages 2 CP;
- Practical Placement 6 CP;
- Final / State examination 20 CP.

The relevance of the study program can be determined analyzing other EU and world universities and comparing their study programs with the study program implemented by RTU.

Similar study programs implemented by the Royal Institute of Technology (KTH) and University of Birmingham (UoB) have been selected for comparison with RTU study program “Railway Engineering”.

Each foreign university has its own system of credit points, so the comparison is also carried out by sections of study courses – in percentage.

- - Compulsory study courses: RTU[1] 6CP (15%), RTU[2] 24CP (30%), KTH 19.3CP(24%), UoB 20CP (33%)
- - Field-specific elective study courses: RTU[1] 4CP (10%), RTU[2] 24CP (30%), KTH 25CP (31%), UoB 6.7CP un 16.7 CP (11% un 28%)
- [ Additional elective study courses: RTU[1] 4CP (10%), RTU[2] 6CP(7.5%), KTH 15.7CP(20%), UoB 6,7CP un 3.3CP (11% un 6%)
- - Internship RTU[1] 6CP (15%), RTU[2] 6CP (7.5%), KTH 0CP (0%), UoB 0CP (0%)
- - Final examination: RTU[1] 20CP (50%), RTU[2] 20CP (25%), KTH 20CP (25%), UoB 26.6CP un 20CP (44 un 33%)
- - Total: RTU[1] 40CP (100%), RTU[2] 80CP (100%), KTH 80CP (25%), UoB 60CP (100%)

Differences are not significant in comparison with KTH. It can be noted that KTH offers students to choose the most suitable courses from the elective study courses.

The UoB study program is unique in that there are no internship and pedagogy courses, as they are provided within the Bachelor study program.

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

Currently, there is a shortage of the leading specialists with the most advanced qualification in railway transport infrastructure and related industries in Latvia and Europe. Taking into account the new “Rail Baltica” railway line to be designed and built in the near future, the demand for specialists will grow. The study program is designed to provide the railway transport industry with qualified specialists and their training in Latvia in accordance with the requirements of the employers formulated in the profession standard.

Global trends, priorities, activities and trends of sustainable development in the railway sector are stipulated in such Latvian and European mid- and long-term strategical documents as National Development Plan of Latvia 2027 (NAP2027), Sustainable Development Strategy of Latvia until 2030 (Latvija 2030), the Rail Strategic Research and Innovation Agenda (SRIA) of the European Railway Research Advisory Council (ERRAC), ERRAC: Rail 2050 Vision, Research and innovation priorities (Rail 2030), etc.

For instance, NAP2027 considers modernization of railways, development of new ICT solutions and services, improvement of the core data transmission network and arrangement of “next generation” networks in remote areas, 5G – along all main roads, as well as smart technologies in traffic flow management. One of NAP2027 strategical milestone tasks is arrangement of a multimodal public transportation network with the railway transport as a “spine”, with multimodal transport and passenger transfer nodes, promoting better access to the regions, mobility of population and accessibility of environment through continued railway electrification, convenient train-bus connections, all these activities ensuring transport accessibility.

These considerations set the railway in Latvia as the priority means of transportation, the development of which requires railway engineers to master modern technologies in order to ensure synergy of the digital railway transformation (digitalization, automation, robotization, artificial intelligence, Industry 4.0, etc.) and transport infrastructure with IT solutions and their safety aimed at making the transportation system customer-oriented and ensuring that smart transport services become an integral element of everyday life of every person.

The vision of railway sector development in Latvia is in line with European and global trends. ERRAC Rail 2050 Vision and Rail 2030 define the tasks of the railway sector for digitalization and automation of the railway transport through design and operation of autonomous trains, automated train functions, artificial intelligence and robotics. Fully automated train functions, autonomous transport vehicles and intelligent remote-control systems guarantee unprecedented level of safety. To achieve the targets of 2050 Vision, the railway sector is supported by technical and scientific research in Europe and around the world in the following fields [ERRAC Rail 2050 Vision]:

- Digitalization: information and communication technologies (ICT) that can receive, identify, process, transmit and analyze digital information via safe, reliable “internet of things” networks;
- Distributed cognitive computerization: ability of machines to cognize and understand the surrounding environment, recognize models, provide significant insights from the distributed Big Data, and learn;
- Robotics: ability of machines to fulfil the targeted tasks autonomously.

Consequently, the study program includes the courses related to digitalization, algorithmization and optimization technologies, as well as optimal management, project management, planning and work organization.

Graduates of the study program will become skilled specialists in modern computer technologies and information technologies in the field of transportation and will be able to work for both railway companies and transportation and IT companies in Latvia and abroad.

Despite the fact that there have not been any graduates from the study program “Railway Engineering” yet, annual student survey results demonstrate railway engineers’ training level and applicability of the acquired knowledge and skills to the labor market. Numerical values are calculated using “1” for the evaluation “fully disagree” and “5” for the evaluation “fully agree”, respectively, followed by the calculation of the average numerical values.

For example, the survey among the graduates of academic year 2019/2020, which involved 63% of the program graduates, obtained the following values:

- Satisfaction with the decision to study at RTU – 4.24
- Satisfaction with the chosen study program – 4.33
- Would recommend this study program to those wishing to study – 3.95
- Satisfaction with the acquired theoretical knowledge – 4.05
- Satisfaction with the acquired practical skills– 4.24.

Good survey results allow concluding that graduates are satisfied and the mastered study program “Railway Transport” in general complies to the sector’s requirements, but it is possible and necessary to improve the identified deficiencies when implementing the study program “Railway Engineering”.

It should be also noted that the majority of graduates could find employment at the only at that time railway concern SJSC “Latvijas Dzelzceļš” (LDZ), and this is why the study program “Railway Transport” was oriented at training of specialists exactly for the needs of LDZ.

In turn, entry of a new player in the railway sector - “Eiropas dzelzceļa līnijas” with the project “Rail Baltica” and the new occupational standard for rail engineers required to extend and generalize the knowledge and competences of railway engineers, allowing them to work both with 1520 Latvian railway and 1435 European rail systems.

### 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 Master's program "Railway Engineering" was developed in 2020 and, compared to previous programs, it no longer contains any specializations, in accordance with the approved Railway Technology Engineer profession standard.

There was no admission for “Railway Engineering” in 2020.

The first admission to the study program took place in 2021 only.

5 students were enrolled at the beginning of the academic year 2020/2021.

- 4 students in Variant [1] of the program.
- 1 student in Variant [2] of the program.

Currently, the study program is mastered only by full-time students.

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

## 3.2. The Content of Studies and Implementation Thereof

### 3.2.1. Analysis of the content of the study programme. Assessment of the interrelation between the information included in the study courses/ modules, the intended learning outcomes, the set aims and other indicators with the aims of the study course/ module

**and the aims and intended outcomes of the study programme. Assessment of the relevance of the content of the study courses/ modules and compliance with the needs of the relevant industry, labour market and with the trends in science on how and whether the content of the study courses/ modules is updated in line with the development trends of the relevant industry, labour market, and science.**

The curriculum of the study program complies to the requirements of the state regulatory enactments and has been developed according to the decision of RTU Senate on “Uniform Requirements for the Study Programs”. The volume of the study program: Variant [1] - 40 credits and duration - 1 year full-time studies and 1.5 years in part-time studies and Variant [2] - 80 credits and duration - 2 years full-time studies and 3 years part-time studies. After graduation from the study program, students receive the professional Master degree in railway transport and qualification of a railway technology engineer.

Learning outcomes of the study courses are closely related to the common tasks of the study program and results of their fulfilment in achieving the set goal.

To achieve all learning outcomes of the study program, it is necessary to master the minimal study plan:

- Optimal Control of Transport Systems
- Railway Enterprise Organization and Management
- One of the courses: Digitalized Optimization Methods of Transport Logistics or Theory of Optimal Solutions or planning and Transport Task Projects Planning and Management or Operation Optimization or Freight Work Optimization or Railway Commercial Activity Organization, which allows specializing in a certain field of railway management.
- One of the courses: Communication Psychology or Communication and Presentation Skills or Pedagogy
- One of the courses in Special English
- Internship
- Master Thesis

In turn, if the student does not have background knowledge in the railway, it is necessary to undertake the study courses together with the students of the Bachelor program of railway engineering to achieve learning outcomes, in addition to a minimal plan:

- Transportation Systems Computer Design and Programming (study project)
- Rolling Stock Structure and Traction
- Railway Stations, Hubs and Train Traffic Organization
- One of the courses: Railway Microprocessor Systems (study project) or Technology of Transport Logistic Systems (study project)
- Three courses out of four: Railway Communication Systems, Operation Technology and Management, Algorithmization and optimization methods in transport tasks and rolling stock electrical machines and electrical equipment
- One of the courses in humanities: Sociology of Management or Sociology of Personalities and Small Groups or Politology or the Basics of Communication or Fundamentals of Law.

Foreign students who have not mastered the Latvian language at the previous level additionally study the course “Latvian for foreign students” courses in the amount of 1CP.

The curriculum of the study courses is evaluated and, if necessary, regularly updated in accordance with the requirements of the industry, labor market needs and scientific trends.

According to the trends in the field of transport, the long-term priority fields of development are the following:

- Green Technologies, Electrification and Electrical Traction;
- Digitalization and Computing Technologies;
- Wireless communication (5G/5G-R,...) and (Global Navigation Satellite System).

According to the world trends in the field of railways, new study courses are created and included in the study program:

- Digitalized Optimization Methods of Transport Logistics 4 CP;
- Transport Task Projects Planning and Management 4 CP;
- Railway Commercial Activity Organization 4 CP;
- Algorithmization and Optimization Methods in Transport Tasks 5 CP,

In order to make the study courses up-to-date and conforming to the railway sector trends, the curricula of the lectures and practical placement are regularly supplemented with the latest advancements in the sector, which are published in:

- New books, for example:
  - Lucas, Callen Railway Transportation Systems and Engineering, New York : Clanrye International, 2020, 237 p.
  - Railway Signalling and Interlocking : international compendium / editors: Gregor Theeg, Sergej Vlasenko ; authors: Enrico Anders [and other 26 authors]. 3rd edition. Leverkusen : Eurail Press : PMC Media House, 2020. 562 p.
- In the international scientific journals, for example:
  - International Journal of Railway Technology, Civil-Comp Ltd.
  - International Journal of Rail Transportation, Taylor and Francis Ltd.
- In the conference proceedings, for example:
  - International Conference on Railway Technology: Research, Development and Maintenance
  - Symposium on the Dynamics of Vehicles on Roads and on Tracks
- In other reliable information sources, for example:
  - World Congress on Railway Research

Or are presented and demonstrated at the world-level international exhibitions, for example:

- InnoTrans: Future of Mobility – exhibition of the leading international transport technologies that takes place every two years in Berlin, divided into five segments: Railway Technology, Railway Infrastructure, Public Transport, Interior and Tunnel Construction and occupies all 42 exhibition halls, available at the Berlin Exhibition Centre.
- Eurasia Rail – innovative engineering, products and services both in the state, and in the private railway sector, organized every two years in Istanbul.

The employees of the state concerns JSC “Latvijas dzelzceļš”, JSC “Pasažieru vilciens” and “Eiropas dzelzceļa līnijas” Ltd were involved in the updating of the study program, these experts expressed their suggestions on improvement of professional specialization. Recommendations of the stakeholders in the sector, study courses for appropriate specialization and discussed internship opportunities were taken into account in the development of the structure and curriculum of the study program.

Employers are interested to take part and make their proposals on enhancement of the study program, as a result, RTU will train the required specialists and employers will fill their vacancies.

In order to enhance and develop the study program, annual student surveys are carried out to let them express their opinion about the acquired study courses and academic staff, as well as to evaluate organization and implementation of the study program.

The Transport Institute (TI) maintains active contacts with the graduates and specialists in the industry in order to organize guest lectures and workshops for the students, academic staff and other stakeholders.

International cooperation of RTU involving specialists in the industry and academic staff from foreign partner universities ensures exchange of experience and development of technology. Cooperation partners of the TI: Kharkov State Railway Transport University, Silesian University of Technology, Deutsche Bahn Academy, Rail Baltica Academy, etc.

RTU is a member of the international association EURNEX - the European Rail Research Network of Excellence that represents European research and education institutions. It unites 33 research institutions operating in the field of railway transport and mobility across Europe, Morocco and China. The goal of the association is to promote research and development of the railway system, to improve cooperation in research and education, as well as ensure knowledge transfer across the association members, European universities and research institutions, interested in railway research, including multidisciplinary facilities, in order to facilitate joint planning and implementation of research projects of the member-states and to establish sustainable research environment for the railway sector, to develop the links between the association members, industrial partners and operators in the railway sector, to improve understanding about special high quality research needs and cooperation opportunities with the railway sector, to promote railway contribution to sustainable transport policies, to improve competitiveness and economic stability of the railway sector and industry.

Cooperation and internationalization policies of RTU FMETA in the context of the study field implementation relates mainly to students of the Foreign Students Department. The students and academic staff are offered opportunities to participate in the international mobility programs. Erasmus/Erasmus+ is the most popular is the mobility program, which has been functioning for many years and the interest in its scholarship is only growing year by year. Upon completion of studies abroad, the information about positive outcomes reaches organizational units of RTU, in turn, foreign students, upon return back to their home countries inform their fellow students about opportunities to study in Latvia. The effect of the study program implementation on the studies and research is extremely positive.

RTU advancement activities:

- Open Days for the students, at Researchers’ Night, visits to schools;
- RTU Student Initiative Fund supported the establishment of the student laboratory “DaVinci”, which will give students an opportunity to fulfil their technical and creative ideas in R&D works, as well as to acquire practical skills in operation of electrical equipment and their prototyping;
- field trips to different sites;
- consideration of students’ evaluations and opinion through student surveys;
- involvement of Latvian specialists and former RTU graduates in the organized events;
- promotion of the academic staff mobility in the framework of Erasmus+ project;
- organization of events to inform the public about the opportunities to study in Daugavpils: participation in various exhibitions; organization of visits to Latgale schools in the framework of Career Days; excursions of pupils and teachers of Daugavpils college; Open Door Days;

Shadowing Days, Researcher’s Night.

Already at preset, in training of specialists, the TI cooperates with such companies and organizations as Railway Department of tthe Ministry of Transport of the Republic of Latvia, Latvian Transport Development and Education Association (LaTAIA), the Latvian Association of Railway Workers (LDzB), Engineering Association of Latvian Railway Workers, the Latvian Association of Welding Specialists (LMSA), as well as with the industrial companies – Eiropas dzelzceļa līnijas (EDZL) and State JSC “Latvijas Dzelzceļš” and its organizational units (freight transportation, Infrastructure and rolling stock administrations), JSC “Rīgas vagonbūves rūpnīcu”, JSC “Lokomotīve”, Traction Rolling Stock Repair Centre JSC “Zasulauks”, JSC “Pasažieru vilciens”, JSC “Starptautiskie pasažieru pārvadājumi”, as well as with the offices of foreign companies in Latvia “Deutsche Bahn Engineering&Consulting GmbH”, “Weidmuller Interface GmbH & Co. KG” and other production, railway freight transportation and forwarding companies.

**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 final examination resulting in awarding the Master degree is viva voce examination of the Master thesis and its results defense. This includes research review, analysis of informative and scientific publications in the field of railway technology.

If a student is able to develop and submit to publication a scientific paper on the problem to be studied or patent application for its solution  additionally to the Master Thesis, as well as to present the work at a scientific conference at the local or international level or to draw up a patent application, this is considered a justification for Master Thesis evaluation improvement, since it shows the student's aspiration for conducting research activity and field development, which is rewarded.

**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.**

Many organizational units of RTU are involved in the implementation of the study program:

- Transport Institute;
- Institute of Humanities;
- Department of Social Sciences;

- Department of Language for Special Purposes.

Assessment of student learning outcomes is carried out in accordance with the "Regulation on the Assessment of Learning Outcomes", (https://www.rtu.lv/writable/public_files/RTU_studiju_rezultatu_vertesanas_nolikums.pdf (in Latvian) and Regulation of the Final Examination at Riga technical University) (https://www.rtu.lv/writable/public_files/RTU_nolikums_par_noslguma_prbaudjumiem_.pdf). Pedagogical methods for the implementation of study courses, their structure, as well as assessment methods, are selected by the academic staff responsible for the study course, in accordance with the specific nature of the course content and study program, as well as the needs of students. Courses and seminars on the latest teaching and pedagogical methods are organized for the academic staff, the attendance of professional advancement courses is encouraged both at the internal events of the faculty, at the RTU level and internationally. RTU Center for Academic Excellence organizes professional advancement events for academic staff.

The academic staff has to inform students about specific assessment criteria for each course at the first lecture, these requirements are published in the e-learning environment of the course.

Assessment of learning outcomes is made through exams or tests. The 10-grade scale is used for assessment of knowledge. Positive knowledge at exams is assessed with the grades 4 through 10. If knowledge of a study course is assessed with grades from 1 to 3, a repeated assessment of knowledge is organized. In case the repeated assessment of knowledge does not give any positive outcomes, a student's knowledge is assessed for the third time by the administrative committee organized by the institute. Tests are not assessed with grades. Tests usually finalize study courses in humanities and social sciences, as well as elective study courses. Exam questions are prepared by a member of the academic staff, who has been delivering the appropriate study course, they are based on the approved program.

Information about all passed tests, research papers and exams is specified in the individual study plans (transcripts of records), which are approved by the Head of Transport Institute. Individual study plans are prepared based on the study field programs within the study field and student-elected study courses from the blocks of compulsory and elective study courses.

Upon the completion of internship, students present an internship report drawn up according to the requirements of methodological guidelines for Internship, which afterwards is checked by an Internship supervisor from the Institute according to the 10-grade scale. In turn, an Internship Supervisor from an industrial company draws up a reference letter about the internship completed by the student.

Assessment of the knowledge level is performed in the written or oral form. Master students can take oral examinations at up to 50 % of courses upon the decision of the Institute Council or the Faculty Council.

Study projects are developed in close cooperation with the academic staff, supervisors and professionals in the field, who not only consult students in the course of the development of term and Master Theses, but also take part in organization and completion of internship, implement study projects and take part in research projects. Functioning of this system is integrated and will allow achieving the goals and outcomes set by the study program. Presentation of the study projects also done in the oral mode presenting a summary of the project content and results, it is followed by answers to supervisor's questions and assessment of the work.

Viva voce examination of the Master Theses is held in the form of oral presentation, it consists of a content summary, answers to the questions of the members of the Final Examination Committee, assessment of the information and the paper. The Master Thesis is assessed by the Final

Examination Committee consisting of the chair person, secretary and at least of three members. The chair of the qualification committee is selected among the leading specialists of a corresponding railway transport field, but half of the members are highly qualified railway specialists.

Variant [1] of the study program full-time students master in the following order.

In the autumn semester, students

1. take compulsory study courses:
    - Optimal Control of Transport Systems 4CP;
    - Railway Enterprise Organization and Management 2 CP
2. Additionally choose
    - one of the courses from the section of the courses of professional specialization:
        - Digitalized Optimization Methods of Transport Logistics 4 CP;
        - Theory of Optimal Solutions 4 CP;
        - Transport Task Projects Planning and Management 4 CP;
        - Operation Optimization 4 CP;
        - Freight Work Optimization 4 CP;
        - Railway Commercial Activity Organization 4 CP;
    - one of the courses from the courses in humanities and social sciences:
        - Communication Psychology 2CP;
        - Communication and Presentation Skills CP;
        - Pedagogy CP;
    - from the Language section - one of the courses in Special English 2 CP, foreign students additionally take the course Latvian for foreign students 1 CP, if Latvian was not already mastered during the Bachelor studies;
3. Also, students choose a topic and start developing a Master Thesis 6 CP.

In the spring semester, students undergo 6 CP

1. Internship 6 CP and
2. Complete the development of Master Thesis in the amount of 14 CP.

During the first year, students

1. Take compulsory courses:
    - Optimal Control of Transport Systems 4 CP;
    - Railway Stations, Hubs and Train Traffic Organization 5 CP;
    - Rolling Stock Structure and Traction 5 CP;
    - Transportation Systems Computer Design and Programming (study project) 5 CP;
2. Additionally choose
    - one of the courses from the section of the courses of professional specialization:
        - Railway Microprocessor Systems (study project) 5 CP;
        - Electrical Machines and Electrical Devices of Rolling Stock 5 CP;
        - Algorithmization and Optimization Methods in Transport Tasks 5 CP

And one from:

- Digitalized Optimization Methods of Transport Logistics 4 CP;
- Theory of Optimal Solutions 4 CP;
- Transport Task Projects Planning and Management 4 CP;
- Operation Optimization 4 CP;
- Freight Work Optimization 4 CP;

        - Railway Commercial Activity Organization 4 CP;
    - one of the courses from the courses in humanities and social sciences:
        - Sociology of Management 2CP;
        - Sociology of Personalities and Small Groups 2CP;
        - Politology 2CP;
        - Basics of Communication 2CP;
        - Fundamentals of Law 2CP.

During the second year, students

1. Take compulsory courses:
    - Railway Enterprise Organization and Management 2 CP;
2. Additionally choose
    - one of the courses from the section of professional specialization study courses:
        - Operation Technology and Management;
        - Railway Communication Systems;
        - Technology of Transport Logistic Systems (study project);
    - from the Language section - one of the courses in Special English 2 CP, foreign students additionally take the course Latvian for foreign students 1 CP, if Latvian was not already mastered during the Bachelor studies;
3. Undergo Internship amounting to 6 CP;
4. Develop the Master Thesis amounting to 20 CP.

Course mapping is cross-referenced within the curricula of the study courses and will ensure achievement of learning outcomes of the study program.

This is not a joint study program.

The study program is also offered in English. According to RTU guidelines for development of the study courses, the content, requirements and methods of assessment is an identical version of the program offered in Latvian. As long as English-speaking students need literature in English, preferably in the digital format, the academic staff also includes into the description of a course the compulsory literature in English, which is done in most cases, if needed, with help of the program head. Implementation of each program course involves members of the academic staff with a C1 CEFR level of English proficiency, confirmed by an appropriate certificate.

During the studies, a variety of student-centered learning (SCL) principles are observed. The student contingent and the diversity of their needs are taken into account and respected. Concluding that the study program is chosen by many students with insufficient post-secondary school knowledge, an additional study course of Elementary Mathematics was organized at RTU level to be acquired by students according to test results.

As long as teaching methods applied at each study course are chosen by the responsible instructors and certain teaching methods are not centralized, sufficiently high diversity of teaching methods is possible.

Strife for autonomy in students is encouraged, at the same time, they are provided with guidance and support from the academic staff. Mutual respect between students and the academic staff is supported, even if senior members of the academic staff may feel it is excessive.

There are appropriate procedures for handling students’ complaints. It can be stated that complaints occur quite seldom. Still, not all complaints can be solved at the level of the study program.

All evaluators are informed and familiarized with the testing and examination methods, and receive assistance in improvement of their evaluation skills. RTU requires that the evaluation criteria and methods, as well as grading criteria, are published preliminarily in the e-learning environment ORTUS.

Student appeals can be considered, still none have occurred, as due to low interest of employers to study grades, students are not interested in higher grades in many cases, but those who want a higher grade are informed about the system of assessment already at the beginning of the term.

### 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 study program includes Internship/Practical Placement amounting to 6 CP.

The guiding principles of Internship at the study program are as follows:

- TI Internship coordinator deals with organization of Internship;
- Internship is managed on the job by a company's internship supervisor;
- Internship is implemented according to the Internship program;
- Students receive individual Internship tasks;
- During Internship inputs to a Bachelor Paper and an engineering project are summarized.

Internship will be organized in cooperation with the existing TI partners and employers in Latvia and in Europe:

- organizational units of SJSC "Latvijas dzelzceļš":
    - Infrastructure for the company's sub-departments (gauges, vehicle depots);
    - Sub-departments of the freight transportation units (maintenance workshops, railway stations);
    - Locomotive Repair Center "Lokomotīvju serviss";
    - Rail Wagon Repair Centre "Vagonu serviss";
    - JSC "Pasažieru vilciens";
    - JSC "Starptautiskie pasažieru pārvadājumi";
    - Traction Rolling Stock Repair Center "Zasulauks";
    - Riga rail wagon-building plant; JSC "Lokomotīve" and other companies.
    - "Eiropas dzelzceļa līnijas" Ltd and companies taking part in the project "Rail Baltica"
    - "Deutsche Bahn AG" – one of the largest European railway corporations offers students of the program "Railway Engineering" to undergo their internship in Latvia or in Germany, under the cooperation agreement.

As it is well-known, the railway infrastructure project "Rail Baltica" is being implemented in order to integrate the Baltic states into the European railway network. This is one of the priority projects of the EU transport network. Thus, new specialists will be in demand, and in connection with the offered opportunity, foreign students studying in English will be able find a fair place of internship and a job.

The aim of internship is directly related to the aims of the study program – to train qualified specialists, offer opportunities of practical knowledge acquisition, which will allow them to start immediately working and applying the skills at railway companies and organizations. Internship is planned to familiarize students with real processes and works on railway sites, to acquire team work and autonomous work skills, and fulfil assigned tasks. At the end of studies, graduates will be awarded a professional Master degree and a professional engineer qualification, thus their employability will improve.

According to the internship organization procedure at RTU, students are assisted by the coordinator of the organizational unit in search for places of internship. If they need additional assistance, they have an opportunity to apply to the Career Support and Service Department, where career consultant and project supervisor help students in search for a place of internship and outreach, as well as support development of career management skills through different activities that can ensure successful outcomes of internship. Once a year, the Career Support and Service Department organizes at RTU the Career Day, whereby students also have a chance to meet personally with representatives of companies and discuss future opportunities. More about the event and its participants in the previous years: http://karjera.rtu.lv/projekti/karjeras-dienas-arhivs/.

An additional resource existing since 2015 is the web-site where companies are encouraged to place vacancy announcements, relevant to RTU students (https://ekarjera.rtu.lv/). Students can connect to it with a university username and follow up internship and job opportunities in the sector.

Additional support in enhancement of practical skills is offered by RTU Development Fund (https://www.rtu.lv/lv/attistibasfonds). Over the years, many hundreds of practical skills training competitions have been organized in cooperation with companies offering students a chance to acquire practical skills.

### 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.

Topics of the Master Theses, which are offered by scientific supervisors – the Department of Railway Engineering Academic Staff with a PhD degree, offer to solve topical problems and tasks in the railway industry.

The Master Thesis includes both scientific research and engineering parts. Within the framework of the research, it is necessary to study the existing situation, define the shortcomings, describe the problem and set the task. Moreover, it is necessary to study similar problems solving methods and to develop a method that would be most appropriate for the task. The optimal engineering solution must be offered for the task, applying calculations, computer modeling and experiments to prove the operability and optimality of the solution.

At the time of drawing of the self-assessment report, the most relevant railway system upgrade and enhancement projects are connected with upgrade of the existing railway, procurement of new trains, improvement of performance of railway sections, linkage of the transport system with Rail Baltica, construction of Rail Baltica and planning of transportation, new telecommunication systems, process digitalization, computerization, optimization, etc., for example:

- Mathematical models and algorithms for the design of Fiber-Optical Networks (SHOSL) in transport;
- 1520/1435 railway systems interaction in the public conveyance fields in Riga region;
- Mathematical modeling and optimization of the magnetic field of the passenger train traction engine;
- < selected stage/ station> increase the level of safety of the microprocessor control system;
- Laying of continuous welded rail in Rail Baltica stages;
- Development of the method of station maneuvers work optimization to minimize costs;
- Development of a digitalized automatic registration system of train traffic;
- Integration and digitalization of passenger service and train traffic management system;
- Improvement of train traffic management system to ensure continuity of work and resource optimization;
- Local rail freight distribution transportation technology on Rail Baltica line in Latvia;
- Development of technology for automation of railway staff awareness management process.

In this study program, viva voce examination of the Master Theses has not yet been held.

By analyzing the completed Master Theses within the professional Master study programs “Railway Transport” and “Railway Electrical Systems”, preceding the program “Railway Engineering”, it can be concluded that the works on the most topical problems get the highest assessment.

Since the Thesis Examination Committee includes representatives of the railway industry, one of the important work evaluation criteria is the final work results contribution to the railway industry and its development and improvement.

| Publicly presented Master Theses | Year | Grade |
|---|---|---|
| Research of train capacity optimization options in the section Torņakalns - Zasulauks during the construction of Rail Baltica tunnel | 2021 | 9 |
| Optimization of power lines EPL-6kV DC, GL in the sections Zasulauks-Kemeri and Zasulauks-Jelgava | 2021 | 7 |
| Modern Mobile Communication Systems on the High-Speed Railways | 2021 | 10 |
| Use of modern voice IP technologies in the railway transport | 2021 | 8 |
| Exploring the possibilities of modernization of the SCADA system applying modern control solutions of feeder lines | 2021 | 7 |
| Development of the typical overvoltage protection solution for Latvian railway structures and related equipment and systems | 2021 | 9 |
| Heightened train movement speed track road structures and bases special features of the study investigation | 2020 | 6 |
| Research and development of optimal timetabling method for dwell time minimization at marshalling station | 2020 | 9 |
| Concept and development of a common train traffic planning and management information system | 2020 | 9 |
| Research and development of efficiency and cost optimization method for shunting operations of port railway station | 2020 | 9 |
| Improving of shunting operations methods by comparative analysis | 2020 | 9 |
| Development of automated train performance calculations in the Microsoft Excel | 2020 | 9 |
| Optimisation of the operational technology of the wagon maintenance facility | 2020 | 9 |
| Analysis of the operational problems of “Noord Natie Ventspils Terminals” railway siding | 2020 | 5 |
| 1520 mm railway signalling system (B class) certification issues in Latvia and B class system interface design | 2020 | 8 |
| Elaboration of laboratory work set for the third generation tonal frequency track circuits | 2020 | 9 |
| Analysis of the trackside CCS devices perspective monitoring system implementation | 2020 | 9 |
| Future mobile communication systems on transport | 2020 | 10 |
| Elaboration and development of technological cards for MPC systems | 2020 | 9 |
| Development of communication and passenger announcement system of combined double-sided railway park | 2020 | 8 |
| Analysis of the freight transport with use of digital documents (on the example of the Daugavpils station) | 2019 | 9 |
| Optimization of logistical flows in the urban passenger transportation system | 2019 | 9 |
| Research and development of genetic algorithm for passenger transportation schedule optimization | 2019 | 9 |
| Diesel multiple unit train DR1AC maintenance system optimization | 2018 | 9 |
| Optimization of freight trains schedules at Skirotava-Tornakalns section | 2018 | 9 |
| Research of cargo mass determination methodology and development of computerized control system | 2018 | 9 |
| Research of analytical method and software development for diesel locomotive train performance calculations | 2018 | 9 |
| Research on balancing of diesel engine YaMZ-238 with partially idling cylinders | 2018 | 10 |
| Implementation of the locomotive control automatizated system on Marshalling Hump | 2018 | 9 |
| Future railway mobile communication LTE system | 2018 | 9 |
| Upgrade of dispatcer remote control system for Sigulda railway station | 2018 | 9 |
| Modernization of control and command system for the traction substation | 2018 | 9 |
| Improvement of level crossing road area monitoring using IR systems | 2018 | 8 |
| Railway switch electronic diagnostics | 2018 | 7 |
| Modernization of the Diesel Generator control module | 2018 | 8 |

As long as Master Theses are assessed by the Qualification Committee, its chair being a relevant leading railway specialist, but the Committee includes highly qualified railway specialists and representatives of the university, the very assessments of papers speak for the quality and relevance of the developed papers in the market. The average grade is 8.57, and the distribution of grades is as follows:

- Outstanding – 3 (8.6%)
- Excellent – 22 (62.9%)
- Very good – 5 (14.3%)
- Good – 3 (8.6%)
- Almost good – 1 (2.9%)
- Satisfactory – 1 (2.9%).

## 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 program is implemented using the available infrastructure and material supplies, due to a high level of digitalization, it provides an opportunity to improve competitiveness of the university, quality of work and effectiveness, as well as availability of information through integration of IT solutions into administrative, learning and research processes of the university, ensuring students, administration and academic staff with modern, reliable, safe and joint IT infrastructure and qualitative IT services. All IT users are provided with the centralized intranet portal ORTUS (https://ortus.rtu.lv/), which functions as a joint digital portal accumulating information from all hubs of RTU information system and provides users with convenient and user-friendly interface and easy access to all IT services catalogue on one site.

For an effective learning Moodle e-learning environment is used to process automatically all binding information (study courses, users, groups, access rights, etc.). This system ensures student-tutor communications. The academic staff posts learning e-materials, knowledge assessment tests, homework tasks, information about a certain study course, etc., in the system. On ORTUS portal students can also see their financial information, apply for a document (statements, transcripts of academic records, copies of the agreement, etc.). For remote online teaching RTU academic staff is provided with Zoom and Microsoft Teams video conference platforms. Students can connect and get access to electronic learning tools at any time and location.

Effective use of classrooms and planning of studies is provided based on digitalization of the classrooms and the schedule (https://telpas.rtu.lv; https://nodarbibas.rtu.lv/). Every RTU student and member of the academic staff can see their class schedules with the specified place and time of a class, name of a tutor, name of an activity and the type of a class. In addition, for users' benefit, the system significantly facilitates planning and scheduling of the classes, as well as optimizes classroom seat occupancy and use efficiency.

For quality control purposes, the digital student surveying system is used, which helps control the quality of the study program and study courses in every academic term. Based on the quality control results, regular activities for optimization of the study programs and learning processes are organized.

For extra benefit of RTU students, academic staff and employees, RTU has purchased rental rights for Microsoft Windows and Microsoft Office software, which provide all users with access to the latest and up-to-date Microsoft software, RTU students for learning purposes also can use RTU licensed operating system Windows and Microsoft Office productivity pack. All RTU users have access to Microsoft Office 365 cloud platform with 1TB disk space per person for data storage and access to different supplementary teamwork and productivity tools (Microsoft Teams, SharePoint Online, Forms, OneNote, OneDrive, Outlook, etc.). RTU students, academic staff and employees have access to the university e-mail boxes.

RTU offers fast optical internet and a vast wireless network infrastructure with more than 400 access points, including the international service Eduroam.

The University library plays a major role in providing methodological and information support to the students. The Scientific Library of RTU (https://www.rtu.lv/en/studies/scientific-library) 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 1.3 million printed documents and e-resources in the databases relevant to RTU fields. In 2016, significant investment was made in the development of the library infrastructure, with the construction of an additional 2240 m2 of space for the Central Library. The total area of the library premises is 6393 m2, of which 3417 m2 are for reader services. There are 713 workstations for library users. The library has four group rooms and six individual cubicles, a Western reading room and a conference room. The library is accessible to users with reduced mobility.

When RTU provides funding for the library, the funding for information resources for each study program is calculated. The collection is replenished according to the recommendations of the heads of study program, researchers, and the allocated funding. The database subscriptions maintained by RTU Scientific Library (https://www.rtu.lv/lv/studijas/biblioteka/informacijas-meklesana/datubazes-eresursi/abonetas-datubazes):

- ProQuest Ebook Central, Academic Search Complete EBSCOhost, Applied Science & Technology Source EBSCOhost, Business Source Ultimate EBSCOhost, EBSCOhost eBook Academic Collection, Wiley Online Library, SpringerLink, The International Monetary Fund.
- Databases financed by the Ministry of Education and Science available to RTU Scientific Library: ScienceDirect, SCOPUS (Elsevier), Web of Science.
- Latvian databases: LETA, Letonika, the Database of Latvian Standards (available on the premises of the Library).

Database usage at the Scientific Library of RTU has been growing since 2016.

The new library premises have allowed to extend the range of services. Since the opening of the new premises in 2018, the number of visits to the library has increased from 103,825 to 691,200. The Central Library is open to users from Monday to Saturday. (https://www.rtu.lv/lv/studijas/biblioteka/darba-laiki-un-kontakti). There is a 24/7 reading room. During the summer period, the Central Library is open every weekday with reduced opening hours.

The library provides students, academic personnel and other stakeholders with various levels of individual consultations and group training in information literacy (https://www.rtu.lv/lv/studijas/biblioteka/lietotaju-apmacibas). Publications not available in the library are delivered via an interlibrary loan or an international loan. Internet access is available throughout the library. The library has copying, scanning, printing, binding services and a self-service dining room. Methodological, informative (including the library resource) and material and technical support comply with the requirements of the regulatory enactments for the regulated professions.  Moreover, new facilities are offered in Ķīpsala Campus, where a newly built shared use FMETA faculty laboratory building starts its work.

Over the past years new literature in the field of railway engineering was purchased, including 22 books in English published mostly in 2018-2020.

Resource support to the study program can be considered as sufficient, as RTU appears to be developed and updated in the information environment. Methodological support includes study books, computer typesetting of courses of lectures, methodological guidelines for laboratory works, journal publications in English, German and Russian, catalogues of equipment, regulatory documents for railway transport, EU directives, international standards, etc.

The lectures within the study program “Railway Engineering'' are delivered in the classrooms equipped with advanced presentation equipment providing all kinds of access to audiovisual learning and information materials, including direct access to the internet.  Computer science related courses are delivered in the shared-use RTU and specialized TI computer classrooms/labs, where workstations are equipped with computers and necessary office hardware and software.

Laboratory works usually are held in the specialized laboratories, but for the study courses that cannot provide them, on-site visits to railway companies will be organized. During the visits, students will be able to get familiarized with real technological processes of the respective companies. During the past years, supply of lab equipment and devices to the specialized laboratories has been sponsored by the state public company “Latvijas dzelzceļš”, as well as by EU structural funds:

- In cooperation with “Phoenix Contact”, 10 working places were equipped with modern controllers.  An opportunity to carry out extended research of the transport sector.
- In cooperation with “Weidmuller Interface GmbH & Co” – 10 workplaces were equipped with modern controllers integrated in one industrial network. An opportunity to develop practical skills and competences in design, development, programming, imaging of transport control systems and in application of network technologies to tasks in the transport sector.
- In cooperation with WAGO „Kontakttechnik GmbH & Co”, 5 workstations were arranged using the company solutions.
- In cooperation with the company „Bombardier Transportation Baltics” the study laboratory “EBILCOK mikroprocesoru sistēma” and a simulator of Šķirotava park BOMBARDIER EBILOCK microprocesor system were established. “Bombardier” technicians installed and put into operation “CPU and environment simulator”, which can be considered as the first step in creation of an integrated laboratory.  Further development of the laboratory envisions the connection of the new simulator to the central processor EBILOCK 950 R4 operated in real conditions, as well as to the CPU of system components, which comprises the necessary terminal equipment of bundles of interface equipment – to provide operation of the switch mechanism, traffic light, track circuits, level crossing signals and other equipment. It is planned to install the terminal equipment in the laboratory. Along with that, the laboratory will allow for acquisition of practical skills for maintenance, repair and upgrade of the whole range of “Bombardier” equipment and systems.
- The laboratory of railway SCB, automation and telemechanics is equipped with Siemens PLCs, railway switches, traffic light, elements of level crossings and of other system components, BOMBARDIER track circuit test bench, National Instruments LabView laboratory devices, work

benches and software.

- The creative student laboratory offers a wide range of instruments and measurement devices, including the National Instruments LabView educational laboratory module of automated and electrical systems ELVIS comprising replaceable learning modules and optional hardware units including a prototyping plate, a fiber optics learning module Fotex, A DC motor control module, a digital electronic Fpga plate, a mechatronic sensor module, etc.
- The laboratory of physical railway simulation (train movement modelling) is equipped with a railway model 1:87 for movement design, programming, testing of different trains using microcontrollers and PLCs.
- The wheel pair testing laboratory located in the laboratory building is equipped with various instruments for damage detection and evaluation - an optical emission analyzer PMI – Master PRO, an ultrasound testing (UT) unit Krautkramer, an electronic microscope for inspection of metal structures, etc., as well as a pneumatic braking system bench.

In summer 2022, the Transport Institute is planning to permanently move its laboratories from the faculty of Electronics and Telecommunications at 12 Azenes Street to the building of FMETA at 6B Ķīpsalas Street with new refurbished premises, designed for installation of specialized railway engineering laboratories.

**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 compliance to the conceptual report approved by the Cabinet on 29 June, 2015, “Implementation of a new higher education financing model in Latvia”, the structural reforms are being gradually implemented in the sector in order to ensure establishment of an effective and sustainable system of higher education.

Basic financing is channeled to state budget funded seats. The number of state funded seats is regulated by the Law on Higher Education, Paragraph 51 and Paragraph 52. The detailed procedure of financing allocation and calculation of one seat is available in the Cabinet Regulations No. 994 “Procedures for Financing Institutions of Higher Education and Colleges from the Funds of the State Budget” adopted on 12 December, 2006.

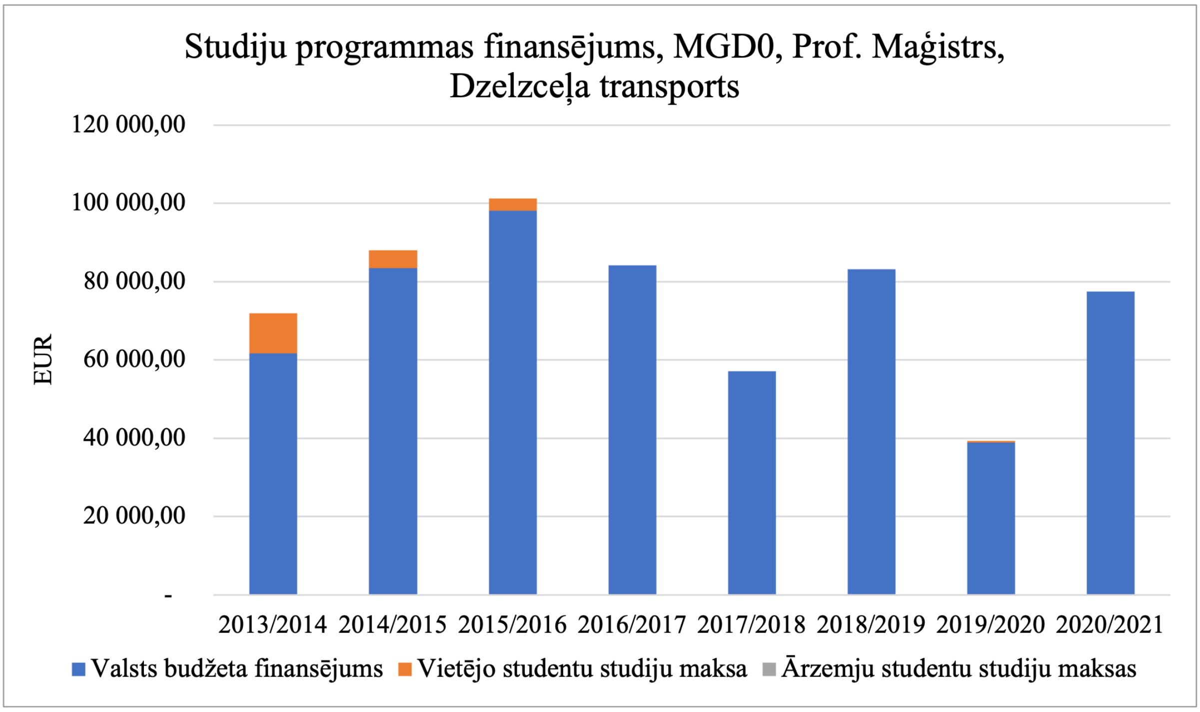
RTU financing in a corresponding academic year is distributed according to the RTU Senate decision “On the Methodology of Distribution and Allocation of Basic Financing, Performance-based Financing and Tuition Fees to Organizational Units of RTU”.

In addition to the basic state budget financing, the program is also financed from the tuition fees of local and foreign students.

The professional Master study program "Railway Engineering" is financed mainly from the basic state budget, the amount of basic financing is based on the number of students. During the reporting period, the total financing to the Master study program has been EUR 602,303.90, of them EUR 18,273.40 is made of the local student tuition fees, but EUR 584,030.50 is the state budget financing. RTU is allocated a sufficient number of state budget funded seats, therefore, as it may be concluded considering the figures below, starting from the academic year 2017/2018, the financing to the study program has been mainly made of state budget subsidy.

| Period | State budget subsidy | Tuition fee by local students | Tuition fee by foreign students | Total financing of the study program | Costs per 1 student, EUR |
|---|---|---|---|---|---|
| 2013/2014 | 61 636.00 | 10 227.00 | - | 71 863.00 | 5 799.00 |
| 2014/2015 | 83 511.17 | 4 516.31 | - | 88 027.48 | 5 799.03 |
| 2015/2016 | 98 169.61 | 3 030.09 | - | 101 199.70 | 5 799.03 |
| 2016/2017 | 84 166.62 | - | - | 84 166.62 | 5 799.03 |
| 2017/2018 | 57 061.05 | - | - | 57 061.05 | 6 060.99 |
| 2018/2019 | 83 233.13 | - | - | 83 233.13 | 6 344.52 |
| 2019/2020 | 38 835.16 | 500.00 | - | 39 335.16 | 6 607.56 |
| 2020/2021 | 77 417.76 | - | - | 77 417.76 | 6 694.22 |

Proportional distribution of funding of the professional Master study program "Railway Engineering" is shown in the Figure below:




State budget funding is calculated on an annual basis, after reduction of amounts covering total costs of the university according to the number of students and credit points and many other criteria. Yearly changing and unpredictable funding allows for limited flexibility in development planning.

Costs per student at the study program are calculated by the Office of Vice-Rector for Finance. As the implementation of the study program involves a variety of RTU organizational units and central offices, the management of the study program cannot specify the costs and the items included in the cost calculation, as well as proportional distribution of the funding among certain items. Likewise, the minimal number of students in the study program in order to ensure cost-effectiveness of the study program cannot be calculated.

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 3.4. Teaching Staff

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

The academic staff involved in the implementation of the study program advance their professional qualification according to conditions of the study program implementation and requirements of the regulatory enactments.

**Mihails Gorobecs**, Dr.sc.ing., Professor, Head of the Department of Railway Engineering, has acquired his professional competence in the following fields of science: Management and optimization of transport movement using AI-based equipment and methods, Computer control in transport¸ Embedded intelligent electrical equipment, computer control and software packs in industrial processes, decision support methods in transport systems, adaptive systems and methods, genetic and evolutionary algorithms, neural networks, fuzzy logic control methods, railway management, safety and optimization methods, computer control of unmanned electrical vehicles, numerical and simulation modelling of systems. More than 10 years of experience in management of different international and national projects in the field of electrical and railway transport, the author of a variety of study books and methodological aids, the author of many patented inventions for railway transport and of more than 120 scientific publications in the international journals and collections of scientific articles. Delivers the study course “Optimal Control of Transport Systems”, “Digitilized Optimization Methods of Transport Logistics”, “Transportation Systems Computer Design and Programming (study project)”, “Transport Task Projects Planning and Management”, “Technology of Transport Logistic Systems (study project)”, “Algorithmization and Optimization Methods in Transport Tasks”, as well as teaching the course “Theory of Optimal Solutions” for foreign students.

**Edmunds Kamoliņš**, Dr.sc.ing., Assoc. Professor, Head of the Transport Institute, the leading researcher, is a Doctor of technical sciences in the sub-field of Electrical Engineering “Electrical machinery and equipment", in 2001 was awarded an engineer qualification at RTU Institute of Railway Transport in the specialization "Computer control, information and electronic systems". More than 12 years of experience in management of studies, research and different research projects. Participates regularly in international conferences, seminars and training courses. The acquired skills and knowledge are conveyed in the study courses, engaging students in different research and educational activities. In 2012 was awarded a qualification of an international welding engineer (IWE). Since 2007 has been an expert in energy related fields at the German company Vācijas TÜV Rheinland Industrie Service GmbH and has taken part in technical inspections for a variety of international projects, which contribute to manufacturing of different equipment for thermal power stations, water supply and waste water treatment, oil refineries, food production, funfairs, etc. Delivers the study courses "Theory of Optimal Solutions" and "Electrical Machines and Electrical Devices of Rolling Stock" in Latvian.

**Pavel Gavrilov**, Dr.sc.ing., Associate Professor, Researcher, Head of the Metallurgy Laboratory of the Transport Institute has professional competencies and qualifications in the field of repair and modernization of rolling stock locomotives and wagons, analysis of damages and corrosion of rolling stock and track elements, metallographic research. He obtained his doctoral degree in 2010 with the doctoral dissertation "Study of derailment of wagons moving on winding sections and lowering from a sorting hill". He has participated in several scientific research projects and expertise in the structure of metal parts of SJSC "Latvijas dzelzceļš". Research interests include analysis of metal structure, damages of cracks and defects. He obtained a diploma of "European welding engineer" and "International welding engineer" and participated in the periodic certification of electric and gas welders of SJSC "Latvijas dzelzceļš". He also works for the railway engineer JSC "Pasažieru vilciens" and uses his experience in implementation of the study course "Rolling Stock Structure and Traction" in Latvian.

**Viesturs Bražis**, Dr.sc.ing., Associate professor, leading researcher has acquired his professional competencies in the following fields: power storage systems, electric drive and automation, DC traction networks, computer control of industrial processes, automatic control methods, computer control of electric vehicles, electric transport and power electronics computer modeling of systems. He has more than 15 years of experience in managing various international and local projects in the field of electric transport and energy storage systems, 20 years of experience in teaching and development several textbooks and handbooks, has patented several inventions in the field of asynchronous electric drive and has more than 40 scientific publications in international journals and articles. Within the framework of research activities, scientific work was also performed as a leading researcher at the Institute of Physical Energy. Ensures the implementation of the study courses "Rolling Stock Structure and Traction" and "Electrical Machines and Electrical Devices of Rolling Stock".

**Jānis Eiduks**, Dr.sc.ing., Assistant Professor of RTU Department of Railway Engineering and Head of the Technical Department of "Eiropas Dzelzceļa līnijas" Ltd. Professionally significant experience in the field: Courses in the field of railway rolling stock in Japan (2000), Chief Technologist of LDZ Rolling Stock Administration (1997-2004), Chief Technical Expert of "Eiropas dzelzceļa līnijas" Ltd. (since 2016), functions in various international formats Deputy Head of the EU Council Land Transport Group on Railways (2015), Latvian Representative to the Administrative Board of the European Railway Agency (2004-2014), Latvian Representative to the OTIF Administrative Committee (2012-2015), Latvian Representative to the European Commission in the Railway Development Committee (2004-2015), Latvia's representative in the European Commission's Railway Interoperability and Safety Committee (since 2004). Research was carried out in traction theory and traction calculations, railway rolling stock braking and safety equipment, rolling stock construction, locomotive power transmission, rolling stock maintenance and operation, railway station and hub theory, train running planning and organization, European Union railway policy, in particular particularly in the field of interoperability and safety, in the regulation of international rail transport. In the study program with his qualification he participates in the coordination of the internship, as well as participates in the implementation of the study course “Railway Enterprise Organization and Management” as well as participates in study courses “Rolling Stock Structure and Traction”, “Railway Stations, Hubs and Train Traffic Organization” for foreign students.

**Fyodor Mikhailov,** Dr.sc.ing., Assistant professor, researcher has professional competencies in the following railway areas: optimization of operation, railway technical operation regulations, freight and commercial work organization, freight optimization. He also works as the head of the technical department of JSC "Pasažieru vilciens". Professional interests also concern the interaction of the 1435 and 1520 railway systems and the field of emission-free technologies (hydrogen, hybrid traction, gas diesel) for use in rail transport. More than 15 years of experience in managing various international and national projects in the field of railway transport (including rolling stock, railway infrastructure and staff training), development of methodological tools and more than 20 scientific publications in international journals and articles, more than 10 presentations in international railway transport conferences. Delivers the study courses “Operation Optimization”, “Freight Work Optimization”, “Railway Commercial Activity Organization”.

**Andrejs Potapovs**, Dr.sc.ing., assistant professor, in 2014 was awarded a doctor degree for the theme “Research of embedded intelligent equipment and development of railway adaptive management”, leading researcher. Results of research are published in different international scientific volumes and journals and refer to adaptive management, embedded railway microprocessor systems, adaptive, automated control and wireless sensor systems, programmable controllers of industrial control systems and 3D-modelling. Takes part in different national and international projects and is the author of some study books, various scientific publications and the patented invention “Smooth and precise adaptive train braking system” and “Device for safe passing of motor vehicle over level crossings using satellite navigation systems”. At the study program he delivers the course “Railway Microprocessor Systems (study project)”, as well as takes part in delivery of the study courses “Transportation Systems Computer Design and Programming (study project)” and “Algorithmization and Optimization Methods in Transport Tasks”.

**Pāvels Stankēvičs**, Dr.sc.ing., Researcher, Department of Railway Engineering, RTU, Head of the Traffic Safety and Technological Process Supervision Department of SIA “LDZ CARGO”, risk Manager. He defended his doctoral thesis “Technology of Production of Antifriction Parts for Rolling Metal Powders and Increasing Tribotechnical Properties” in 2020. Pavel Stankevics has a doctoral degree in construction and transport engineering as well as a professional master's degree in transport management. Since 2014 performs pedagogical as well as scientific research work, has more than 20 years of practical experience in railway transport, gained while working in the railway sector in various positions related to the operation of rolling stock, work organization and planning, traffic safety supervision and risk management. Extensive practical experience and qualification level allow to provide students with up-to-date and in-depth knowledge in the field of railway transport, ensuring the achievement of full-fledged study results. He is the author and co-author of more than twenty scientific articles in the fields of transport and materials science. Research interests: railway transport brake systems, transport safety, composite metal powder materials. Conducts the study course “Rolling Stock Structure and Traction” for Latvian students.

**Aleksejs Vasiljevs**, M.sc.ing., Researcher. Applicant for the degree of Doctor of Engineering Sciences, researcher at the RTU Transport Institute and Head of the technological systems control department of SJSC Latvijas dzelzceļš. Research and work interests include mathematical modeling of radio wave propagation, railway signaling, centralization and interlocking, methods for increasing the safety and security of communication systems, automation of hill control systems and equipment, application of industrial Internet solutions in the field of railway automation and telematics. More than 5 years of experience in launching, servicing and ensuring the operability of railway microprocessor control systems, raising the professional competence of SJSC "Latvijas dzelzceļš" employees, development of study institute study course materials, laboratory work, practical tasks; supervisor of more than 10 final theses. The study program provides study courses “Transport communication systems” and “Railway telecommunication systems”, as well as conducts the course “Railway transport microprocessor systems (study project)” for foreign students.

**Katrīne Otersone**, M.sc.ing., Assistant, research assistant. Her bachelor's thesis "Perspective 5G mobile communication network in railway transport" was defended in 2019 and "Modern mobile communication systems in high-speed railways" was defended with excellence in 2021. Fields of research activity are telematics systems, real-time transport radio systems, railway telecommunication systems, wireless communication networks, intelligent transport networks, network security. She has experience in developing study materials, practical tasks, giving lectures and conducting practical works in study courses of transport communication systems and railway telecommunication systems. Participates in the implementation of the study course “Transport Communication Systems” for Latvian students

**Oksana Iščuka**, M.sc.ing., researcher has acquired professional competencies in the following fields of science: organization and management of passenger transport, operation technology and management, design of railway stations and junctions, transport logistics, traffic management and optimization, decision support methods in transport systems, statistical methods, railway transport management, optimization methods , mathematical and simulation modeling of technological processes of railway station work. It is planned to develop an energy efficiency technology project for sorting station logistics in the near future. More than 5 years of experience in the management of various bachelor's theses in the field of railway transport, development of several study handbooks and 15 scientific publications in international journals and paper proceedings and other publications. She works at the Latvian Railway and uses the practical experience of train movement and shunting work in the sections equipped with automatic and semi-automatic blocking, dispatching centralization; provision of principal services, execution of customs procedures (transit) in the Computerized Transit Control System, examination and execution of railway transport documents, preparation of reports on open and closed transit declarations, automated charging for transportation fees, etc. Implements study courses “Operational Technology and Management” and “Railway Stations, Hubs and Train Traffic Organization” for Latvian students.

In general, the data attest the academic staff qualification and their ability to ensure the quality of the study courses. A range of tutors in parallel are employed in the railway sector, so their practical skills and competences are conveyed to the study program.

It is evident that in parallel with the process of studies, the academic staff also takes active part in research, which promotes sharing experience with the students during the studies. Students are familiarized with field-related innovations, problems and goals. Tutors tell about real projects, research, methods, developments and results, and students can see the interrelation between the course content and on the job tasks and understand the necessity of its learning, as well as try to find solutions themselves, thus developing their skills and competencies. It allows continuously improve and update the study curriculum in accordance with the industry trends and demands.

Training and improvement of qualification of the academic staff is carried out with help of conferences and seminars, learning at different courses, participation in work of other organizations as consultants, or on the job experience. Every year the tutors take active part in methodological seminars organized by RTU and other universities.

FMETA has established a long term and reliable cooperation with foreign lecturers, who are involved in the implementation of the study program. The professional Master study program “Railway Engineering” also plans to invite visiting professors from other countries.

It is also planned to involve the specialists and representatives of companies in the sector, since they could convey specific knowledge and share experience in the corresponding study courses.

- On 30 September 2021, the online workshop was organized by the German state railway company “Deutsche Bahn” (DB) about the role and opportunities of railway in the future;
- n 23 April 2021, the online conference organized by Rail Baltica and the Ministry of Transport “21st century Railway in Latvia: Challenges and Opportunities in Education” envisioned for the current and future railway engineering students.
- The students of the study program “Railway Engineering” took active part in a series of lectures organized by a joint venture of Rail Baltica RB Rail JSC Rail Baltica Academy for the students in natural sciences and engineering (and for the general public in the Baltics) on 3-17 June 2021, and currently are taking part in the new lecture season starting from 5 November, 2021.

### 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 study program involves RTU academic staff members whose profiles are provided in their **curriculum vitae**. The academic and research staff and their qualifications comply with the requirements of the study course.

11 members of the academic staff form the Transport Institute are involved in implementation of the study program:

- 1 professor – Doctor of Science, whose academic and teaching qualifications meet the evaluation criteria for academic and teaching qualifications of the candidates to the position of a professor set by regulatory documents;
- 3 associated professors – Doctors of Science, whose academic and teaching qualifications meet the evaluation criteria for academic and teaching qualifications of the candidates to the position of an associate professor set by regulatory documents;
- 3 assistant professors – Doctors of Science, whose academic and teaching qualifications meet the evaluation criteria for academic and teaching qualifications of the candidates to the position of an assistant professor set by regulatory documents.

1 assistant and 3 researchers also take part in the implementation of the study program.

Among the academic staff from the Transport Institute involved 8 hold a PhD degree and 3 – a Master degree, 2 of them studying at a PhD study program.

The average age of the academic staff from the Transport Institute is 39.8 years. 1 is in the age group of 20-30 years old, 4 – 30-40 years old, 5 – 40-50 years old, 1 – 50-60 years old, and none – in the 60+ group.

In December 2020, Pāvels Stankevičs, who specializes in construction and traction of the rolling stock, publicly presented his PhD Thesis. It allows implementing the results of the research carried out within the Doctoral Thesis in the courses on the railway rolling stock, increasing their value with topical problems in these fields and their innovative solutions. Furthermore, the awarded scientific degrees provide the young doctors with an opportunity to apply for and manage research projects, which in turn will further increase the quality of studies due to continuous follow up of up-to-date trends in the railway sector.

A degree candidate Aleksejs Vasiļjevs is getting ready for his viva voce examination. He is working with railway automation, telematics and telecommunication systems and already now is taking an active part in the teaching and development of new study courses. This field of studies is supported by an assistant, PhD student Katrina Otersone, whose field is wireless communication networks GSM-R/5G-R, their safety and reliability. She is involved in teaching activities as an assistant and supplements the study course about communication systems in transport and railway telecommunication systems with information about these advanced technologies.

One of the most important modern requirements in the railway industry is the need for knowledge and skills in information technologies, design and programming of embedded equipment, microprocessors and railway electronic systems. In order to improve the quality of management of the study program, some new members of academic staff were invited in 2021 – Professor Mihails Gorobecs, who has vast experience in computer sciences (hardware and programming), information technologies (numerical modelling and simulation of logistics and transport systems, computer modelling, databases, web technologies), energy technologies in computer control (industrial systems, robotic systems, design and programming of embedded systems and their control algorithms for transport applications), and AI technologies (neuron networks, fuzzy logic, genetic and immune algorithms, intelligent agents) to be developed and adopted in many railway transport projects, and Assistant Professor Andrejs Potapovs, whose “niche” includes programmable controllers and microcontrollers, adaptive systems, systems of embedded sensors.

It will allow future railway technology engineers to freely use information technologies in the management and optimization of transport systems, defining management procedures and program algorithms, as well as to lead projects related to the development of railway software-intense solutions.

In view of the fact that in the new future electrical energy, electrical traction and electrical systems will dominate in the railway sector as the most environmentally friendly and green, in order to improve the quality of the study process it was necessary to invite specialists with vast experience in electrical machinery and electrical equipment and in rail transport systems - Assoc. Professor Edmunds Kamoliņš and Assoc. Professor Viesturs Bražis.

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

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

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

The proportionality of the professional and academic teaching staff is ensured in the implementation of the study program, thus creating a balanced staff that helps to achieve the goal and results of the study programs.

The co-operation of the teaching staff is formed in the meetings of the methodological commissions, in individual talks with the director of the study program, in the talks with the teaching staff, as well as in the joint meetings of the teaching staff of the Department of Railway Engineering, discussing various issues.

The teaching staff of the study program cooperates in the implementation and updating of the content of the study courses, coordinates the topics in order to avoid duplication of the content. The teaching staff also cooperates within the research groups, offers ideas for the topics of qualification papers and improvement of study programs. At the same time, the teaching staff participates in the development of extracurricular activities for students, for example, to provide student study tours to employers, or to attract visiting lecturers in the field.

In accordance with the internal normative documents regulating the RTU study process, the Council of the Transport Institute operates within the study program, which is one of the elements of ensuring the quality of the implementation of the Program.

The main directions of the work of the council are:

1. Evaluation of study course descriptions for approval at the meeting of the Railway engineering department and approval by RTU Study Department.
2. Review and approval of study and methodological materials.
3. Organization of lesson observation and analysis of results.
4. Organization of methodological seminars on current events.
5. To provide proposals for the development and improvement of new study courses.
6. Coordination of master thesis topics.
7. To discuss novelties in the use of information technologies in the study process and to provide recommendations to the management of the institute / faculty.

For the moment of the drawing of the self-assessment report:

- number of students in [1] variant of the program is 4
- number of involved members of academic staff, considering selected study courses only, is 5

Therefore, the student-academic staff ratio is 0.8.

- number of students in [2] variant of the program is 1
- number of involved members of academic staff, considering selected study courses only, is 11

Mathematically, there are 0.09 students per academic staff. But in this case, it is impossible to calculate the ratio properly, because the students of variant [2] join both the flow of the master's study program variant [1] and the flow of the bachelor's level.

# 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 | MGH0_diploms_dipl_supple.zip | MGH0_diploms_dipl_pielikums.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) | | |
| 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 | MGH0_stud_statist_EN.pdf | MGH0_stud_statist_LV.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 | MGH0_StEdSt_6_annex.pdf | MGH0_ValzSt_6_pielik.pdf |
| 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) | MGH0_ProfSt_7_annex.pdf | MGH0_ProfSt_7_pielik.pdf |
| 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 | MGH0_CoursMapp_8_annex.pdf | MGH0_KursKart_8_pielik.pdf |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MGH0_CurricStProgrPL_9_annex.pdf | MGH0_StudProgrPL_9_pielik.pdf |
| Descriptions of the study courses/ modules | MGH0_DescriptStud_cour.zip | MGH0_Studkurs_Apr.zip |
| Description of the organisation of the internship of the students (if applicable) | MGH0_Descr_org_internsh.pdf | MGH0_Prakse_apr.pdf |
| III - Description of the Study Programme - 3.4. Teaching Staff | | |
| Confirmation that the academic staff of the doctoral study programme includes not less than five doctors, of which at least three are experts approved by the Latvian Council of Science in the branch or sub-branch of science in which the study programme intends to award a scientific degree (if applicable) | | |
| Confirmation that the academic staff of the academic study programme complies with the requirements specified in Section 55, Paragraph one, Clause 3 of the Law on Higher Education Institutions (if applicable) | | |

# Mechanical Engineering and Mechanics (51526)

| | |
|---|---|
| Study field | *Mechanics and Metal Processing, Heat Power Engineering, Heat Technology, and Mechanical Engineering* |
| ProcedureStudyProgram.Name | *Mechanical Engineering and Mechanics* |
| Education classification code | *51526* |
| Type of the study programme | *Doctoral study programme* |
| Name of the study programme director | *Anita* |
| Surname of the study programme director | *Avišāne* |
| E-mail of the study programme director | *anita.avisane@rtu.lv* |
| Title of the study programme director | *Dr.sc.ing., docente* |
| Phone of the study programme director | *29268113* |
| Goal of the study programme | *The aim of the study program is to implement higher-level studies that prepare doctors of science who are highly qualified specialists in such fields of engineering and technology as "Mechanical Engineering and Mechanics," "Materials Science," "Medical Engineering" and "Environmental Engineering." and energy" in the sub-sector "Thermal energy" with an understanding of the latest scientific theories and knowledge, systemic thinking and skills for work in engineering and high-tech companies that are able to solve research and innovation tasks, independently put forward research ideas and conduct independent research, to develop a doctoral dissertation that contributes to the expansion of knowledge mechanical engineering and mechanics or materials science, medical engineering, environmental engineering and energy, or nanotechnology.* |
| Tasks of the study programme | *1. To provide an opportunity to carry out independent research work on the chosen topic;*<br>*2. To provide in-depth theoretical knowledge, skills, and attitudes that would enable doctoral students to successfully carry out scientific research in the chosen field of the Study Program, systematize, methodologically analyze practical and experimental observations, linking them with theoretical knowledge, and demonstrate conceptual and analytical skills in scientific theory development;*<br>*3. To prepare high-level specialists who are able to carry out high-quality and internationally significant scientific research using modern research methods, to publish and report the results of them at international conferences, scientific seminars, etc .;*<br>*4. To develop doctoral students' knowledge of technical innovation methods, to introduce new research and engineering system diagnostics methods, to promote the integration of scientific research and modern technology into a single innovative operating environment, to promote research productivity and competitiveness;*<br>*5. To prepare highly qualified scientists for Latvian and foreign universities, scientific institutions, and industry.* |

| | |
|---|---|
| Results of the study programme | *The graduate of the study programme:*<br>*1. Acquires an understanding and knowledge of the planning, organization, implementation, and processing of scientific data,*<br>*2. Is able to perform independent, critical analysis and evaluation, solve significant research or innovation tasks, independently put forward a research idea and hypothesis, tasks, plan and manage scientific projects;*<br>*3. Is able to evaluate and choose appropriate methods for research independently, has gained a new understanding of existing knowledge and its application in practice, implementing a significant amount of original research, part of which is at the level of internationally cited publications,*<br>*4. Is able to demonstrate knowledge and understanding of the latest scientific theories and knowledge, masters research methodology, and modern research methods in the relevant scientific or professional field and the interaction of different areas;*<br>*5. Is able to promote the technological and social progress of a knowledge-based society in an academic and professional context.* |
| Final examination upon the completion of the study programme | *Research Work* |

# 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 degree in 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 or Materials Science, or Medical Engineering, or Environmental Engineering and Energy, or Nanotechnology.* |
| 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 degree in 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 or Materials Science, or Medical Engineering, or Environmental Engineering and Energy, or Nanotechnology.* |
| 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 program "Mechanical Engineering and Mechanics" was developed 8.2.1. within the framework of the second round project of the specific support objective "To reduce the fragmentation of study programs and strengthen the sharing of resources (hereinafter - SAM 8.2.1.) by combining the existing doctoral study programs "Engineering Technology, Mechanics and Mechanical Engineering" and "Production Engineering."

The content and planning of the program is designed to adapt it as much as possible to each student, taking into account the student's research topic, thus deepening the student's knowledge in the specific field of research.

On September 2, 2020, the Study Quality Commission of the Academic Information Center decided on licensing the program. In the Fall semester of 2021, the approbation of the program was started.

**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 doctoral study program "Mechanical Engineering and Mechanics" at Riga Technical University has been implemented since the fall semester of 2020. Graduates of the study program will obtain a doctoral degree in the sub-sectors of the group of Engineering Sciences and Technology by the chosen direction of the study program. The aim of the doctoral study program "Mechanical Engineering and Mechanics" is to implement higher-level studies that prepare doctors of science who are highly qualified specialists in such fields of engineering and technology as "Mechanical Engineering and Mechanics," "Medical Engineering," "Nanotechnology" and the field's "Environmental Engineering" subfield "Environmental Engineering and Energy" with an understanding of the latest scientific theories and knowledge, systemic thinking and skills for work in the field of engineering and high-tech companies, able to solve research and innovation tasks, independently research, solve scientific problems and develop doctoral theses that contribute to the expansion of knowledge. The mutual connection between the results of the doctoral study program and their accessibility is ensured by evaluating the doctoral thesis in accordance with the Cabinet of Ministers Regulation No. 1001 from 27.12.2005. "Procedure and Criteria for Awarding a Doctoral Degree" by the Doctoral Council, three reviewers, and interested parties participate in the public defense of the doctoral thesis. Doctoral studies are planned for four years, divided into eight semesters. The duration of full-time studies is four years (48 weeks x 4 = 192 weeks). The amount of studies in doctoral studies is 192 CP (1 CP/week x 192 weeks). The volume of the program and the total duration of studies are the same for students with different previously acquired education: 192 CP - for full-time studies - for students with a master's degree in engineering. The program is open to applicants with an academic and professional master's degree in engineering in the relevant field. Applicants who have obtained an academic master's or professional master's level education in a field of science not related to engineering must additionally acquire educational equivalence courses (the director of the study program defines the orientation courses to be acquired by the student, taking into account the applicant's previous education documents and professional knowledge). The goal of a high-quality study process is internationally competitive, analytical, and creative-minded specialists trained in prestigious, internationally recognized high-quality studies who ensure the development of the Latvian economy and who have the ability to learn throughout life. The goal of excellent research is high-quality scientific research that meets the needs of the Latvian and international economy, is widely involved in global, national, and sectoral research programs, and is integrated into the study process. The goal of sustainable valorisation is an efficient environment for technology transfer and innovation development, which promotes the creation of new technological companies and the creation of products. The study program provides an opportunity to prepare doctors of engineering who can work in Latvian and foreign companies in various fields and in universities, research institutions, and other organizations where research knowledge, skills, and competencies are required. The usefulness of the doctoral study program "Mechanical Engineering and Mechanics" is evidenced by the growing demand for a wide range of specialists in engineering and technology who can professionally use competencies in the Latvian and international markets. Referring to the 2018 report of the Ministry of Economics of the Republic of Latvia, "INFORMATIONAL REPORT ON MEDIUM AND LONG-TERM LABOR MARKET FORECASTS," labor supply and demand forecasts with higher education by educational thematic groups in 2025, demand is significantly higher in the engineering, manufacturing and construction sectors than the offer. (https://em.gov.lv/files/tautsaimniecibas_attistiba/dsp/EMZino_06072018_full.pdf)

According to the data of the Association of Mechanical Engineering and Metalworking Industries of Latvia (MASOC) (www.masoc.lv), the production volume is increasing every year by 10 - 15%. The demand for highly qualified engineering specialists is growing rapidly. It is significantly influenced by Latvia's long-term economic strategy and industrial development guidelines approved by the Cabinet of Ministers. They state that the basic principle of Latvia's industrial development is to stimulate the growth of industry based on knowledge and scientific achievements, based on the use of high technology and skilled labor, which increases the efficiency and competitiveness of industry in the world market. According to the Global Innovation Index 2019, Latvia ranks 34th. It is especially noted that Latvia is one of the countries that showed the expected result. However, according to the criterion "Knowledge and technology outputs," Latvia ranks 45th globally, so the training of highly qualified specialists is a topical task. The study program "Mechanical Engineering and Mechanics" includes science subjects that prepare experts who have developed skills and work techniques related to the respective field of science to such an extent that they can critically analyze the problems of the field. The graduate is able to work in research using innovative solutions. The study program focuses on a comprehensive and systematic approach, where study courses allow to gain in-depth knowledge and understanding of the place and role of processes and technologies in the development of their industry and the development of other current economic sectors.

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

There are no graduates in the study program "Mechanical Engineering and Mechanics" yet. Still, considering that the program is designed to improve the quality of education in the previous doctoral study programs, it is possible to analyze and forecast graduates' employment.

The study program prepares highly qualified doctors of engineering who can work in Latvian and foreign companies of various fields and in universities, research institutions, and other organizations where research knowledge, skills, and competencies are required.

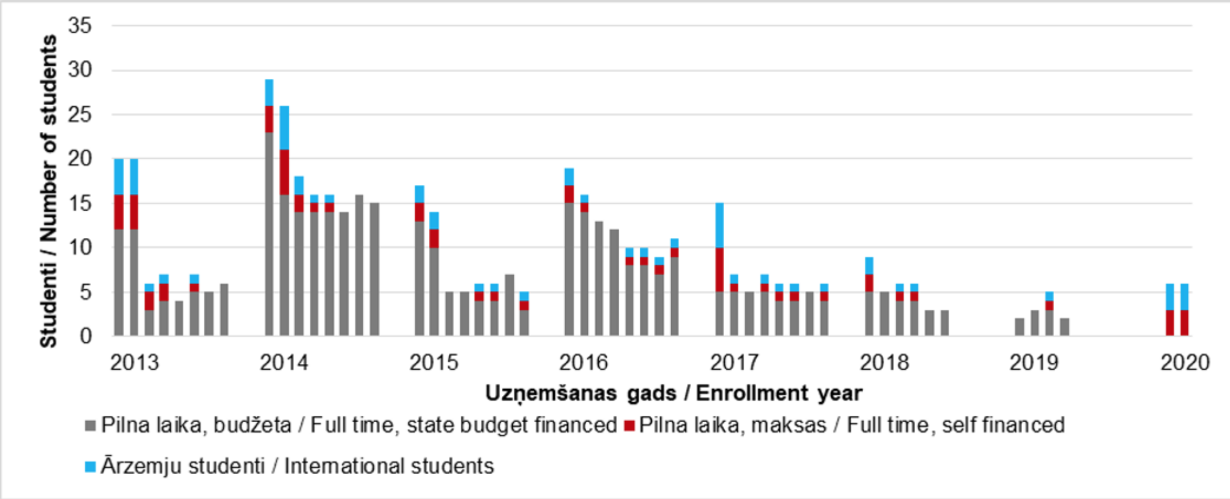
Graduates of the study program can work in mechanical engineering, metalworking, woodworking, food production, health care, etc.

The content of the study program and its implementation is based on the relevant existing normative documents of the Republic of Latvia, taking into account the strategic development goals of RTU, the Institute of Mechanics and Mechanical Engineering, and the Institute of Biomedical Engineering and Nanotechnology of the Faculty of Mechanical Engineering, Transport and Aeronautics. The study program "Mechanical Engineering and Mechanics" includes science subjects that prepare experts who have developed skills and work techniques related to mechanical engineering. These experts are able to critically analyze the problems of mechanical engineering and mechanics, including research, using innovative solutions. The study program focuses on a comprehensive and systematic approach, where study courses allow to gain in-depth knowledge and understanding of the place and role of processes and technologies in the development of mechanical engineering and mechanics and the development of other current economic sectors. Several doctors of science are prepared every year. In recent years, intensive modernization processes have been taking place in companies in the industry, foreign companies with new technologies are entering Latvia, and cooperation with companies from other countries is expanding. According to data from the Association of Mechanical Engineering and Metalworking Industries of Latvia (MASOC) (www.masoc.lv), the production volume increases by 10-15% annually. The demand for highly qualified engineering specialists is growing rapidly. All the more so because Latvia's long-term Economic Strategy and Industrial Development Guidelines, as a guiding principle for industrial development, aim to stimulate industrial growth based on knowledge and scientific advances. It is based on the use of high technology and skilled labor, which increases industrial efficiency and competitiveness in the global market.

### 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.

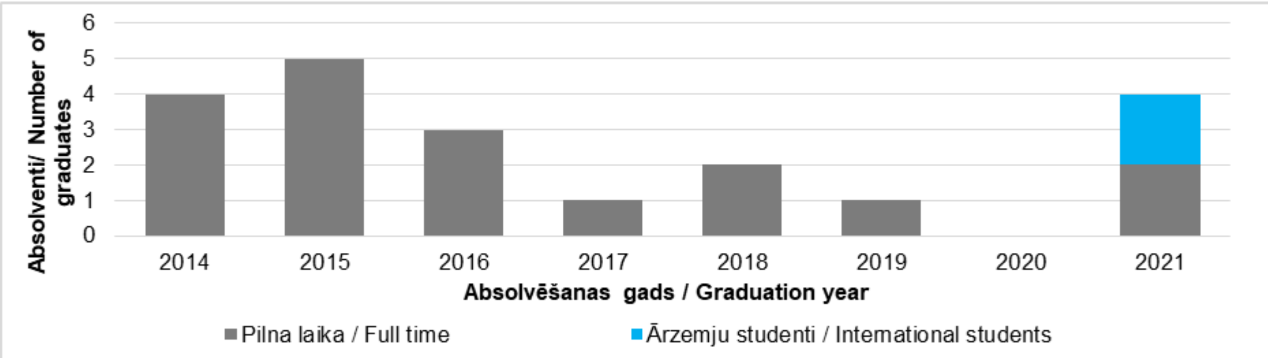
Currently, one student in the study program "Mechanical Engineering and Mechanics" is enrolled in the first year for studies in Latvian and two students for studies in English. One student is enrolled in the 3rd year of the program, resuming studies from the study program "Production Engineering". One student has been transferred to the 3rd year from the doctoral study program " Engineering Technology, Mechanics and Mechanical Engineering ".

The statistics of previous years' students are based on the data of the doctoral study programs "Engineering Technology, Mechanics and Mechanical Engineering" and "Production Engineering."




*Number of Students in the Study Program*

As can be seen from the schedule, the number of students in the program is considered to be average and sufficient to provide quality training. In recent years, admissions, both due to the reorganization of institutes and changes in the study program and measures to attract public students, have not been as effective as in previous years. Considering the inadequate funding of science in Latvia, the potential circle of those wishing to study is decreasing.




*Number of Graduates*

**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.**

Students are offered compulsory study courses, specialization, and free choice study courses during the studies. The compulsory study courses of the study program are common to all students of the doctoral program "Mechanical Engineering and Mechanics." They provide knowledge for independent preparation of the doctoral thesis and practical application of the obtained research results. In the study course "Design and Analysis of Physical and Computer Experiments," students acquire knowledge about the design and analysis of experiments that facilitate the process of creating a complex system product. In the study course "Scientific Writing," students receive the necessary knowledge to prepare and submit a scientific publication. "Protection, Promotion, and Valorisation of Scientific Results" provides students with the knowledge to develop valorization plans based on the identification and life cycle of intellectual property and develop intellectual property protection strategies based on the valorization plan. Thus enabling students to achieve critical competencies beyond engineering and in the field of mechanical or medical engineering, but also opens up the possibility of using them in other engineering fields. Limited choice subjects that supplement students' competencies include professional specialization study courses. Limited choice study courses are divided into the directions of the doctoral program. Students choose study courses in the amount of 21 CP, according to their dissertation topic. Both compulsory and courses of limited choice are adapted to each student individually, taking into account the student's research topic, thus deepening the student's knowledge in the specific field of research.

The diversity of study courses offered by the study program allows students to develop the necessary competencies, thus facilitating the training of highly qualified specialists who are suitable for the requirements of the modern labor market and knowledge-intensive economy. As well as allows students to reach the upper limit of knowledge in their chosen field of specialization.

Within the free choice study course framework, students can acquire any doctoral study level course at Riga Technical University. The free choice study course depends on the student's research topic and the skills that must be obtained to successfully develop the doctoral thesis. In parallel with the acquisition of study courses, students carry out research work.

Acquisition of the program ends with the defense of the doctoral thesis (dissertation) in the doctoral council.

Faculty members of the Institute of Mechanics and Mechanical Engineering (MMI) and the Institute of Biomedical Engineering and Nanotechnology (BINI) were involved in developing the study program.

Taking into account that the study program combines the branches of science "Mechanical Engineering and Mechanics," "Medical Engineering," "Materials Science," "Nanotechnology" and the subfield "Environmental Engineering and Energy" "Heat Energy," the study program ensures the connection and mutual influence of different fields, which is one of the most current global trends in recent years - to prepare new scientists who are ready for interdisciplinary cooperation and, as a result, are able to expand the boundaries of knowledge and give new insights to existing knowledge and its application in practice. This innovative approach is more common in study programs related to IT, electronics, or fundamental sciences such as chemistry, biology, etc. than in mechanical engineering.

**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).**

Within the study program, a wide range of highly qualified specialists in mechanical engineering, materials science, nanotechnology, and thermal energy with integrated education and systemic thinking, skills of independent scientific and pedagogical work, knowledge and skills for employment in economic institutions, researchers can be employed in mechanical engineering and metal processing companies, local governments, ministries, as well as to act as evaluators of scientific achievements, experts of international organizations, etc.

The study program can be acquired in six specialization directions: "Mechanical Engineering Technology," "Applied Mechanics," "Machine Dynamics and Design," "Heat Power Engineering and Heat Engineering," "Medical Engineering,"

Graduates of the study program acquire competencies corresponding to the level of international achievements in engineering, which correspond to the upper limit of knowledge and allow them to solve critical problems of mechanical engineering, mechanics, medical engineering, materials science, nanotechnology, and heat in research and innovation. The result of the study program is an independently developed doctoral thesis with significant theoretical significance and potential for practical use, which includes original research results obtained by independently evaluating and selecting appropriate research methodologies and modern research methods, and provides new scientific and professional knowledge in mechanics and mechanical engineering, in the fields of engineering, materials science, nanotechnology and thermal sciences. Acquired competencies correspond to the level of international achievement of the respective field of science, corresponding to the upper limit of knowledge and enabling to solve critical engineering problems in research and innovation and enabling independent professional, scientific or academic activities, expanding existing knowledge and providing new understanding of engineering and technology sub-sectors, according to the chosen direction of the study program.

**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.**

Assessment of study results takes place in accordance with the Regulations for Assessment of Study Results (https://www.rtu.lv/writable/public_files/RTU_1_studiju_rezultatu_vertesanas_nolikums.pdf) and the Regulations on Final Examinations at Riga Technical University (https://www.rtu.lv/writable/public_files/RTU_nolikums_par_noslguma_prbaudjumiem_.pdf).
Pedagogical methods, the structure of study courses, and assessment methods are chosen by the teaching staff responsible for the study course, according to the specifics of the course content and program and the needs of students. Lectures and seminars on the latest teaching and pedagogical methods are organized for the academic staff. Attend in-service training courses is encouraged both at the faculty's internal events and the RTU level and internationally. RTU Center for Academic Excellence organizes in-service training events for academics. RTU participation in the ERASMUS + program ensures the academic staff's professional development on an international scale (https://www.rtu.lv/lv/internacionalizacija/mobilitate/erasmus).

The teaching staff must acquaint the students with the specific evaluation criteria of each study course in the first lesson, and they are published in the course e-learning environment in RTU intranet ORTUS.

The implementation of the study program is realized in close cooperation with the supervisor of the dissertation. In addition, the reporting of the semester at RTU MMI and BINI and the attestation of doctoral students at the end of the study year take place (according to the RTU Doctoral Regulations). The implementation mechanism of this type of study program allows ensuring the achievement of study results.

The development and licensing of the study program are subordinated to the year of accreditation of the study field corresponding to the study program. If the students of the study program to be completed, do not complete their studies in the year of accreditation of the study field and if they wish to continue their studies, then, in accordance with the Study Agreement, students will be offered to continue their studies in a new study program or other educational institution. It is planned to start the implementation of the study program so that there will be students in the new study program for the evaluation of the study field. When submitting the self-evaluation report of the study field corresponding to the study program, it will not include in the RTU study program development and consolidation plan as the indicated existing study programs to be closed in the study direction.

The academic staff involved in implementing the study program regularly improves the content of the implemented study courses and updates the used study materials. Study organization methods are periodically reviewed and evaluated. Study courses are developed in close cooperation with companies. The industry-oriented approach is implemented through practical and laboratory classes within the study courses. The academic staff has the opportunity to supplement their professional knowledge and gain valuable experience in one of the foreign universities, which is in line with the strategy for the development of the European Higher Education Area.

**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 opportunity for the promotion of the doctoral study program students is provided in accordance with the Cabinet of Ministers Regulations "Procedure and Criteria for Awarding the Doctoral Degree" No. 1001 of 27.12.2005:https://likumi.lv/ta/id/124787-zinatniska-doktora-grada-pieskirsanas-promocijas-kartiba-un-kriteriji

in accordance with the RTU Regulations on Promotion Councils and Promotion at RTU (approved at the RTU Senate sitting on October 29, 2007, protocol No. 517):https://www.rtu.lv/lv/studijas/doktora-limena-studijas/promocija/noteikumi-par-promocijas-padomem-un-promociju.

In accordance with the regulations mentioned above, upon successfully completing studies and elaboration of a doctoral thesis under the supervision of an experienced scientist (professor, associate professor, assistant professor, or leading researcher approved by RTU), the applicant submits a doctoral dissertation for public defense. Together with the other required documents, the applicant for a scientific degree submits to the Promotion Council of the respective field an extract from the minutes of the meeting of the RTU structural unit at which the doctoral thesis was developed with a recommendation to accept the doctoral thesis for defense. Out of a total of 16 doctoral councils currently operating at RTU, students of the doctoral program "Mechanical Engineering and Mechanics" have the opportunity to develop doctoral theses for defense in such RTU doctoral councils. (https://www.rtu.lv/lv/studijas/doktora-limena-studijas/promocija/promocijas-padomes): "RTU P-04" and "RTU P-16", which are entitled to award the degree of Doctor of Science (Ph.D.) in the field of Mechanical Engineering and Mechanical Engineering Mechanical Engineering Technology and Measuring Instruments and Metrology, as well as in the field of Medical Engineering in the field of other medical engineering , as well as "RTU P-19", which is entitled to award the degree of Doctor of Science (Ph.D.) in the sub-sectors of environmental engineering and energy. Depending on the content of the doctoral thesis, it is possible to defend the doctoral thesis in a joint meeting of several doctoral councils or the doctoral council of another university.

Upon receipt of the doctoral thesis and other necessary documents, the Doctoral Council acknowledges that the doctoral thesis complies with Regulations No. 1001 and the scientific competence of the council; it organizes the promotion process (including the promotion of the work for the evaluation of VZZK). The defense of the dissertation with the subsequent decision-making on the award of the scientific degree takes place in an open public session if the dissertation does not contain commercial secrets or State secrets. The doctoral degree is awarded to the applicant based on the decision of the Promotion Council by order of the Rector of RTU. All decisions made by RTU, the council, or the SSC and the actual actions in the promotion process can be challenged in the Latvian Science Council within a month.

Thus, the doctoral study program "Mechanical Engineering and Mechanics" students are provided with the possibility of promotion and a high-quality promotion process that fully complies with RTU and state regulations.

### 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.

There are no final theses and graduates in the study program "Mechanical Engineering and Mechanics." In turn, in the existing doctoral study programs "Engineering Technology, Mechanics and Mechanical Engineering" and "Production Engineering." the topics of students' doctoral theses (research area) are selected by applying for admission to studies. At the same time, the program director recommends a potential supervisor and consultants. At the same time, the program director recommends a potential supervisor and consultants. At the beginning of doctoral studies, for each doctoral student, by order of the RTU Vice-Rector for Science and support of the Doctoral Studies Department, the supervisor of the doctoral thesis is approved. The topic of the dissertation is specified before the defense of the dissertation.

Topics of doctoral theses defended during the reporting period:

| | |
|---|---|
| 2013. | A new method for checking the quality of extruded joints |
| | Investigation of a pump with rotating permanent magnets for transportation of liquid metals |
| | Investigation of the characteristics of transparent nanocoatings of transparent conductive oxides |
| | Methods for solving problems of optimal synthesis of three-dimensional rubber technical products |
| | Investigation of the possibility to increase the wear resistance of rotor contact surfaces of screw compressors |
| | Combined cycle gas trigeneration in temperate climates |
| | Dynamics analysis of positioning systems, control optimization and structure synthesis |
| | Application of metamodeling for shape element optimization |
| | Global analysis of pendulum system dynamics, new bifurcation groups and rare attractors |
| 2014. | A method of applying quality systems to improve the management skills of mechanical engineering companies |
| | Influence of internal geometry of short fiber composites on load-bearing capacity and collapse of a material |
| | Radiation stability assessment method for digital medical X - ray equipment |
| 2015. | Influence of measuring force and surface roughness on the accuracy of linear dimensional measurements of highly elastic material parts |
| | Fiberglass knitted reinforcement in composite materials |
| | Cylindrical cell refractometer and its application methodology |
| | Electron emission ionization radiation method based on ZrO2: PbS nanostructured films |
| | Adding vibrator diagnostics to hydraulic units with generator air gap monitoring |
| 2017. | Surface wetting control method with ultraviolet radiation for polymethyl methacrylate eye prostheses |
| 2018. | Vacuum meter test methodology research |
| 2019. | Vertification of radiotherapy with flat dose gradients |
| | Anhydrobiosis of yeast cultured under limited oxygen conditions and its biotechnological applications |
| | Analysis of dynamic processes in cryostats with electric machine cooling |
| | Gaseous fuel combustion control methodology in the intensive electrostatic field |
| | Research of dynamics and reliability of heavy-duty water cooling systems |
| 2020. | Laser fused surface hardening single layer coating with a gradient of mechanical properties |
| | Analysis of material surface restoration technologies and research of laser melting technologies |
| | Dynamics analysis and control optimization of fluid extraction equipment |
| 2021. | Analysis of the interaction of simple shaped objects with liquids and optimization of control |

## 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 best equipped and most modern metrology laboratory in the Baltics, opened in September 2018 at the RTU Laboratory House, is available for the acquisition of common study courses of the study program and the research of doctoral students. The laboratory is equipped with metrological equipment from the Japanese company Mitutoyo, mainly used for quality control of manufactured parts - from simple linear dimensions between two surfaces to complex 3D surface geometry control and surface roughness measurements. The laboratory offers component roundness control equipment, contour meter, 3D coordinate measuring machine, 2D roughness meter, non-contact 2D optical measuring microscope, part height meters, and various hand tools for measurements. It is planned to install a 4D roughness meter in the laboratory in the future. The use of the laboratory in the study work will bring the skills and knowledge of young Latvian researchers closer to the skills of scientists from other countries, making it more competitive and more relevant to the labor market.

There is also a welding laboratory of the MTAF Transport Institute (TI) with eight fully-equipped workstations with modern equipment and other equipment (arc welding: MMA, MIG / MAG, TIG, gas welding, and cutting, plasma welding, and cutting).

In the specializations "Applied Mechanics" and "Machine Dynamics and Design," the study program is implemented by the structural units of MMI.

The Department of Theoretical Mechanics and Resistance of Materials (TMMP), as well as the Scientific Laboratories of Machine and Mechanism Dynamics (MMD) and Materials Experimental Mechanics (MEM) and the Mechanics Expertise Center, have material resources, equipment, and software available to PhD students.

The MEM Scientific Laboratory has equipment and apparatus for testing materials and structural elements under static and dynamic loads (universal testing equipment Zwick / Roell Z150 and Zwick / Roell Z600, dynamic load testing equipment Zwick / Roell HB50, industrial compression and bending testing equipment Control, multi-channel electronic data collection stations/strain stations / HBM, etc.).

The ARMFIELD wind tunnel is also available to doctoral students, which can be used to study the aerodynamic properties of bodies. Vibration testing of products and materials can be performed using the ESD201 Vibration Stand in the MMD Scientific Laboratory. In addition, the laboratory has control equipment (Vibration meter VB - 8200, Spectrum analyzers GSP-810 and GSP-827, Spectrophotometer UV-9200, Oscilloscopes 2x35MHz, 2x100MHz and 2x150MHz, Electric field meter CA-41, Electromagnetic field meter CA 40, Pulse generator HM, Function generator HM 8030 - 6, Universal meter HM 8021, etc.).

MMD Research Laboratory offers doctoral students a powerful workstation that can be used for a wide range of research calculations using licensed commercial and RTU software:

- ADAMS 2018 (MSC Software, Inc.) - for dynamic modeling of spatial multibody systems;
- ANSYS 2019 (Ansys, Inc.) - a variety of systems for finite element analysis;
- Catia v6 (Dassault Systemes, Inc.) - for CAD / CAE / CAM calculations and design;
- EDAOpt (RTU) - for planning, approximation, and optimization of experiments;
- EDEM 2018 (DEM Solutions Ltd.) - for bulk material dynamics calculations with discrete

element method;

- KEDRO (RTU) - for multi-criteria robust optimization of composite material elements;
- SolidWorks 2018 (SolidWorks Inc.) - for 3D object design and GEA calculations;
- Working Model - for modeling the dynamics of 2D multibody systems, etc.

In the specialization "Medical Engineering," the study program is implemented by the structural units of the Institute of Biomedical Engineering and Nanotechnology, the Department of Medical Physics and Engineering, and the Department of Nanoengineering, which has the following equipment at their disposal:

- For the analysis of physical properties of biomaterials: infrared, visible light spectrometers, photoelectron emission spectrometer, XPS, Scent spectroscopy and SIM spectroscopy spectrometer;
- For the analysis of the nanostructure of materials and their surface: atomic force microscope, restoration of the transmission microscope;
- Microfluidics for single-cell chip research: laminar flow chamber; optical microscopes, image recording apparatus;
- Rapid prototyping workshop equipped with 3D printers, nanocoating device (spin-coating);
- For physiological measurements: universal biopotential recorders and equipment for the layout of electronic measurement systems;
- For activities with medical sources of ionizing radiation: stationary, portable and dental equipment, computed tomography, equipment for diagnostics of X-ray equipment;
- Software for creating virtual measuring instruments.

In the specialization "Mechanical Engineering Technology," the study program is implemented by the structural unit of MMI, Department of Mechanical Engineering and Mechatronics (MMK). MMK Materials Processing Laboratory has welding equipment at its disposal:

- ESAB welding machine Aristo MIG 3001i / Feed 3004 - semi-automatic fusible electrode welding in shielding gas environment (MIG / MAG), can also be used for manual arc welding with the melting electrode (MMA) and non-melting (tungsten) electrode in inert shielding gas environment (TIG);
- ESAB welding machine Caddy Tig 2200i AC / DC - equipment for manual arc welding with a melting electrode (MMA) and with non-melting (tungsten) electrode in inert gas environment (TIG);
- Pulse - contact welding equipment, which is designed for various materials of wires and the like for pulse contact welding of products. The thickness of welding materials: 0.05 ... 3 mm;
- "Okuma" CNC machining center, which has been handed over to the RTU MTAF MMK department. SIA «NAGLIS & ERR» provides technical support for the successful operation of all CNC machines in the laboratory, ensuring the training process.

In its turn, MMK Tribology Scientific Laboratory has the following scientific equipment:

- Tribometer: CSM Instruments TRB-S-EE;
- Hardness tester Proceq Equostat 3, etc.

The study program in the specialization "Heat Power Engineering and Heat Engineering" is implemented by the Department of Heat Power Systems of MMI, which has the following equipment at its disposal:

- Air-to-water heat pump;
- Training laboratory stand "Thermal measuring equipment for construction and insulation materials";
- Heat exchanger research and testing equipment with water-water turbulent heat exchanger

and thermostat;
- Training laboratory stand "Heat transfer in the process";
- Temperature measuring equipment;
- Research equipment and other equipment for steam compression refrigeration processes.

RTU students and lecturers can also use the modern computing infrastructure of RTU HPC (High-Performance Computing) Center or Scientific Computing Center (http://hpc.rtu.lv/), incl. RTU supercomputer and scientific software.

**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).**

Within the framework of cooperation with the European Organization for Nuclear Research (CERN), in which Professor Toms Torims works as the representative of Latvia, doctoral students have the opportunity to apply for research at CERN (Geneva) to cooperate with CERN scientists. The directions of the offered research / doctoral theses are mainly related to mechanical engineering technologies, including additive production technologies, as well as the applications of particle accelerators in industry.

In the framework of cooperation with the Belarusian State Technical University (Minsk), doctoral students have the opportunity to apply for research in the Plasma and Laser Technology Scientific Laboratory. Within the framework of research in the field of laser technologies (welding and fusion), it is also possible to carry out a robotic complex for laser processing in the Department of Technology of Daugavpils University.

In the field of medical engineering, cooperation is taking place with Latvian clinics, CERN and other foreign partners (Bulgaria, Russia, Romania, Finland, Turkey, Germany, Sweden, Ukraine, others), working on joint international scientific projects (HORIZON and others).

**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).**

RTU funding from the state basic budget consists of study base funding corresponding to the list of study programs and the number of students, scientific activities.

The number of study places is allocated after negotiations with the Ministry of Education and Science. Study base funding from the state budget is allocated for full-time studies. The amount of the financing for the study base is determined based on the number of study places determined by the state at RTU, the base costs of the study place determined by the state, and the study cost coefficients for the thematic areas of education.

The study cost coefficients of the thematic areas of education determine the amount of study place costs in the respective thematic field of education concerning the base costs of the study place.

The study cost coefficients for the bachelor's and professional study programs in the thematic areas of education are determined by the Regulations "Procedures for Financing Higher Education Institutions and Colleges from the State Budget" approved by the Cabinet of Ministers on December 12, 2006. (https://likumi.lv/ta/id/149900) (from now on - the Regulations).

The values of study cost coefficients for master's study programs are one and a half times, but for doctoral study programs - three times higher than the values of study cost coefficients specified in Annex 1 to the Regulations for the relevant thematic area of education.

The amount of study base funding granted to a higher education institution or college from the state budget for the implementation of bachelor's, professional, and master's study programs shall be 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 funding;

Tb - basic costs of the study place;

ki - the study cost coefficient of the relevant thematic area of education (Annex 1 to the Regulations);

ni - the number of study places in the bachelor and professional study programs in the relevant thematic area of education determined for the higher education institution or college;

mi - number of study places in the master's study programs of the respective thematic field of education;

Sb - social security costs of the study place in bachelor's, professional, and master's study programs (Annex 2 to the Regulations).

The direct costs of the study place and the social security costs of the study place shall be determined in accordance with Annex 2 to the Regulations.

The Ministry of Education and Science annually calculates the base costs of the study place for the next budget year. By November 1 of the current year, the calculations are coordinated with the Ministry of Finance and the ministries subordinate to higher education institutions and colleges.

RTU funding from the state basic budget for the provision of study places in the respective academic year is distributed in accordance with the RTU Senate decision "On the Methodology for Distribution and Use of Basic Budget, Performance Financing and Paid Student Funds for RTU Structural Units" in the respective academic year (from now on - Methodology). The Methodology is annually reviewed and approved in the new version, taking into account the necessary changes.

RTU has a decentralized budget, and a separate budget is planned for each structural unit. In a general sense, a budget is a plan of revenue and expenditure for a specific period, work, event, or function. RTU's revenues and expenses are managed according to the principles approved by the Senate or determined by the Vice-Rector for Finance.

According to the Methodology, funding for structural units is allocated either according to the financial or budget year or immediately after receiving the funding. For RTU structural units, the financial or budget year is from October to September of the following year. For this period, the funding is calculated and allocated:

- Grant or basic budget financing (training of state budget students) is allocated as a monthly

limit - 1/12 of the calculated annual financing is given to the structural unit per month;
- Financing of paid students (training of paid students, including debtors' paid funds) is distributed twice a year (in October and April) as a monthly limit - 1/6 of the calculated funding for the semester is allocated to the structural unit per month;
- Performance funding (research support funding) is allocated as a monthly limit - 1/12 of the calculated annual funding is allocated to the structural unit per month;
- Science base funding (science support funding) is allocated as a monthly limit - 1/12 of the calculated annual funding is allocated to the structural unit per month;
- Tuition funding for foreign students is distributed several times a year, taking into account that the most significant amount of the planned workload is allocated to the unit at the beginning of the semester - it is planned to continue aligning the allocation process with the tuition process.

At RTU, each head of a structural unit is provided with remote access to operative financial information on a budget of the structural unit, including the planned scope of work and the corresponding allocation of funding in future periods for the implementation of study programs and study courses. Based on this information, the head of the structural unit plans the work of the structural unit at the beginning of each financial or budget year, including remuneration issues for the academic staff, which is subordinated to the specific head of the structural unit, and developing a procurement plan for the next year by the study program or study course to ensure the operation and development, etc.

In addition to the study places financed from the state basic budget, the financing of the study program also consists of paid study income, which can be divided into two subgroups:

1. Local fee-paying students;
2. Foreign paid students.

Funding from local fee-paying students is allocated according to the Methodology. To ensure more significant opportunities for the development of paid study programs, a significant part of the funding for several academic years is directed to the study program director to ensure the process, etc.

Funding from foreign students is distributed in the respective academic year in accordance with the decision of the RTU Senate "On approval of the methodology for allocating funds for the study process at the RTU Department of International Cooperation and International Students" in the respective academic year (from now on - Methodology2, appendix XX). The Methodology2 is annually reviewed and approved in light of the necessary changes.

2019/2020 During the academic year 2006-2006, RTU made significant changes to the Methodology2 to bring it closer to the Methodology, thus facilitating the work process responsible for implementing study programs - both by approximating the funding periods and the principles.

Analyzing the study program in general and the study procedure financing at RTU in general, it can be seen that in the case of basic budget and local fee-paying students, funding has been and is determined based on the fundamental principles set by the state; In the process of determining the amount of funding, both the study cost coefficients of the thematic areas and the values of the study cost coefficients according to the level of the study program, as well as the number of students in the study program and the related study courses are taken into account. As mentioned above, using the study cost coefficients of the thematic areas of education, it is possible to determine the amount of funding required to implement the specific study program and study course. In the Methodology 2018/2019. The RTU Senate confirmed that in the future, the study cost coefficients of the thematic areas of education would be applied individually to each study course included in the study program, thus ensuring an even more appropriate amount of funding for the implementation of the study courses included in the study programs. In order to implement this system, an expert commission was established by order of the Vice-Rector for Studies, which determined its thematic area for each study course. RTU has the following thematic areas and applicable coefficients:

| Thematic area of RTU courses | RTU coefficient |
|---|---|
| Physics | 3.2 |
| Medical engineering | 2.9 |
| Mechanics, mechanical engineering, construction of machines and apparatus | 2.9 |
| Heat engineering, heat, gas, and water technologies | 2.9 |

From 2019/2020. It is planned to apply similar principles to Methodology2 study programs, where the total number of foreign students in all study years is greater than or equal to 90. In study programs where there are less than 90 foreign students, a support mechanism is defined, financed from the total funding of foreign students, ensures an appropriate amount of the financing for the implementation of study course study courses.

To ensure the operation and sustainable development of study programs, RTU has historically introduced the practice of improving the Methodology and Methodology2 for each academic year in accordance with changes in the external and internal environment, thus preventing possible risks in the implementation of the study program or its study courses. All stakeholders are involved in the change process, thus ensuring transparency and a transparent decision-making process. The RTU Vice-Rector initially initiates the necessary changes for Finance, and additional modifications may be undertaken by any RTU employee by submitting a request to the RTU Vice-Rector for Finance or the RTU Senate Finance and Budget Commission.

An estimate of the cost of one study place can be found in Appendix XX (Calculation of the cost of a study place).

Information on the minimum number of students in RTU study programmes is provided in the appendix of the self-evaluation report "On minimal number of students in study programmes".

Information on the funding distribution between the cost items is provided in the appendix of the self-assessment report "Funding distribution between the cost items".

## 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.**

Ten professors - doctors of sciences, "Mechanical Engineering and Mechanics" or "Physics and Astronomy" participate in implementing the study program.

Have been elected professors by the professors' councils and whose scientific and pedagogical qualification complies with the criteria specified in the regulatory enactments regarding the evaluation of a candidate's scientific and pedagogical qualification for the position of professor.

Professors elected by the Council of Professors of "Mechanical Engineering and Mechanics": Dr.sc.ing. Irīna Boiko; Dr.sc.ing. Andrejs Krasnikovs; Dr.sc.ing. Vitalijs Beresnevics; Dr.sc.ing. Olga Kononova, Dr.sc.ing. Aldis Balodis; Dr.sc.ing. Toms Torims; Dr.sc.ing. Alexander Janushevsky; Dr.sc.ing. Igors Tipāns.

Professors elected by the Council of Professors of Physics and Astronomy: Dr.habil.phys. Jurijs Dehtjars; Dr.phys. Aleksejs Katasevs.

Four elected associate professors participate in implementing the study program - doctors of sciences, who have been elected as associate professors by the professors' councils of the field of "Mechanical Engineering and Mechanics" or "Energy" and whose scientific and pedagogical qualification complies with the regulatory enactments.

Associate professors elected to the Council of Professors of "Mechanical Engineering and Mechanics": Dr.sc.ing. Artis Kromanis and Dr.sc.ing. Vladislavs Jevstignejevs.

Associate professors elected to the Council of Professors of "Energy": Dr.sc.ing. Sigurds Jaundalders and Dr.sc.ing. Dmitrijs Rusovs.

**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.**

Considering that the study program "Mechanical Engineering and Mechanics" was developed with new content and planning accordingly, the existing teaching staff is considered to be newly created. No changes have been made since the moment of licensing.

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

The most significant publications of the teaching staff involved in the study program are summarized in Appendix.

**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).**

Projects of teaching staff, funding sources, and amounts are summarized in Annex 3.4.4. Teaching staff project_Mācībspēku projekti EN_LV.

**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).**

In total, 18 doctors of sciences participate in implementing the study program, of which 8 are LZP experts. Ten professors - doctors of sciences, who have been elected as professors by the professors' council and whose scientific and pedagogical qualification complies with the criteria specified in the regulatory enactments regarding the evaluation of the scientific and pedagogical qualification of a candidate for the position of a professor, participate in the implementing of the study program. The implementation of the study program involves three elected associate professors - doctors of sciences, who have been elected as associate professors by the professors' council and whose scientific and pedagogical qualification complies with the criteria specified in the regulatory enactments on the evaluation of scientific and pedagogical qualifications of associate professors.

Both joint study courses and participation in collaborative projects and joint publications testify to the cooperation, which can be seen in the lecturers' and in the list of publications.

Currently, the supervisors of the doctoral theses and lecturers of the study courses planned for this study year are involved from the teaching staff.

# 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 | MDC0_diploms_LV_EN.docx | MDC0_diploms_LV_EN.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) | MDC0_CHE_opinion.zip | MDC0_AIP_atzin.zip |
| 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 | MDC0_stud_statist_LV_EN.docx | MDC0_stud_statist_LV_EN.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 | | |
| 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 | MDC0_CoursMapp_8_annex.docx | MDC0_KursKart_8_pielik.docx |
| The curriculum of the study programme (for each type and form of the implementation of the study programme) | MDC0_CurricStPogr_9_annex.docx | MDC0_StudProgrPL_9_pielik.docx |
| Descriptions of the study courses/ modules | RMDC0_DescriptStud_cour.zip | RMDC0_Studkurs_Apr.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.zip | Apliecinājums - LZP eksperti doktora programmā.zip |
| 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 |