



CENTER FOR QUALITY ASSESSMENT IN HIGHER EDUCATION

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**EVALUATION REPORT**

**STUDY FIELD**

**MECHANICAL ENGINEERING**

At Kaunas University of Technology

**Expert panel:**

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## Study Field Data\*

<b>Title of the study programme</b>	<i><b>Mechanical Engineering</b></i>	<i><b>Mechanical Engineering</b></i>
State code	6121EX008	6211EX009
Type of studies	University studies	University studies
Cycle of studies	First	Second
Mode of study and duration (in years)	Full-time (4 years)	Full-time (2 years)
Credit volume	240	120
Qualification degree and (or) professional qualification	Bachelor's Degree in Engineering Sciences	Master's Degree in Engineering Sciences
Language of instruction	Lithuanian, English	Lithuanian, English
Minimum education required	Secondary education	Bachelor's degree or its equivalent
Registration date of the study programme	19-05-1997	19-02-2007

*\* if there are joint / two-fields / interdisciplinary study programmes in the study field, please designate it in the foot-note*

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# I. INTRODUCTION

## 1.1. BACKGROUND OF THE EVALUATION PROCESS

The evaluation of study fields is based on the Methodology of External Evaluation of Study Fields approved by the Director of Centre for Quality Assessment in Higher Education (hereafter – SKVC) 31 December 2019 [Order No. V-149](#).

The evaluation is intended to help higher education institutions to constantly improve their study process and to inform the public about the quality of studies.

The evaluation process consists of the main following stages: 1) *self-evaluation and self-evaluation report prepared by Higher Education Institution (hereafter – HEI)*; 2) *visit of the review team at the higher education institution*; 3) *production of the evaluation report by the review team and its publication*; 4) *follow-up activities*.

On the basis of external evaluation report of the study field SKVC takes a decision to accredit study field either for 7 years or for 3 years. If the field evaluation is negative such study field is not accredited.

The study field is **accredited for 7 years** if all evaluation areas are evaluated as “exceptional” (5 points), “very good” (4 points) or “good” (3 points).

The study field is **accredited for 3 years** if one of the evaluation areas was evaluated as “satisfactory” (2 points).

The study field is **not accredited** if at least one of evaluation areas was evaluated as “unsatisfactory” (1 point).

## 1.2. THE REVIEW TEAM

The review team was completed according the Experts Selection Procedure (hereinafter referred to as the Procedure) approved by the Director of Centre for Quality Assessment in Higher Education on 31 December 2019 [Order No. V-149](#). The Review Visit to HEI was conducted by the team on *November 25, 2020*. Due to the coronavirus pandemic, the Review Visit was organised online using video-conferencing tool (Zoom).

1. **Prof. dr. Oluremi Ayotunde Olatunbosun**, *Honorary Senior Fellow in the Department of Mechanical Engineering at the University of Birmingham, UK.*
2. **Prof. dr. Jasmina Casals-Terré**, *Associate Professor (Accredited as FULL PROFESSOR by AQU), Department of Mechanical Engineering, Universitat Politècnica de Catalunya (UPCBarcelonaTech), Spain.*
3. **Prof. dr. Mikael Enelund**, *Dean of Education, School of MATS (Mechanical, Automation & Mechatronics, Design, Marine and Shipping), Chalmers Tekniska Högskola, Sweden.*
4. **Dr. Vaidas Liesionis** *LT AB Astra general Manager, Lithuania.*
5. **Mr. Marijus Ambrozus**, *graduate of Vilnius university second cycle study programme Theoretical physics and astrophysics, Lithuania.*

### 1.3. GENERAL INFORMATION

The documentation submitted by the HEI follows the outline recommended by the SKVC. Along with the self-evaluation report and annexes, the following additional documents have been provided by the HEI before and during the site-visit:

No.	Name of the document
1.	Photo material about facilities for disabled persons
2.	CV of two members of teaching staff
3.	Quality Assurance Manual approved by Kaunas University of Technology Senate on June 11, 2014 Resolution No V3-S-45

### 1.4. BACKGROUND OF STUDY FIELD/STUDY FIELD PLACE AND SIGNIFICANCE IN HEI

Kaunas University of Technology (*hereafter* – KTU, university) was established in 1920 and is one of the largest technical universities in the Baltic countries. It consists of 9 faculties, 8 research institutes, a library and departments of administration and support. Studies at the university are executed on bachelor's, master's, integrated and doctoral degree study levels. After fulfilling all the requirements of the study programme, the student is awarded a diploma of an equivalent qualification degree (Bachelor's, Master's or Doctor's). The university has currently 8442 students of which 655 are international and 1915 employees of which 1114 are academics. The vision of KTU is to be a leading European University with knowledge and technology development and transfer-based activities.

The first cycle study programme *Mechanical Engineering* (state code – 6121EX008) (*hereafter* – study programme, the first cycle study programme) and the second cycle study programme *Mechanical Engineering* (state code – 6211EX009) (*hereafter* – study programme, the second cycle study programme) in the study field of Mechanical Engineering are carried out at the Faculty of Mechanical Engineering and Design at where the Department of Mechanical Engineering is responsible for the programmes. The study programmes and the study environment are updated continuously according to a continuous development philosophy.

The present evaluation is the third one for the programmes in the study field of Mechanical Engineering. The previous evaluation was carried out in 2015. After the evaluation significant improvements of the programmes have been carried out and all recommendations of the previous evaluation have been implemented carefully according to a continuous development philosophy. The quality of the programmes would benefit from continuing working along the same philosophy.

The self-evaluation report (*hereafter* - SER) for the present evaluation was carried out by a self-evaluation team appointed by the order of the Rector. The self-evaluation group consisted of the four professors, three lectures, one student and one social partner and was headed by the Head of the Study Programmes.

## II. GENERAL ASSESSMENT

*Mechanical Engineering* study field and **first cycle** at Kaunas University of Technology is given **positive** evaluation.

*Study field and cycle assessment in points by evaluation areas.*

<b>No.</b>	<b>Evaluation Area</b>	<b>Evaluation of an area in points*</b>
1.	Study aims, outcomes and content	4
2.	Links between science (art) and study activities	4
3.	Student admission and support	4
4.	Studying, student performance and graduate employment	4
5.	Teaching staff	4
6.	Learning facilities and resources	5
7.	Study quality management and publicity	5
	<b>Total:</b>	<b>30</b>

\*1 (unsatisfactory) - there are essential shortcomings that must be eliminated;

2 (satisfactory) - meets the established minimum requirements, needs improvement;

3 (good) - the field develops systematically, has distinctive features;

4 (very good) - the field is evaluated very well in the national and international context, without any deficiencies;

5 (exceptional) - the field is exceptionally good in the national and international context/environment.

Mechanical Engineering study field and **second cycle** at Kaunas University of Technology is given **positive** evaluation.

*Study field and cycle assessment in points by evaluation areas.*

<b>No.</b>	<b>Evaluation Area</b>	<b>Evaluation of an area in points*</b>
1.	Study aims, outcomes and content	4
2.	Links between science (art) and study activities	4
3.	Student admission and support	4
4.	Studying, student performance and graduate employment	4
5.	Teaching staff	4
6.	Learning facilities and resources	5
7.	Study quality management and publicity	5
	Total:	<b>30</b>

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3 (good) - the field develops systematically, has distinctive features;

4 (very good) - the field is evaluated very well in the national and international context, without any deficiencies;

5 (exceptional) - the field is exceptionally good in the national and international context/environment.

## III. STUDY FIELD ANALYSIS

### 3.1. STUDY AIMS, OUTCOMES AND CONTENT

*Study aims, outcomes and content shall be assessed in accordance with the following indicators:*

*3.1.1. Evaluation of the conformity of the aims and outcomes of the field and cycle study programmes to the needs of the society and/or the labour market (not applicable to HEIs operating in exile conditions).*

*(1) Factual situation*

The aims and learning outcomes of the first and second cycle study programmes in Mechanical Engineering (hereafter – ME) study fields are complete in the sense that they address scientific, and practical as well as professional engineering knowledge, skills and attitudes demanded by the industry in Lithuania as well as in the EU. The ME department works closely with global and local strategic industry partners such as Festo, Hi-Steel, Mars Lietuva, Baltec CNC Technologies. Education is generally on the agenda in meetings with partners. The employability of the graduates is evidenced to be very high. Interviews with employers and alumni verify this. The employers are very satisfied with the graduates from the ME programmes at KTU and highlight their professional skills as lying in the forefront compared to graduates from other ME programmes in Lithuania. The employers also expressed the needs of substantially more graduates from the KTU ME study field programmes. This is also confirmed by several Lithuanian investigations, reports and documents referred to in the SER. There is a huge demand for ME engineers in Lithuania and specifically in the Kaunas area. As stated in the SER, Mechanical engineering is one of the largest sectors in the EU and the sector is expected to grow with 3.8% annually over the next 10 years and the need for graduates from ME study programmes is forecasted to grow by 3 to 6 % in the next five years.

*(2) Expert judgement/indicator analysis*

The content and level of aims and learning outcomes of the first and second cycle study programmes are relevant for the labour market of mechanical engineering in Lithuanian as well as in international contexts. The expected learning after the first cycle is relevant and enough for a direct transfer to a position as a mechanical engineer equipped to use existing techniques, tools and processes to solve ME problems in an innovative manner. The learning after the second cycle is relevant for a direct transfer to doctoral studies or a position as mechanical engineer equipped to develop new technology and use technology in such a way that enables new forms of innovations. The fact that the aims and learning outcomes of the ME programmes are in line with the needs of the industry and society is supported by recognition by The Investors' Spotlight quality label and by membership in ECIU (European Consortium of Innovative Universities). To conclude, ME study programmes at KTU prepare their graduates very well to meet the demand of ME engineers in Lithuania and for international careers as ME engineers.

### *3.1.2. Evaluation of the conformity of the field and cycle study programme aims and outcomes with the mission, objectives of activities and strategy of the HEI.*

#### *(1) Factual situation*

The aim of the first cycle study ME programme is: “To provide fundamental knowledge in Mechanical Engineering, to develop abilities and skills necessary for developing mechanical products and their components, for controlling and operating engineering equipment and technological engineering systems, identifying and solving technical mechanical problems in integrated engineering systems”. While the aim of the second cycle is: “To develop the abilities to solve the problems of mechanical engineering in the context of sustainable development, to apply innovations and research results of the field of mechanical engineering for the development of integrated engineering systems”. Although the aim of the first cycle programme is not expressing sustainable development explicitly they are in line with the KTU mission: “To provide research-based studies of international level; to create and transfer knowledge and innovative technologies for sustainable development and innovative growth of the country; to provide an open creative environment that inspires leaders and talented individuals”. Sustainable development is addressed in the programme level learning outcomes of both study cycles’ programmes.

The learning outcomes are in line with national standards as well as the European Accredited Engineer (EUR-ACE) requirements for first and second cycles engineering degrees, respectively, and thus in line with international standards.

#### *(2) Expert judgement/indicator analysis*

The aims and learning outcomes comply with the mission of KTU. However, this could be further clarified by explicitly addressing sustainable development in the aim of the first cycle study programme.

### *3.1.3. Evaluation of the compliance of the field and cycle study programme with legal requirements.*

#### *(1) Factual situation*

The first cycle study programme is a four years programme of 240 credits (ECTS) (8 semesters with 30 credits each). Credits allocated to the study field specific expected learning are 126 (math, physics science and practical work are not included). Practise is 15 credits if choosing the study path (track) with specializations or alternatively 30 or 60 credits if choosing the study path of extended practise. The final degree project allocates 18 credits. The lay-out is consistent with legal requirements. The second cycle programme is a two years programme of 120 credits (ECTS) (4 semesters with 30 credits each). 72 credits are allocated for deeper learning in the study field and 30 credits are allocated for the final degree thesis while the remaining 18 credits are electives that may be used for deeper learning in the study field or in neighbouring fields. The lay-out is consistent with legal requirements.

The planned student workload for a semester is 800 hours. The contact hours for each subject are at least 40% at both cycles. Over 90% of the teachers at both cycles hold a scientific doctoral degree and are active in research. The structure and qualifications of teachers meet the legal requirements of Lithuania.

(2) *Expert judgement/indicator analysis*

The study programmes meet the general legal requirements of first (hereafter – BSc) and second (hereafter – MSc) level programmes in Lithuania.

3.1.4. *Evaluation of compatibility of aims, learning outcomes, teaching/learning and assessment methods of the field and cycle study programmes.*

(1) *Factual situation*

The aims of the study programmes describe in a concise way what the students should achieve by following the study programmes.

The programme learning outcomes are divided into six different categories and are in line with EUR-ACE standards. The programme level learning outcomes are well formulated and describe very well the knowledge, skills and attitudes the students are expected to possess upon graduation. The learning outcomes are formulated in a manner that enables to determine whether the student has achieved the learning or not. The programme learning outcomes are the guiding principle and a tool in the design of the curriculum and subjects. The distribution of the programme learning outcomes to the different subjects are carried out systematically and illustrated by design matrices in Annexes 5 and 6 of the SER. During the evaluation team's virtual visit it was made clear that the teachers are familiar with the programme level learning outcomes and take the responsibility to teach and assess them where appropriate as indicated by the design matrices.

All courses have learning outcomes with designated learning activities and assessment methods in accordance with the principle of constructive alignment. Complete subject descriptions including aim, learning outcomes, content, evaluation methods, etc. are easily accessible through the KTU web. The subjects have a variety of teaching activities ranging from lectures, exercises, laboratory work, problem-based learning to teamwork, case studies, discussions, role play and reflective learning, etc. The assessment (evaluation) methods are well balanced and include both traditional methods such as written exam and assignments and more unorthodox methods such as discussions, reflections, and mind mapping. The final grade for a subject is typically built-up of assessed achievements during the course and a final assessment.

The subjects' learning outcomes are generally well written and in line with the learning outcome approach with sufficiently detailed outcomes that can be assessed during an evaluation process. But the opposite also exists in subjects of both study programmes (first and second cycle). Active verbs are not used in the formulations of several learning outcomes which make it difficult to assess whether the student has achieved the expected learning or not. It is strongly recommended to avoid formulations like being able to understand, have abilities, being aware of, understanding of, etc. For example, in the first cycle subject "Introduction to Mechanical Engineering" there is a learning outcome expressed as "Is aware about typical problems practically solved in the field of mechanical engineering, knows the set of competencies necessary for the activities of mechanical engineer" which is, e.g., better expressed as "Can describe typical problems solved in the field of mechanical engineering and list the set of competencies....". An example from the second cycle programme is from the subject "Applied Fluid Dynamics" with the learning outcome "Is able to define and understand the principles of fluid dynamics and the equations of continuity, momentum and energy conservation" which, e.g., may be formulated as "Is able to define and explain the principles of fluid dynamics and apply the equations of continuity, momentum and energy conservation".

There is an annual process to review and refine the programme learning outcomes led by the Study programme committee with representatives from faculty, students and industry partners. In the same process all learning outcomes of the subjects of the programmes are reviewed and refined according to a continuous improvement philosophy.

*(2) Expert judgement/indicator analysis*

The aim of the first cycle programme is too narrow in that it claims that the programme aims to prepare for continued studies in technology. Most graduates go directly to work as ME engineers in the industry. In fact, the outcomes of the programme and its subjects very well prepare the graduates to practise engineering.

The programme learning outcomes are formulated equally with international best practices. The level and content are relevant for international best level ME programmes. From the evaluation team's interviews with employers and alumni it is evident that the expected learning described in the learning outcomes is relevant and enough for national and international careers as engineers and for transfer to MSc and doctoral studies nationally as well as internationally.

However, there is ample room to improve the formulation of subjects' learning outcomes. The quality assurance process with its continuous improvement philosophy provides very good conditions to achieve this provided that the teachers receive support in the process. The didactic unit *Edu\_Lab* has proven to be able to give support in the learning outcomes approach.

Learning outcomes, teaching activities and assessment are constructively aligned. The variation of teaching and assessment methods is well balanced to ensure learning and evaluation of the broad variation in the expected learning in progressive engineering educations. Furthermore, it provides good conditions for students with different learning styles and preferences to achieve the expected learning and qualifications.

*3.1.5. Evaluation of the totality of the field and cycle study programme subjects/modules, which ensures consistent development of competences of students.*

*(1) Factual situation*

The first cycle study programme has all traditional ME subjects but also more recent ME subjects such as Information technology and Sustainable development and training of professional engineering skills such as communication, project management and teamwork. The order of subjects is logical starting with Math, Physics and IT but also an Introduction to mechanical engineering which gives a view on the applications as well as the field of ME and thus motivates students to study. Later in the programme, after the fifth semester the core of ME field has been taught and the students are prepared to choose a specialization (Biomechanics, Mechanical Systems Design or Robotics Engineering) or extended the study path Technological practise. The specializations are structured to enable students' knowledge and skills to be developed in a gradual manner and prepare for the Final Degree Project. Professional practise and Product development project prepare students for professional careers as ME engineers.

The second cycle study programme consists of in-depth compulsory and elective subjects in the core of mechanical engineering but also recent extensions such as Renewable energy, Microelectromechanical systems, Mechatronics and Control and optional competences such as Business, IT, Data science and Modern languages. Moreover, the students get a mandatory introduction to scientific research and work in research projects to develop research skills. The last semester consists of the final degree project in which the students apply their

theoretical and practical skills together with research skills to solve complex problems of ME by using knowledge and skills acquired in the programme so far.

*(2) Expert judgement/indicator analysis*

The first cycle study programme has relevant level and content. The structure is logical, and subjects are up to date. There is a good balance of fundamentals, applications and broadening electives. The specializations are in line with the ambitions of KTU and relevant for the labour market. General professional engineering skills are integrated to a level which ensures that graduates are well prepared for work as an ME engineer. Further, the theoretical and practical depths are enough for a direct transfer to MSc studies.

The second cycle study programme has relevant level and content. The subjects are up-to-date and closely tied to recent research finding and/or industrial practise. Thus, the programme provides excellent conditions for a direct transfer to doctoral studies or a career as a professional engineer able to solve advanced engineering problems in ME as well as neighbouring fields such as aerospace, mechatronics and manufacturing.

*3.1.6. Evaluation of opportunities for students to personalise the structure of field study programmes according to their personal learning objectives and intended learning outcomes.*

*(1) Factual situation*

The first cycle study programme offers three 60 credits specializations and a general practical oriented study path. Students can also personalize their studies in their choices of electives within Philosophy, Sustainable development and Modern language. In the 8<sup>th</sup> semester the students can choose between a 12 credits Product development project or taking the subjects Product aesthetics (6 credits) and Semester project (6 credits) in parallel with the Final degree project (18 credits). Students have good opportunities to choose the topic for the Final degree project based on their interest. In addition students can individualize their education by taking bridging courses in the first year to prepare them better for their studies, use 6<sup>th</sup> or 7<sup>th</sup> semesters for international exchange studies or participate in the Talented academy (6 credits).

The second cycle study programme consists of mandatory subjects of 48 credits and the Final degree project of 30 credits together with 42 credits elective. 24 credits (subjects) of the electives are assigned to specialization in the ME field. In this category, students are offered 14 different subjects closely connected to different recent findings within ME research and industrial practise. The remaining 18 credits the students can use to develop expert competences within ME or to broaden their competences within the Master+ path including, e.g., data science, Artificial Intelligence, business, media and language. The Master+ model offers either a masterpiece in the chosen discipline by choosing the Field Expert track or to strengthen the interdisciplinary skills in addition to the main discipline by choosing the Interdisciplinary Expert track with a choice of a different competence to compliment the chosen discipline.

Furthermore, the students are offered a wide variety of topics for the Final degree project and they also have the possibility to propose topics themselves.

*(2) Expert judgement/indicator analysis*

The students in the first cycle study programme have excellent possibilities to personalize their studies and to obtain specialist knowledge in a field or to practise engineering. The opportunities for students to broaden their horizons by choosing electives within philosophy

and sustainable development or go on international exchange courses are well planned and integrated in a very good way.

The students in the second cycle have excellent conditions to personalize their education, there is ample room to compose subjects to become an expert within the field of ME but also broaden knowledge and competences in emerging technologies such as data science and embedded systems which are very relevant for the field of ME. In addition, the students have excellent opportunities to develop professional skills and research methodology skills as well as practising engineering and research.

### *3.1.7. Evaluation of compliance of final theses with the field and cycle requirements.*

#### *(1) Factual situation*

There is a process of suggesting topics for Final degree projects at both study cycles, in this process topics can be suggested by teacher, social partners, and students. The topics are approved by the head of programmes. The Final degree projects have learning outcomes and evaluation procedures adapted to the learning outcomes. The programmes prepare the students for the final degree project by enough theoretical content but also by integrating research methodology and training in handling problems with open solution spaces and uncertainties.

The topics for the first cycle Final degree projects are relevant for the ME field and relevant for the industry. The Final degree projects are valued highly by the industry partners in discussions with the evaluation team.

The topics for the second cycle Final degree projects are research oriented or advanced engineering in the ME field. The scientific ambition of the second level Final degree project is high, and the students are prepared by preceding subjects in Basic scientific research and Research projects.

#### *(2) Expert judgement/indicator analysis*

The learning outcomes and evaluation procedures of the Final degree projects indicate best practise. The students are also properly prepared by the preceding subjects in the study programmes including appropriate theoretical and practical knowledge as well as knowledge in scientific methodology and training in mastering problems with open solutions spaces and uncertainties.

Although very few first cycle Final degree projects were available in English, the evaluation team found them to be relevant for ME field and of sufficient quality, but the scientific contents were a little less than expected and instead focusing on engineering design, manufacturing and production.

The topics of the second cycle Final degree projects are relevant in level and scope for an MSc in the field of ME. There are examples of topics that are demonstrably closely linked to current research at KTU and topics that include the solution of recent advanced industrial problems. The evaluation team only got access to rather few reports in English. Judging by these, the Final degree projects are of high quality and the students master the scientific and engineering as well as the methodology aspects of the problem-solving chain. However, their quality should benefit by more careful proofreading. For example, in the thesis entitled "Investigation of thin carbon and glass fibre plates impact characteristics" the Poisson's ratio for PMMA is calculated to 0,54 from measurements (p. 24 and 26). Fundamental theories of linear elasticity states that Poisson's rate cannot exceed 0,5 and in literature values are typically reported in the range between 0.35 to 0.4.

### **Recommendations for this evaluation area:**

- 1. The programme level learning outcomes are found to be well formulated and relevant for the BSc and MSc degrees in Mechanical engineering, respectively. The expected learning matches very well the demands from industry in Lithuania as well as within the EU. The study programmes are well structured and up-to-date and of high international standard. The subjects are relevant for progressive ME study programmes. However, not all subjects have learning outcomes formulated according to the learning outcomes and constructive alignment approaches. There is a robust annual process in place to review and reform the learning outcomes and to train teaching staff which has led to remarkable major developments in a short time. The evaluation team recommends that this work is continued and intensified with the goal that all subjects should have learning outcomes expressing what the students can achieve after successfully passing the subject. The learning outcomes should be formulated with active verbs, using a taxonomy, that make them possible to assess whether the students have reached them in an external evaluation process.*
- 2. Final degree projects are in general relevant and of satisfactory quality level. To better prepare the students for the global market of engineering and research it is recommended to promote writing the final theses in English (in particular on master's level).*

## **3.2. LINKS BETWEEN SCIENCE (ART) AND STUDY ACTIVITIES**

***Links between science (art) and study activities shall be assessed in accordance with the following indicators:***

### ***3.2.1. Evaluation of the sufficiency of the science (applied science, art) activities implemented by the HEI for the field of research (art) related to the field of study.***

#### ***(1) Factual situation***

Almost all teachers in the ME study fields (first and second cycles) hold doctoral degrees and are active in research and innovation activities.

Table 2.3 p. 25 of the SER presents the number of research projects at the Faculty of Mechanical Engineering and Design (hereafter – MIDF). The number of research projects is steadily growing, in 2019 it was a total of 24 including 13 international. Section 2.1 pages 25 and 26 lists many international (more than 30) and national partner (about 10) universities and research institutes. Moreover, MDIF has active cooperation in Research & Development with over 30 companies including both Lithuanian and global ones.

The number of PhD students within the ME study field is growing steadily, in 2019 it was 16 including 6 international.

The number of publications of teachers of ME first and second cycle study fields in scientific international journals with citation index is steadily growing. In 2019 faculty (active in first and second cycles) of MIDF published 24 papers of which 12 in journals with high impact factors (Q1-Q2 quartile journals). The share of publications in high impact journals has increased from 29% in 2017 to 63% in 2019. The number of publications and presentations at scientific conferences is also growing to, in 2019, a total of 39 of which 28 were international. It is noteworthy that students participated in 12 of these. This includes first and second cycle students.

Teachers of the first and second cycles study field in ME are members of several high reputation international research organizations and societies, as, e.g., SPIE-The international

society for optics and photonics, IASED - International Academy of Science and Engineering for Develop. Furthermore, they act as reviewers for several international scientific journals.

The level of Research and Development activities related to the Study field of ME during the period of 2013-2017 was evaluated by Research and Higher Education Monitoring and Analysis Centre (MOSTA) using three criteria research quality, economic and social impact and development potential. The quality was assessed to be very good for Materials Engineering and Mechanical Engineering and good for Energetics & Power Engineering. The economic and social impact was assessed good for all the fields while the development potential was assessed satisfactory and good.

The MDIF's incomes from research projects and R&D activities have been growing significantly the last three years, from EUR 153k to EUR 334k.

In the SER it is evidenced that the amount and quality of research are of very high quality in Mechanical Engineering and Materials Engineering and of high quality within Energetics and Power Engineering. Teachers of the ME first and cycle study fields are involved in internationally strong research projects and a relatively high number of international and national industry related research projects. Students in the second cycle are actively involved in the research through the Research projects and in the Final degree projects.

#### *(2) Expert judgement/indicator analysis*

The teachers in the first and second cycles ME study fields are active in research directly related to the content of the study programmes. The research projects range from international in-depth scientific oriented to more applied research with stakeholders in the Lithuanian industry. Considering the size of the faculty the number of PhD students and awarded PhD degrees are rather low. There is a culture of publishing research internationally and there are examples of publications in scientific journals with high impact factors. However, 48 international publications over a period of three years are not enough in relation to a teaching staff of about 150. However, it is noted that the number of publications in scientific journals with a high impact factor is increasing which indicates that the institute is focusing on quality rather than quantity. In addition, the evaluation team finds that the strategy and the plan for research activities related to the ME study field is successful in that the activities are increasing both in volume and quality while being financially viable as well as inclusive from a student perspective.

#### *3.2.2. Evaluation of the link between the content of studies and the latest developments in science, art and technology.*

##### *(1) Factual situation*

The subjects within the study programmes are anchored in research and/or best practise. The specializations in the first cycle programmes are within areas that the department has research activities. Moreover, first level students are introduced to research and development through individual projects, semester projects.

In the second cycle study programme research is an integrated part of the programme plan. Students learn research methodology in Basics of Scientific Research. In Research Projects 1 and 2, students apply the methodology together with theoretical knowledge to plan, conduct and present research. The ME subjects are on an advanced level and taught by teachers that are active in research in the specific subject.

In the Final degree project students solve complex problems in ME by applying theoretical and practical knowledge and skills together with skills of scientific research. The research

problems and degree topics are either taken from research projects or from partners in the industry.

*(2) Expert judgement/indicator analysis*

Specializations of the first cycle study programme are related to areas in which the department has research and some of the subjects include recent developments. In the second cycle study programme research is integrated into the programme plan by specific subjects on research methodology but there are also examples of disciplinary subjects having learning outcomes that are achieved by carrying out research, e.g., in Microelectromechanical Systems Design. To conclude, the links between the content of the programmes and recent developments are obvious and especially strong in the second cycle study programme.

*3.2.3. Evaluation of conditions for students to get involved in scientific (applied science, art) activities consistent with their study cycle.*

*(1) Factual situation*

First cycle students can get involved in research and development activities through individual task projects, semester projects and Final degree projects. The Final degree project task originates either from research at KTU or from industrial partners. Teachers invite students to take part in research and provide methodology support and advice on how to solve the problems.

Research is an integrated part in the second level programme. All students take part in research through Research projects 1 and 2. In the Final degree project they use research methodology to independently solve an advanced ME problem either related to recent research at KTU or to advanced problems in the industry.

*(2) Expert judgement/indicator analysis*

It is encouraging to observe the level of student participation in research including the possibilities for students to participate in scientific conferences. Involving first cycle students in research is admirable and demonstrates that the students have developed deep and active technical knowledge as well as their ability to actively contribute to research. Also, the systematic and conscious approach in the second level programme to integrate research and involve students into research is admirable.

The second cycle Final degree projects reports available in English for the evaluation team indicate that the students can solve advanced research and industrial problems in the ME field. However, the available first cycle Final degree projects are mostly dealing with design projects and the relation to science can be questioned if compared to international BSc degree projects. On the other hand, they are relevant and valuable training for students preparing for a direct transfer to a position as an ME engineer.

***Recommendations for this evaluation area:***

- 1. Consider having some First cycle degree projects that are more oriented towards research for students that are planning to continue with MSc studies or are interested in research.*
- 2. Encourage and support faculty to publish internationally in scientific journals with high impact factors.*

### **3.3. STUDENT ADMISSION AND SUPPORT**

***Student admission and support shall be evaluated according to the following indicators:***

### *3.3.1. Evaluation of the suitability and publicity of student selection and admission criteria and process.*

#### *(1) Factual situation*

The admission procedure is described in KTU websites in both Lithuanian and English. It is straightforward for international students to find the information (<https://admissions.ktu.edu/degree-students/#application>).

Admission of Lithuanian citizens to the first cycle state-funded and non-state-funded places is carried out through centralised admission and institutional admission. EU citizens have an opportunity to apply for the state funded place. Central admission concerns admission to state funded places is carried out by Association of Lithuanian Higher Education Institutions (LAMA BPO). Institutional admission only admits students to non-state founded places. Institutional admission handles applications to non-state funded places. International students are admitted to non-state funded places through the institutional admission procedure.

Lithuanian applicants compete with a competition score with a threshold. Applicants to the first cycle programme need at least 12 years of secondary education while applicants to the second level need a BSc in Mechanical engineering or in relevant neighbouring fields.

International applicants to the first cycle need to have a senior high school diploma with good average grade (min 60% CGPA) and good grades (min 60% CGPA) in mathematics and physics and demonstrated proficiency in English. International applicants to the second cycle need to have a BSc in Mechanical Engineering with a good average grade and demonstrated proficiency in English. International students are only admitted for full time studies to the programmes taught in English.

During the last three years, there is a stable number of students admitted to the first cycle programme. In 2019, 70 students were admitted (including 18 international). The number of students admitted to the second cycle programme is lower. In 2019, 17 students were admitted including 8 international students.

The statistics in the SER give no information of gender on applicants, admitted and enrolled students. In discussions with management, teaching staff and students the evaluation team learnt that the number (and proportion) of female students are very low. It was also obvious that to achieve a more gender balanced student body was not on the agenda.

#### *(2) Expert judgement/indicator analysis*

The websites give good information about the admission procedure. The webpages for international applicants are easily accessible and very informative. The admission procedures are transparent and well-founded. The number of students on the first cycle is good. During the last three years the number of students entering the second cycle programme has varied between 10 and 25 (including international students). Such a number of students does not guarantee financial sustainability.

To increase the number of students but also to create a more gender-equal education, it is suggested to give more effort towards recruiting female students.

### *3.3.2. Evaluation of the procedure of recognition of foreign qualifications, partial studies and prior non-formal and informal learning and its application.*

#### *(1) Factual situation*

The subjects and learning outcomes achieved at other higher education institutions and via non-formal education can be recognized and included in the study programmes following KTU Guidelines listed in the SER. The guidelines state that a maximum of 75% of the credits in the study programme can be achieved by recognizing credits from another higher education institution. A maximum of 50% of the scope of a study programme can be achieved through non-formal education including work activities, non-formal adult education, independent learning, etc. Recognized modules (semesters) are listed in the SER demonstrating that the procedure is put in practise.

#### *(2) Expert judgement/indicator analysis*

The procedure for recognition of foreign qualifications, partial studies and prior non-formal and informal learning is fair and is demonstrated to be practiced as intended.

### *3.3.3. Evaluation of conditions for ensuring academic mobility of students.*

#### *(1) Factual situation*

The Faculty of Mechanical Engineering and Design has 86 Erasmus+ agreements. KTU is a member in European Consortium of Innovative Universities (ECIU) in which a group of universities including KTU each offers fully recognised study packages of 30 credits (ECTS) for exchange students in first and second cycles of Mechanical Engineering. Each partner university can send four students per academic year. In the first cycle study programme, 6<sup>th</sup> or 7<sup>th</sup> semester can be used for the exchange. In the second cycle such study packages are recognized as mandatory or electives of core subjects. The students can also complete the exchange studies of one to two semesters or summer/winter programmes abroad under bilateral cooperation and student exchange agreements signed between KTU and the university partners. Students going on exchanges can apply for scholarships to cover increased living costs. However, the number of students going on international exchanges and internships is low and in recent years very low, in 2018/19 only 1 (1<sup>st</sup> cycle) + 3 (2<sup>nd</sup> cycle) and in 2019/20 only 2+2 students have gone on international exchange.

The internship under Erasmus+ is available at the companies, training and research centres, etc. at all the countries participating in Erasmus+. The internships can be recognized as part of extended practise or in one of the modules Technological Practise or Product Development Practise in the first cycle programme.

#### *(2) Expert judgement/indicator analysis*

The department and the study programmes create very good conditions for international exchange studies and internships. This includes recognition, support and promotion. Despite very good conditions very few Lithuanian students go abroad for exchanges and internships. The common explanation for the low numbers is that Lithuanian students are employed in companies to work in parallel with their studies and unwilling to leave for a longer period. Regarding incoming students, the numbers are much more favourable particularly in the first cycle. The reason for this is the strategic decision to offer both level study programmes in English. It is admirable to deliver the whole first cycle programme in English. Most common practise in Europe is to deliver first cycle programmes in national language and offer specific courses and specific semesters in English to enable student exchanges.

### *3.3.4. Assessment of the suitability, adequacy and effectiveness of the academic, financial, social, psychological and personal support provided to the students of the field.*

#### *(1) Factual situation*

The university has a broad and comprehensive support programme for students. This includes necessities such as study guidance, help in difficult social situations, help for students with special needs and career counselling. In addition, there are also preparatory courses in mathematics and physics, mentorship programmes, support for students to participate in international projects and research, etc. Furthermore, there is a well-functioning web-based system for students to book time for consultation with teachers. It is easy to find the necessary information on the university's web pages, including the English pages.

#### *(2) Expert judgement/indicator analysis*

The university ensures an adequate level of academic, financial, personal, psychological and social support. This was clearly confirmed by the interviewed students who also highlighted that the teachers were very helpful and responsive. In particular, at the second cycle, there is an almost collegial relationship between students and teachers that is very beneficial for students' learning. During the evaluation team's meeting with the teachers, this picture was confirmed, without exception, all teachers spoke very well about the students and the collaboration.

The mentorship programme including possibilities to choose a mentor in each stage of the education, including peer mentor, academic mentor, career mentor and research mentor, is an admirable and ambitious initiative that creates very good conditions for well-being and engagement in the studies.

### *3.3.5. Evaluation of the sufficiency of study information and student counselling.*

#### *(1) Factual situation*

The university web provides clear information to prospective and admitted students about the necessary and recommended preparation, the studies and the university. Information is also provided by e-mail. One week before the start of studies, students have a welcome week where they are introduced to studies, study and university processes, possibilities to go on exchanges abroad, facilities, student association and student life. The first cycle study programme begins with an introductory module in which students are introduced to the study programme, the discipline of Mechanical Engineering, the professional role, etc. Subjects generally start with an introduction of the subject and an illustration how the subject fits into the study programme. All subjects have complete descriptions with purpose, learning objectives, content, evaluation criteria, literature and teachers. The subjects' descriptions are easily accessible in the KTU web and in the study portal Moodle.

It is straightforward for students to book consulting sessions (face-to-face and online) with teachers. Study Information and Service Centre is staffed and open for drop-in and booked meetings. The centre handles matters concerning issues of the organisation of studies, tuition fees and support. Head of study programmes in the field of ME provides consultations on issues regarding individual study planning, the selection of the final degree project topic or enterprise for internships, recognition of learning outcomes and competences.

Student interests are represented on university level by KTU Students' Association and on local level by Faculty of Mechanical Engineering and Design Students' Association. The Student associations are represented in the Senate and in all boards dealing with students

matters. Student associations provide guidance and support to their members regarding study matters and student life.

*(2) Expert judgement/indicator analysis*

The university together with the Faculty of Mechanical Engineering and Design and the students' associations provide a sufficient level of study information and student counselling. Teachers and advisory staff are easily accessible and there is clear information about where students should be able to get answers to various questions and concerns, etc. The web pages are informative and easily accessible and very good sources of information for prospective students as well as enrolled students.

***Recommendations for this evaluation area:***

- 1. Put recruitment of female students on the agenda by, e.g., do targeted recruitment activities, set role models and show that there are good career opportunities that are not associated with gender. Take help from the industry and the good collaboration that exists with social partners in this. Make all student statistics gender-disaggregated, including recruitment, student results and student satisfaction. Identify if there are any barriers for female students, this includes the culture and jargon of teachers and students.*
- 2. Continue to develop and extend the international learning environment. Consider teaching some subjects only in English and consider teaching the second level study programme only and entirely in English. Intensify efforts including creating incentives to get first level students to go on exchange and internships abroad.*

### **3.4. STUDYING, STUDENT PERFORMANCE AND GRADUATE EMPLOYMENT**

***Studying, student performance and graduate employment shall be evaluated according to the following indicators:***

***3.4.1. Evaluation of the teaching and learning process that enables to take into account the needs of the students and enable them to achieve the intended learning outcomes.***

*(1) Factual situation*

The study process including purpose, learning objectives, teaching methods and activities, level, content and assessment are chosen based on current best practices and traditions. The unit for didactics provides support and recommendations regarding subject structure, learning outcomes, teaching activities and assessments, etc. Students are exposed to a wide variety of teaching and learning methods as well as assessment methods. To stimulate the active involvement and creativity of students, different methods of active learning are applied, as, e.g., project activities (preparation and visualization of projects), design thinking, work in teams, study visits, discussions, problem-solving sessions, laboratory sessions, activity reflections and role play.

Graduates from first and second cycles have opportunities to continue their studies at higher levels, graduates from first cycle to second level and graduate from second cycle to doctoral studies. Students are admitted to the next level on a competitive basis. In the evaluation team's interview with students these possibilities were evidenced.

*(2) Expert judgement/indicator analysis*

Subjects are designed according to the scientifically and practically based pedagogical principle of Constructive alignment linking learning outcomes, teaching activities and assessment. Teaching and learning activities are chosen to promote active learning. The wide

variety of teaching methods and examination gives students good conditions to achieve the different learning objectives. In addition, it provides good conditions for students with different learning styles to complete their studies and develop.

During the evaluation team's discussions with the teachers it was evident that the didactic unit has had impact. All teachers reported that they have had training at the unit and that it had been valuable for their teaching. The award for excellence in teaching has created encouragement and attention for good efforts in education.

The content, level, and outcomes of the first and second cycles study programmes are enough and relevant for a direct transfer to studies at next level at KTU as well as internationally.

### *3.4.2. Evaluation of conditions ensuring access to study for socially vulnerable groups and students with special needs.*

#### *(1) Factual situation*

It is stated in the SER that "individual differences of all employees and students, their potential and contribution are recognised and valued are ensured". Support to students with special needs is provided by KTU Student Information and Service Centre. A social welfare coordinator at the Department of Student Affairs provides consultations regarding scholarships, financial support and assistance. The Department of Student Affairs in cooperation with the Students' Associations provide activities related to the education of the community and fostering of the culture of equal opportunities: training for the administration and teachers on working with disabled students, ethics and adaptation of study processes.

Most buildings and other facilities are accessible for all students with special mobility needs.

#### *(2) Expert judgement/indicator analysis*

The conditions ensuring access to study for socially vulnerable groups and students with special needs appear to be fine. However, accessibility for students with special needs regarding mobility to large Amphitheatre auditoriums need to be improved. The management has this on the agenda, but quick action needs to be taken to resolve this issue.

### *3.4.3. Evaluation of the systematic nature of the monitoring of student study progress and feedback to students to promote self-assessment and subsequent planning of study progress.*

#### *(1) Factual situation*

There are several processes in place for monitoring students' progress in their studies and to provide feedback to students. Once a year the rector receives a report including indicators of progresses such as examinations, terminations, results, student satisfaction, evaluation of effectiveness of measures for quality, attendance, and other information relevant to monitoring of quality and progresses. There is an early-warning system in place to identify and support students with poor results, poor attendance and/or low activity in their studies.

The Study programme committee analyses student performance and quality of study programmes and subjects as well as feedback from students in surveys to define actions for improvement. Several recent actions are listed in the SER.

#### *(2) Expert judgement/indicator analysis*

There are good processes in place for monitoring the students' progresses in their learning as well as their participation in teaching activities. Students receive valuable feedback on results

and achievements but also, where applicable, identified areas that require improvement and actions.

From the interviews the evaluation team learnt that in addition to the formal processes for monitoring and giving and receiving feedback, there are several informal channels for feedback to teachers and students that enhance quality.

#### *3.4.4. Evaluation of the feedback provided to students in the course of the studies to promote self-assessment and subsequent planning of study progress.*

##### *(1) Factual situation*

As mentioned in the SER: “The students are provided with comments on their study achievements, regular or specific errors, the reasons of errors are explained, and ways to eliminate them are generally suggested”. Moreover, from the evaluation team’s discussion with students and teachers it is evident that teachers give prompt feedback to students on reports, assignments and tests.

Students also get regular feedback on how their semester feedback on subjects and the study programme are taken care of and how it has affected development work. The SER presents changes of the programme due to results of student feedback. The student representatives in the Study programme committee reports back on student-initiated developments to the student bodies of both study programmes.

##### *(2) Expert judgement/indicator analysis*

The processes in which students receive feedback on their study result are well thought out and used effectively. Students receive prompt feedback on their achievements which is very positive from a learning perspective. The students' opinions on subjects and their education as a whole are well taken care of and the students receive feedback on how their feedback has affected study programmes as well as specific subjects.

#### *3.4.5. Evaluation of employability of graduates and graduate career tracking in the study field.*

##### *(1) Factual situation*

Data for monitoring the career of graduates are collected in different ways. Official statistical data on graduates employed in Lithuania are provided by the Government Strategic Analysis Centre. Data is also collected through alumni surveys, contacts and social media such as LinkedIn. About 75% of the graduates from the first cycle find a relevant position in Lithuania during their education or immediately after their graduation. The share of recent graduated from the second cycle study programme that found a relevant position in Lithuania during their or immediately after their studies is 95%. About 30% of the graduates from the first cycle study programme continue their studies in second cycle study programmes at KTU or at other universities. There is no official Lithuanian data on graduates from the KTU ME study field programmes that are employed outside Lithuania. Official data is also missing for graduates that are citizens of foreign countries.

Information on the opinion of employers regarding the professional preparation of graduates and acquired competencies after graduation is collected from social partners and different organisations as well as in direct contact with alumni. Alumni and social partners in the discussion with the evaluation team emphasized that graduates are well prepared for positions in the Lithuanian industry. Graduates studying second level programmes outside Lithuania reported that in specific subjects they lacked some theoretical knowledge but that the practical knowledge offset this as, e.g., in the finite element method.

*(2) Expert judgement/indicator analysis*

The competence, skills and attitudes of graduates from both study programmes correspond to the expectations of the labour market in Lithuania and in the EU. The close and mutually beneficial relations with the Lithuanian industry are admirable. Both parties are responsive and can act on wishes, which means that the graduates are well prepared for positions in the industry and quickly find relevant positions. The employability of the graduates is evidenced to be very high.

As pointed out in the SER there is no systematic process to track and get feedback from alumni working outside Lithuania. It is therefore recommended to build up such a process.

*3.4.6. Evaluation of the implementation of policies to ensure academic integrity, tolerance and non-discrimination.*

*(1) Factual situation*

The Board of Academic Ethics ensures compliance with the Code of Academic Ethics. Any member of the University's community has a right to submit a report on the fact of academic violation to the Board of Academic Ethics who investigates. Students sign a learning agreement and declaration of integrity. The university has strict rules regarding written examinations as well as laboratory work, reports, assignments, etc. to ensure that the students' achievements are carried out independently without unauthorized aids. Courses for training on the topics of copyrights, plagiarism prevention, citation of the sources, preparation of the list of references, etc. are organised by the Library on a regular basis. The Guidelines for the Detection of Plagiarism in the Students' Written Works regulate the procedures for the co-occurrence inspection and plagiarism detection.

The University assures tolerance and non-discrimination by implementing the Equal Opportunities and Diversity Policy. All employees and students can submit complaints regarding harassments, discrimination, and violation of equal opportunities. The complaints are investigated, analysed and the decisions are taken by the University's Equality Committee.

In the last three years, two students of the ME study field have been penalized with reprimands for academic dishonesty.

*(2) Expert judgement/indicator analysis*

Policies to ensure academic integrity, tolerance and non-discrimination are in place and are well formulated. Special care is taken at the Faculty of Mechanical Engineering and Design to emphasize the principles of impartiality, objectivity, no initial prejudices and tolerance in the teaching of international students which is honourable and necessary to create a good international study environment.

*3.4.7. Evaluation of the effectiveness of the application of procedures for the submission and examination of appeals and complaints regarding the study process within the field studies.*

*(1) Factual situation*

The university has an electronic system for students and employees to report cases of violation of equal opportunities. Cases can also be submitted by email. Complaints are considered confidential and cannot be disclosed to the persons who are not related to the alleged violation or its examination, except for the cases when the applicant has already disclosed this information. All the received complaints regarding the violation of equal

opportunities submitted by employees and students are analysed. In the last three years, two students of ME have been penalized for academic dishonesty.

There is a process for students to submit complaints on decisions regarding assessments, qualifications, reviews, etc.

During the last five years one first cycle student has filed an appeal against the work of the Qualification Commission of the Final degree projects, as he considered it to be of poor quality. However, the Vice-Dean found that the students' complaints were unfounded. Another, representative example is that of two students having doubts of the objectivity of the negative assessment of their Final degree projects by reviewers. Based on the Guidelines of Final degree project preparation and defence, they requested the appointment of a second reviewer, which were granted, who also presented the negative assessment

*(2) Expert judgement/indicator analysis*

The procedures for the submission and examination of appeals and complaints regarding the study environment and processes are in place, accessible as well as transparent.

***Recommendations for this evaluation area:***

*There is no systematic process to track and get feedback from alumni working outside Lithuania. It is therefore recommended to build up such a process.*

### **3.5. TEACHING STAFF**

***Study field teaching shall be evaluated in accordance with the following indicators:***

***3.5.1. Evaluation of the adequacy of the number, qualification and competence (scientific, didactic, professional) of teaching staff within a field study programme(s) at the HEI in order to achieve the learning outcomes.***

*(1) Factual situation*

The compositions of the teaching staff are well described in the SER. The share of teachers active in the first cycle programme that holds a PhD exceeds 85% while the share active in the second cycle programme exceeds 90%. The age distribution is favourable with the majority in the age span between 30 and 60 age. The SER reports promotions to full and associate professors and recruitment of young lecturers. Scientific and teaching merits are required for academic employment and promotions to associate and full professors. There are 16 doctoral students in the field of Mechanical Engineering. Although the number of doctoral students is somewhat low compared to the size of the faculty, the size is enough to have a turnover of academics in the future.

The number of teachers active in the first cycle study programme is 144 while the number of teachers active in the second cycle student program is 45. In the SER, the ratio between number of students and teaching staff is presented for the university as whole and for and the MDIF. This since teachers normally teach subjects in several study fields or in several faculties. The number of students per full time equivalent teacher is around 13 for both KTU as a whole and for MDIF.

Most of the teachers have written textbooks, are involved in research, and regularly participate in international scientific conferences.

Generally, teachers get experience of engineering practise by carrying out R&D projects in cooperation with companies, have research contracts involving companies and supervise final

degree projects in cooperation with industry. In addition, there is a good number of teachers that are practising engineers at companies and institutes outside KTU. Based on the information in the SER, the share of the teaching staff that work at least half time outside the HEI is estimated to be around 10% in both first and second cycles study programme.

The share of teachers in the first level study program that has a determined English proficiency level corresponding to B2 is 42% while the share of teachers with determined proficiency in English of least B2 is 60%. The evaluation team notes in particular that the share of teachers who have not evaluated their ability in English is relatively high (22-30%) in both the first and second cycles study programmes. Furthermore, from interviews with teachers and students the evaluation team may conclude that the teachers are sufficiently proficient in English and comfortable in teaching in English.

*(2) Expert judgement/indicator analysis*

The numbers of teaching staff in the two programmes are sufficient and teachers' formal qualifications exceed the legal requirements. From the teaching staff's CVs and academic activities, it is obvious that the qualification of the teaching staff is adequate to ensure the study programmes aims and learning outcomes. In the interviews with students, it was made clear for the evaluation team that the students appreciated the teachers very much and that they found them to be highly qualified, supportive and dedicated to teaching.

*3.5.2. Evaluation of conditions for ensuring teaching staffs' academic mobility (not applicable to studies carried out by HEIs operating under the conditions of exile).*

*(1) Factual situation*

KTU employees are encouraged to use the Erasmus+ mobility programmes for teaching and training. Visits to non-Erasmus+ member countries are also possible through agreements signed by the University. Moreover, KTU is a member of European Consortium of Innovative Universities (ECIU). Teachers can apply for support from ECIU for research or academic exchange visits within the ECIU network.

*(2) Expert judgement/indicator analysis*

Good opportunities exist for teachers to participate in academic mobility programmes. The number of teachers participating in academic mobility (research, teaching, and training) the last three last year has varied between 15 and 20 annually (which corresponds to a share around 10%). The number is adequate but the teachers participating are not evenly distributed. Some teachers are very active, and others are less active. It is a fact that also incoming visiting teachers contribute to the international environment by sharing experiences and participating in teaching. However, a broader participation in academic mobility programmes need to be encouraged.

*3.5.3. Evaluation of the conditions to improve the competences of the teaching staff.*

*(1) Factual situation*

KTU has a process in place for development of teachers' didactic skills and competences. Following the previous evaluation, the university has built up and put in use a unit for didactic training named Edu\_Lab Centre for Excellence in Learning and Teaching. The unit offers training courses within 10 different pedagogical themes including Teaching in English, Design of study programmes (constructive alignment and learning outcomes approaches), Development of virtual learning skills and Problem-based learning. A high number of teachers have completed the training courses. In the last five years, ME study fields teachers have

completed 175 training courses. No information of the actual numbers of teachers is given in the SER but the Basic training course has been completed by 44 teachers indicating that at least around 30% of the teachers have completed training courses. After finalizing didactic training, teachers are invited to a follow-up programme in which they develop their teaching and subjects with support from specialists from the Edu\_Lab. In addition, Edu\_Lab, in cooperation with heads of study programmes and teachers organises events for networking to share good practice experience among teachers, e.g., Teachers Café. KTU applies an approved Language Policy with the aim that all personnel must have English knowledge of at least level B2 while teachers teaching in English need to have knowledge of at least level C1. KTU organises courses of English language and teachers are provided with opportunities to follow the courses during working hours. The strategy has been successful, and 50% of the teaching staff in the second cycle programme has English knowledge corresponding to level C1 (the share in the first cycle study programme is 30%). From interviews with teachers and students the evaluation team may conclude that the teachers are sufficiently proficient in English and comfortable in teaching in English. Moreover, from discussions with teachers it is clear that the teachers now are skilled in the learning outcomes approach and that they also are aware of the benefits with this approach.

Employees at KTU have possibilities to do traineeships, take open courses and take one study module per semester. Furthermore, KTU supports research activities, research visits and participation in scientific conferences to an adequate level.

*(2) Expert judgement/indicator analysis*

The evaluation team finds that KTU and the Faculty of Mechanical Engineering offer excellent conditions to improve the competences of their teaching staff. This includes scientific, topic-oriented knowledge in the field as well as didactic and language skills. The rapid formation of the didactic unit and its large broad activities and impact in the relatively short time it has been in use is impressive. The fact that teachers appreciate the didactic training they receive and believe that it has improved their teaching is admissible.

***Recommendations for this evaluation area:***

*Create incentives for teachers to participate in international mobility programmes by, e.g., extended financial support, valuing participation in salary discussions and in promotions.*

### **3.6. LEARNING FACILITIES AND RESOURCES**

***Study field learning facilities and resources shall be evaluated according to the following criteria:***

*3.6.1. Evaluation of the suitability and adequacy of the physical, informational and financial resources of the field studies to ensure an effective learning process.*

*(1) Factual situation*

The physical infrastructure available for teaching, learning and training is sufficient both in terms of size and quality as well as accessibility. The students of both study programmes have access to good auditoriums, labs and to a well-equipped library. The laboratory and computer equipment (hardware and software) are up-to date as well as adequate both in size and quality. The Faculty of Mechanical Engineering and Design has more than 40 laboratories and workshops covering both traditional and recent aspects of Mechanical Engineering including materials, thermo, rapid prototyping, biomechanics, etc. Senior students also have access to laboratories at the Institute of Mechatronics. Most of the facilities are renewed and upgraded

during the last five years. The buildings of MIDF are adapted for students with special needs such as mobility disability. Special wider doors and elevators to the different floors have been installed. Suitable work conditions in computer rooms and laboratories are created for students with special needs. Amphitheatre auditoriums need to be improved. They need to be better adapted to the students with restricted mobility when attending theoretical lectures.

The teaching materials are adequate and available in the library (textbooks, books, electronic papers, journals, electronic databases) and the access is very good. The electronic library resources are available for students.

Students have access to labs and workshops in scheduled sessions for subject and project work but also outside school hours for their own training and research. Students have sufficient access to software for design, simulations, numerical analyses, programming, management, office work, etc. The list of software is appropriate for first and second cycle studies in the field of Mechanical Engineering.

The maximum number of students in classrooms and labs is regulated by occupancy norms that ensure a safe learning environment suitable for efficient teaching and learning. There are spaces allocated for student's individual work as well as teamwork (reading rooms, project spaces, workshops for creativity, etc.). The students can perform simple machining operations, manufacture samples or structural elements necessary for projects. More complex machining is performed in the mechanical workshop. This requires contacting the responsible employees of the Laboratory Center to get assistance and support.

In interviews with the evaluation team, the students clearly expressed that they were very satisfied with their study environments and facilities (physical as well as digital). They also confirmed that they had good access to workshops and labs, also after school hours.

#### *(2) Expert judgement/indicator analysis*

The infrastructure for teaching and learning, including auditorium, labs, workshops, spaces for creativity, library, computer rooms, software, electronic and digital resources, are excellent facilities, adequate in all aspects and up to date.

The use of the facilities is well thought out and well planned. This creates very good conditions for active and experiential learning, which has proven leading to deep and active knowledge.

The evaluation team concludes that the suitability and adequacy of the physical, informational and financial resources are enough to ensure effective learning processes.

### *3.6.2. Evaluation of the planning and upgrading of resources needed to carry out the field studies.*

#### *(1) Factual situation*

The labs and workshops are systematically upgraded. Extensive purchases of new equipment have taken place over the past three years. State of the art equipment for geometric measurements has recently been established in cooperation with high tech companies.

Lecture rooms are currently under reconstruction to be flexible and suitable for interactive and blended learning methods. In addition, two classrooms are planned to adapt for interactive, blended forms of studies.

The MDIF plan for laboratories includes a recently developed concept for a laboratory for testing of technological processes and pilot manufacturing in engineering.

KTU is currently establishing an interdisciplinary innovation and testing lab, M-lab. The M-lab will be an area for research, innovation, knowledge sharing and education. According to descriptions of the layout, planned workshops and labs as well as planned activities, the M-lab will be on par with the innovation labs of world-leading engineering schools.

*(2) Expert judgement/indicator analysis*

The Faculty of Mechanical Engineering and Design and the university have repeatedly shown that they can maintain, develop and create new environments for learning, research and innovation. The developments and upgrading carried since previous evaluation are impressive.

The new M-lab has the potential to become a landmark for education, research and innovation in the eastern parts of Europe and for KTU to approach the European university top level.

***Recommendations for this evaluation area:***

*Continue the work of developing the learning environment with emphasis on spaces for project work, creativity and flexible spaces for blended learning. Ensure that the experience of the transition to digital learning due to Coronavirus (COVID-19) is taken advantage of and continues to develop.*

### **3.7. STUDY QUALITY MANAGEMENT AND PUBLICITY**

***Study quality management and publicity shall be evaluated according to the following indicators:***

***3.7.1. Evaluation of the effectiveness of the internal quality assurance system of the studies.***

***(1) Factual situation***

The management of study programmes is well described in the SER. The Senate has the overall responsibility to monitor changes in studies, the management of clusters of study programmes, quality assurance, etc. The Vice-rector of studies is responsible for vision, strategy and the standard quality system for the education and head of the university level Study Programme Committee. The Department of Academic Affairs is responsible for the development and implementation of the quality guidelines and the monitoring of the quality of studies at the University's level. Faculty of Mechanical Engineering and Design ensures the realisation of the study programmes and staff's subjects.

The major body for development, quality assurance and execution of the study programmes is the Study Programme Committee. The Study Programme Committee is headed by the Head of Study Programmes who is responsible for the quality and improvement of the study programmes including achievement of goals, compliance with KTU rules and guidelines and Lithuanian legislations. The head is also responsible for communication with and collecting feedback from students, teachers, alumni and social partners. The Mechanical Engineering Study Programme Committee includes members representing first and second cycle students, teachers and social partners.

The quality assurance system is extensive and contains quality loops on several levels. KTU's internal quality system is described in the Quality Assurance Manual. The quality system complies with Standards and guidelines for quality assurance in the European Higher Education Area (ESG). KTU internal system includes the model of the management, the application of the student-oriented educational philosophy, the improvement of the competence of lecturers, the system of the student's success and the development of the

feedback and monitoring system. Feedback is systematically collected from students, teachers, alumni and stakeholders through surveys, round table discussions and meetings. All subjects are reviewed annually with respect to learning outcomes, teaching activities and assessment by the Study Programme Committee. Students fill in semester surveys (“Questionnaire on Study Modules and Lecturers” at the end of the autumn and spring semesters) in which they anonymously give feedback on subjects and lectures. The survey responses are reviewed by the Study Programme Committee which also decides whether action is required.

In the evaluation team’s interview with teachers, it was clear that there was an awareness of the role of the Study Programme Committee and the quality system. The teachers take the students’ feedback seriously and use it to improve their teaching. This was confirmed by students who were also able to give examples of improvements that were made based on their criticism.

#### *(2) Expert judgement/indicator analysis*

The study management system including the quality assurance system is in line with the European standards of higher education. The management system has a clear structure with clear responsibilities at different levels. Decision paths are short. Decisions are taken at the level where they naturally belong, as the Study Programme Committee decides on the aims, learning outcomes, contents, study plans and implementation of the programmes and subjects. The management structure has proven to be able to make comprehensive and important decisions and overcome universities inherent resistance to change. This is, e.g., manifested in the successful implementation of all recommendations and necessary measures identified in the previous evaluation.

The internal quality system is well defined and systematically put in practise. Awareness and acceptance of its importance is high, which creates good conditions for improvement.

### *3.7.2. Evaluation of the effectiveness of the involvement of stakeholders (students and other stakeholders) in internal quality assurance.*

#### *(1) Factual situation*

Feedback from stakeholders are systematically collected and analysed through several channels including surveys, round table discussions and regular meetings. Students have the possibility to give views anonymously on all subjects and teachers in the semester surveys “Questionnaire on Study Modules and Lecturers” at the end of the autumn and spring semesters. Students also have the possibilities to give views on the quality of studies, management and the programmes in the annual survey “Voice of Students”. The major body for development, quality assurance is the Study Programmes Committee in which teachers, students and social partners are members.

In the evaluation team’s interviews with teachers, students, alumni and social partners it was made clear that their feedback was taken seriously and that actions based on the feedback were reported back.

#### *(2) Expert judgement/indicator analysis*

Feedback is used effectively in the development of the quality of the study programmes and the learning environments.

There do not seem to be any clear guidelines and incentives for students’ participation in the Study Programme Committee. From interviews with management, students and student

association, the evaluation team did not receive a clear answer on how the students were appointed and how they were introduced to the work in the committee.

### *3.7.3. Evaluation of the collection, use and publication of information on studies, their evaluation and improvement processes and outcomes.*

#### *(1) Factual situation*

Complete information of study programmes for prospective as well as admitted and enrolled students is easily accessible on the KTU webpages. This information includes results from evaluations and accreditations.

Specific information for the first and second levels study programmes in the field of Mechanical Engineering is easily accessible on the KTU web pages. This information includes study programme plans, aims, study programme learning outcomes, subject descriptions including content, aim, learning outcomes, literature, evaluation, teaching activities, etc. In addition, information is given on possibilities for international mobilities, learning facilities, uniqueness of study programmes, career opportunities and stakeholder testimonials.

#### *(2) Expert judgement/indicator analysis*

The KTU websites are informative and easily accessible. All necessary information for prospective national and international students is easily accessible in Lithuanian and in English. Information for *enrolled* students about the study programmes and their different goals, opportunities, possibilities and choices etc. are easily accessible and sufficient for all students to be able to complete their studies successfully.

### *3.7.4. Evaluation of the opinion of the field students (collected in the ways and by the means chosen by the SKVC or the HEI) about the quality of the studies at the HEI.*

#### *(1) Factual situation*

Student feedback is collected systematically through different channels including university level surveys, semester surveys on subjects and teachers' performances as well as in formal and informal meetings. The feedback is regularly collected and analysed in the Study Programme Committee in which students are members. Actions based on the feedback are reported back to students by the student members in the committee and in the study administrative system Moodle and to the Students' Association.

In the evaluation team's interview with students, students confirmed that their feedback is taken seriously and that it has had impact.

#### *(2) Expert judgement/indicator analysis*

There are clear procedures to collect and analyse student feedback at different levels at the university management. Feedback from students is demonstrably taken seriously by the management at different levels. Several measures have been taken based on student feedback.

#### ***Recommendations for this evaluation area:***

*Strengthen the role of the students in the Study Programme Committee. Create incentives for students to get involved in committees and boards, by e.g., showing that they have impact and by giving them certificates and reviews of their efforts. Be sure to report back results on surveys, feedback sessions, etc. including actions initiated by the results.*

## IV. EXAMPLES OF EXCELLENCE

- The KTU website is excellent. General information about the university, education, admissions as well as specific information about study programmes and subjects are easily accessible, complete and informative.
- The management structure with short decision paths, clear responsibilities and the strong programme level committee is admirable. The management structure has proven to be able to handle change (top-down as well as bottom-up) efficiently. This includes also implementation, evaluation and refinement of changes.
- The student learning-oriented environment including laboratories and workshops as well as digital tools are excellent facilities with up-to-date adequate equipment. The possibilities with the new M-lab will further strengthen this to become a benchmark for progressive Mechanical Engineering education.
- Close and mutually beneficial relations with the Lithuanian industry are admirable. As a result, the knowledge, skills and attitudes of the graduates perfectly match the needs of the industry and the graduates quickly find relevant job positions.

## V. RECOMMENDATIONS\*

1. Complete and intensify the work of reviewing all the subjects' learning outcomes to ensure that they have evaluable learning outcomes that describe what the students should be able to do after completing the subject. Use active word and a taxonomy to indicate the desired level of the knowledge, skills and attitudes.
2. Set up a strategy to recruit more female students. Make all statistics gender segregated and analyse data. Conduct targeted recruitment events, identify role models and show career paths. Collaborate with industry partners in showing that the engineering profession is gender neutral.
3. Increase the level of internationalisation in the study programmes. Encourage more participation in mobility and exchange programmes by teachers and students. Consider having a single joint track taught entirely in English on the second level. Having separate tracks for international and national students at master's level is a barrier for integration of students and prevents students from taking advantage of having international students at campus in preparing for the global market of engineering. Teaching in national language does not fit into a master's programme with ambitions of becoming an international benchmark.
4. Consider offering some first cycle Final degree projects oriented towards research with theoretical depth for students who aim to transfer directly to a master's programme. Quality assurance Final degree reports to avoid obvious mistakes that can lead to reviewers and stakeholders drawing hasty conclusions.

\*If the study field is going to be given negative evaluation (non-accreditation) instead of RECOMMENDATIONS main **arguments for negative evaluation** (non-accreditation) must be provided together with a **list of “must do” actions** in order to assure that students admitted before study field's non-accreditation will gain knowledge and skills at least on minimum level.

## VI. SUMMARY

The following is a summary of the findings of the evaluation team based on the Self-Evaluation Reports and the interviews with the university administration (senior management and faculty administration staff), staff responsible for the preparation of the SER, teaching staff and stakeholders (students, alumni, employers, social partners). The evaluation team gives a positive evaluation to the implementation of study field Mechanical Engineering First Cycle and Second Cycle at Kaunas University of Technology with all areas of evaluation assessed as very good or exceptional.

The first and second cycle study programmes in Mechanical Engineering at Kaunas University of Technology are progressive, relevant and ambitious programmes that recruit very able and dedicated students from inside and outside Lithuania. The number (and the share) of female students is very low and lower compared to many similar educations in the rest of Europe. As there is a great need for engineers in Lithuania and the fact that the study programmes can welcome many more students, it is an opportunity to recruit talented female students that needs to be explored carefully. The quality of the education will also benefit from more gender-balanced student bodies.

The links between the study programmes and the Lithuanian industry oriented towards product development, manufacturing and production are very strong. The employability of the graduates is very high. Alumni as well as the employers are very satisfied with the study programmes and particularly with the practical and professional skills gained by following the study programmes.

The teachers are in general very skilled, dedicated and ambitious and they are very involved in the study programmes. All teachers have expert knowledge in their fields of teaching but also enough didactic training and perform well in teaching. It is a good mutually respectful relationship between teachers and students. At the master's level, it is almost a collegial relationship which is beneficial for students' learning and development.

The processes around the Final degree projects are stable and well-functioning. Structure and expected learning outcomes are transparent and well described. It is straightforward for the students to find topics and supervisors. Almost all projects are carried out in the industry or in close cooperation with industry. Most of the first cycle Final degree projects are related to solve issues in the industry. This is good for students aiming to go to a position in industry while students aiming to continue at master's level might benefit from a project more directed towards research.

The managements at all levels have engaged successfully in developing programme level learning outcomes according to best European practise that comply with EUR-ACE standard. The same holds for the learning outcomes of most subjects but some subjects' learning outcomes need to adapt the learning outcomes approach with outcomes that are observable and externally verifiable. There is an annual process in place that reviews and refines subjects' learning outcomes, but the education would benefit from speeding up the process a bit.

The unit for didactic training is well-functioning with an impressive breadth of business, especially considering that it is a relatively new unit. A good number of teachers have had training at the unit. Teachers who have had training testify that they have benefited from it in their teaching.

The management structure for education and study programmes is well-functioning with clear responsibilities and short decision paths. It is very encouraging and impressive to observe how well the study programmes have taken recommendations from previous evaluation into account and implemented them all carefully to almost best practise level. Thus, the management structure has proven to be able to handle change very effectively. It is particularly rewarding to have a Study Programme Committee designated to the study programmes within a field. The committee for Mechanical Engineering has proven to be well-functioning and shown itself to be able to ensure quality and develop the study programmes. The quality assurance system involving quality loops at different levels is well-functioning. Feedback from students, alumni and social partners are collected and used to improve quality. All stakeholders receive information about improvements and developments after each review.

There are a good number of international students in the study programmes that create good opportunities for the students to develop skills in intercultural communication and cooperation. However, the favourable conditions are not fully utilized as the students are often divided into two streams in the subjects, one which is taught in Lithuanian and one which is taught in English. Teaching staff is ready to teach in English and students are sufficiently proficient in English. Thus, it would be possible and beneficial to join the two streams, at least at the second level, to prepare the students for the global market of engineering but also for using staff and other resources more efficiently.

The students have access to adequate library, auditoria and computer facilities including a complete set of up-to-date software for mechanical engineering applications, simulation and calculations, etc. The laboratory and workshop facilities are excellent. They are used in a very conscious manner focussing on students' learning and training. The new M-lab will provide additional opportunities for the students to collaborate across different disciplines with innovation, research development in a creative environment together with researchers and industrial partners.

#### Expert panel signatures:

1. Prof. dr. Oluremi Ayotunde Olatunbosun (team leader) *academic*
2. Prof. dr. Jasmina Casals-Terré, *academic*
3. Prof. dr. Mikael Enelund, *academic*
4. Dr. Vaidas Liesionis, *representative of social partners'*
5. Mr. Marijus Ambrozas, *students' representative*