STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Kauno technologijos universiteto

STUDIJŲ PROGRAMOS *GAMYBOS INŽINERIJA (valstybinis kodas - 621H70004)* VERTINIMO IŠVADOS

EVALUATION REPORT OF *PRODUCTION ENGINEERING* (*state code - 621H70004*) STUDY PROGRAMME

at Kaunas University of Technology

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Išvados parengtos anglų kalba
Report language – English

Vilnius
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DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	***Gamybos inžinerija***
Valstybinis kodas	621H70004
Studijų sritis	Technologijos mokslai
Studijų kryptis	Gamybos inžinerija
Studijų programos rūšis	Universitetinės studijos
Studijų pakopa	Antroji
Studijų forma (trukmė metais)	Nuolatinė (1,5)
Studijų programos apimtis kreditais	90
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Gamybos inžinerijos magistras
Studijų programos įregistravimo data	2007

INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme	***Production Engineering***
State code	621H70004
Study area	Technological Sciences
Study field	Production and Manufacturing Engineering
Type of the study programme	University studies
Study cycle	Second
Study mode (length in years)	Full-time (1,5)
Volume of the study programme in credits	90
Degree and (or) professional qualifications awarded	Master of Production Engineering
Date of registration of the study programme	2007

CONTENTS

I. INTRODUCTION

1.1. Background of the evaluation process

The evaluation of on-going study programmes is based on the **Methodology for evaluation of Higher Education study programmes,** approved by Order No 1-01-162 of 20 December 2010 of the Director of the Centre for Quality Assessment in Higher Education (hereafter – SKVC).

The evaluation is intended to help higher education institutions to constantly improve their study programmes 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 programme SKVC takes a decision to accredit study programme either for 6 years or for 3 years. If the programme evaluation is negative such a programme is not accredited.

The programme is **accredited for 6 years** if all evaluation areas are evaluated as "very good" (4 points) or "good" (3 points).

The programme is **accredited for 3 years** if none of the areas was evaluated as "unsatisfactory" (1 point) and at least one evaluation area was evaluated as "satisfactory" (2 points).

The programme **is not accredited** if at least one of evaluation areas was evaluated as "unsatisfactory" (1 point).

1.2. General

The Application 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, during and/or after the site-visit:

No.	Name of the document
1.	Action plan on solving problems defined by „Round table with students" (example from database)
2.	List of Start-up's
3.	Transcripts of records (examples taken from database)
4.	Marketing and communication activities for the study programmes in the field of

	Production engineering
5.	Module assessment summary (example from database)
6.	List of laboratories visited on 18th of November at KTU

1.3. Background of the HEI/Faculty/Study field/ Additional information

Kaunas University of Technology (KTU) is a public research university located in Kaunas, Lithuania. With almost 11,000 students, it stands as the largest technical university in the Baltic States. It offers 135 academic studies (bachelors, masters and doctorates), 39 of which are taught in English.

The Faculty of Mechanical Engineering and Design has 24 study programmes, of which 10 are Bachelor's, 14 are Master's and 4 scientific fields of Doctoral studies (the most related to assessed program being Mechanical Engineering and Materials Engineering). One of these Master's, is the *Production Engineering* Masters' programme to be assessed.

According to the SER the programme is focused mostly on the development, optimization and control of production and manufacturing processes. It is a 90 ECTS Master's programme that is taught completely in Lithuanian. A previous evaluation of the programme was carried out in 2008. It was given a positive evaluation with a recommendation to revise the study programme according to General requirements for technological studies and to revise and optimise the number of specialisations. It was further recommended that the use of scientific laboratories, especially for projects of master students, should be increased and entrepreneurship skills of students should be improved while introducing economical aspects into some of the projects. Finally it was recommended to decrease the drop-out rate of the students.

As a result of the recommendations of the previous assessment various improvements have been made to the structure and execution of the Programme. The Programme aims, learning outcomes structure and content of the Programme and study subjects have been improved in order to satisfy the needs of employers as well as to satisfy the requirements of national and European legislation in the area of higher education.

1.4. The Review Team

The review team was completed according *Description of experts' recruitment*, approved by order No. 1-01-151 of Acting Director of the Centre for Quality Assessment in Higher Education. The Review Visit to HEI was conducted on *17th November, 2016.*

1. **Dr. Oluremi Olatunbosun (team leader)**, *Head of Vehicle Dynamics Laboratory, School of Mechanical Engineering, University of Birmingham, United Kingdom;*
2. **Prof. Marti Casadesus,** *Full Professor, Department of Management, University of Girona, PhD in Industrial Engineering, Spain;*
3. **Prof. Mats Hanson,** *Professor in Mechatronics, Department of Machine Design, KTH Royal Institute of Technology (until 2014), Sweden;*
4. **Mr. Audrius Jasėnas,** *director of public organization "Intechcentras", Lithuania;*
5. **Ms. Dovilė Kurpytė,** *student of Vilnius Gediminas Technical University study programme Electrical and Electronics Engineering, Lithuania.*

Evaluation coordinator – Ms. Ina Šeščilienė.

II. PROGRAMME ANALYSIS

2.1. Programme aims and learning outcomes

Skills and competences provided to the students in the course of this program are properly described and readily available on the Internet. All information provided to the students is clear and understandable. The description found on the internet is indicative of a programme with modern content, able to provide the required skills, competences and career opportunities. However, this information is only available in Lithuanian language. The main aim of the program is presented concisely and clearly. In the aim of the program it is indicated that the graduate will be able to solve specific problems appearing in various sectors of the industry. Going deeper into the programme's SER such a proposition can be found – "*Graduates of PE study Programme are employed at engineering production companies (manufacture of metal products, machinery and equipment, transport equipment, etc.) "*.

The self-evaluation report states that the programme learning outcomes have been updated recently in 2014 in accordance with EUR-ACE Framework standards and Lithuanian legal requirements for second cycle degree programmes and is in line with labour market needs. When improving the program the results of the most recent stakeholders' surveys are used. Before each academic year the programme's the learning outcomes are revised and improvements to the programme are discussed with interested parties and students. Some lectures are delivered by specialists from industrial companies, but the number of such external specialists could be higher.

Program self-evaluation report (SER) and reports from the Social Partners during the site visit indicate that the labour market clearly needs universal production engineers every year, which would be able to quickly switch to different production areas. The programme aims and

learning outcomes are consistent with the type and level of studies and the level of qualifications offered and the name reflects the content of the programme and its learning outcomes

2.2. Curriculum design

The curriculum design meets legal requirements for the study field of Production Engineering. The study Programme is revised at the Production Engineering Field's Studies Programme Committee (FSPC). The learning outcomes were updated in 2014 and arranged in accordance with EUR-ACE Framework standards, Shared 'Dublin' Descriptors for Short Cycle, First Cycle, Second Cycle and Third Cycle Awards, The European Qualifications Framework for Lifelong Learning, ECTS User Guide and requirements of national regulations (Law on Higher Education of the Republic of Lithuania, Description of the General Requirements for the second cycle Degree Programmes and Description of Study Programmes External Evaluation and Accreditation Procedures). In 2016, learning outcomes were revised and adjusted according to Descriptor of the Study Fields of Engineering of Production Engineering.

The curriculum consists of 90 ECTS credits from which 36 are devoted to research. The study subjects and their content are sufficient to prepare professionals who are knowledgeable in production technologies, are able to carry out research and apply them in the manufacture of metal products, machinery and equipment, transport equipment, etc. It is therefore sufficient to ensure the achievement of the learning outcomes. Nevertheless a review of the curriculum is recommended for improvement of the study programme.

The titles of some subjects seem quite similar (e.g. *Computer-Aided Design and Design for Automated Assembly; Integrated CAD/CAE/CAM Systems and Computer Integrated Manufacturing)* and there is some duplication in content. However, better coordination between lecturers of different subjects should enable duplication of content to be avoided.

There are doubts whether certain subjects should be included in the Production Engineering programme, e.g. *Advanced metallic materials, Melting and Crystallization processes, Formation of Material properties* and *Analysis of materials structure and properties,* since they are specific to the metals industries. However, since they are optional subjects this may not be a problem. It is also felt that *Mechanical Vibrations* is not needed as a core subject and should be replaced by a new compulsory subject *Production Management* (based on the existing subject *Innovative Production Technologies* which is a vital subject for any Production Engineering programme. This was also the view of the alumni and social partners during interviews with them.

In the Programme's self-evaluation it is mentioned that graduates of this study programme are able to work in any manufacturing companies, for example in textile and food industry, so the question is whether the student needs such subjects like *Melting and Crystallization Processes, Formation of Materials Properties, Analysis of Materials Structure and Properties*. However, these are electives and may be chosen by students who wish to work in the metal production industries.

Of all the subjects of the study programme, *Innovative Production Technologies* is the subject that provides students with the knowledge of manufacturing in the sheet metal, plastics and composites industries. It also covers such topics as concurrent engineering and lean production, environmental protection, quality control, rapid prototyping, computer-aided process planning etc. It therefore combines elements of Production Management and innovative manufacturing systems. These are topics which should be compulsory for students on the study programme. Unfortunately it is currently an elective subject. In order to ensure that all students of the study programme acquire the appropriate knowledge and skills, a reorganization of the curriculum is necessary to ensure that these topics are taught in the core subjects of the study programme. Production engineers must be prepared to work in a leading position, so as stated above it is essential that all students in this study programme should acquire knowledge of production management.

In the Self-evaluation report it is mentioned that the graduates are prepared to continue their studies in order to get doctoral degree. The research content of the study programme is 36 ECTS credits (Research Project 1 and Final degree project) which is 40% of the degree programme. It is felt that this is enough for the student to make a decision on PhD studies.

The program contains some innovative subjects such as *Automation of Production Processes*, *Innovative Production Technologies* and *Computer Integrated Manufacturing*, but only *Automation of Production Processes* is compulsory. It is necessary that students are acquainted with modern widely used terms and their applications such as *"Industry 4.0", "Data security", "Smart Industry", Enterprise Resource Planning (ERP) software integration to process control systems (PCS) at the production level* etc. Therefore these topics should be introduced in the core subjects of the study programme.

2.3. Teaching staff

The study programme's staff is well-balanced. There are 6 professors, 14 associate professors and 4 other specialists involved in the study programme. The share of workload is adequate as well. The age distribution of the staff is balanced and there is a good proportion between the young specialists and experienced professionals. The number of the teaching staff is

adequate to ensure learning outcomes. 4 new young teachers have started working at the Department since 2013 and the department has 5 doctoral students and 1 post-doctoral researcher ensuring future succession of those nearing retirement. The teaching staff of the programme is involved in research directly related to the study programme being reviewed.

Lecturers constantly participate in international scientific conferences in Lithuania and abroad. Lecturers are quite active in preparing scientific papers and participating in research activity. While some of the professors involved in the programme have established an international profile in their publications (e.g. Barauskas, Dragasius, Ostasevicius), a large proportion of the research output is published in local journals (e.g. *Mechanika* and *Journal of Vibro-engineering*, both of which are based at KTU). There is a need to make more effort to publish research results in international journals.

In the self-evaluation report (SER), it is mentioned that lecturers should constantly improve their qualifications. The university actively promotes and finances staff's participation in both local and international conferences and various trainings and seminars are provided for improving their qualification.

In SER (table 2.6) it is indicated that the number of international visiting academics is increasing (2 in 2012, 4 in 2013, 3 in 2014 and 13 in 2015). So far in 2016 there have been 5 visiting lecturers. The involvement of teachers of the study programme in international mobility under the Erasmus+ programme is very good in the last 3 years with an average of 10 mobility's per year.

2.4. Facilities and learning resources

Students have good environment to listen to lectures, there are no over-crowded classrooms, the number of students in the group is reasonable. All facilities of the faculty and of branch of the university library at the faculty have been renewed in 2014. Classrooms are equipped with computers, audio and video appliances, internet, laboratories – with effectively functioning and safe laboratory appliances. Students can perform individual tasks in seminar rooms and other spaces allocated for the student's individual work. The facilities of KTU library fully meet the needs of the study programme. Students may also use other electronic resources of the library (databases of research papers, e-library recourses, etc.) on university computers or on their personal computers. Students have enough of individual working places; it is easy to find recent publications and books in the library, which are available in sufficient quantities.

Laboratories are quite well equipped with some new technological equipment (e.g. 3-D prototyping, robotic systems, CNC processing equipment) which is necessary for laboratory work organization. The equipment is being regularly renewed. However some of the old

equipment (materials testing) needs to be replaced. Laboratories use new and popular software which is used in industry. However, students reported during the visit that some computers used are quite old and very slow.

During the visit there was no evidence that the laboratory facilities were being utilized very much for projects by students of the study programme. There was hardly any student in the laboratories (it was stated that this was due to the timing of the laboratory visit (14.20 – 15.20) which falls outside the period of study by Masters' students). Nevertheless there was little evidence of on-going student projects. This indicates that one of the recommendations of the last evaluation has not been fully addressed.

2.5. Study process and students' performance assessment

Admission to the study programme is based on the qualifications from the first cycle degree programme and is strictly on merit. The number of students entering into Production Engineering Program is increasing while the admission score is quite stable. This is an encouraging trend but is due mainly to an increase in the number of government funded places. It is also observed that the drop-out rate of students of the study programme has decreased since 2012. It therefore appears that the concern raised by the last evaluation regarding student drop-out rate has been addressed.

It is observed that the average evaluation of the final project work has decreased every year starting from 2012 onwards. It is not clear why this is the case but perhaps some students lack necessary knowledge to produce the highest quality final work.

Various methods (including interactive) of studies are used: oral lectures, presentations, discussions, individual and group works, case analysis, testing, projects.

Students and graduates said during the site visit, that they were mostly satisfied with the teaching methods and that the teachers were very helpful. They felt that the programme is a good preparation for their jobs. However, there are some reservations, namely:

- Project management should be included in the core curriculum
- CNC programming, which is part of an elective course, was very useful and should be made compulsory. However, we found that CNC programming is actually taught in the subject *Automation of Production Processes* which is a compulsory subject.
- There should be more lectures by practitioners from industry.
- Mechanical Vibrations should not be a compulsory subject.

The employers also expressed their opinion about the programme. While they were broadly satisfied with the quality of the graduates of the study programme, they had some reservations. These are what they would like:

- Students should be taught more innovative problem solving techniques through the introduction of more practical group projects.
- Communication skills should be improved.
- Project Management should replace Mechanical Vibrations as a compulsory subject.
- Lean management techniques should be taught and used in exercises which social partners are willing to provide.

The social partners are also willing to give more lectures about practical application of knowledge in industry.

The University has excellent conditions for students to participate in the Erasmus+ exchange program as there are 23 cooperation agreements. Students have opportunities to participate in student mobility programmes but their participation in such kind of programmes is extremely low – on average, less than 1 student per year.

The university has a system to provide good academic and social support for students in need of such support. This includes consultation periods with lecturers, Careers Days organized by the Careers Service of the university, scholarships, etc.

The criteria of student's achievements assessment are publicly announced at the beginning of a semester – at the first lecture of a study subject the lecturer introduces to the students the study subject's aim, themes, tasks and schedule of self-study and how the final grade will be assessed based on coursework and examination.

The university is in the process of creating a good tool which will enable it to monitor and analyse graduates' employment. Results of questionnaires sent to graduates of the programme show that the employment rate is 100%. In fact most of the students already have jobs while studying for their Masters' degree. Graduates are employed in the advanced Lithuanian engineering industry companies. Many graduates are working as heads of company's departments, engineers and managers of projects so professional activities of the majority of graduates meet the programme providers' expectations.

The study process, system of student's assessment and support are clear and their descriptions are publicly available. The research experience and knowledge of Programme lecturers are transferred to students within programme modules. The social partners are involved in the implementation through membership of the Qualifications Committee and improvement of study process through participation in the stake holders' survey.

2.6. Programme management

The responsibilities for the implementation and monitoring of the programme are clearly allocated: It is the Field's Study Programme Committee (FSCP) that is responsible for the strategy and development of the programme. This Committee together with the Director of the study programme monitors and revises annually the structure and content of the programme. Finally, changes of programmes are approved by the Faculty Council where there is a representation of academics, students and social partners.

There is a clear system of internal quality assurance of the studies in KTU including: traditions of quality assurance in Department; involvement of employers, social partners, students and representatives of industry into improvement of study content, clear process and evaluation; good and publicly accessible academic information system; periodic evaluation of each study subject by the students. The stakeholder's feedback system is based on periodical surveys. Students, graduates, teachers and employers are periodically (in the middle of semester, at the end of semester, after graduation, etc.) asked to evaluate study subjects, study programmes and other aspects of academic life.

2.7. Examples of excellence *

From the self-evaluation report there is no area obvious to be mentioned as an example of excellence.

III. RECOMMENDATIONS

1. Particular elements of modern *Production Management* techniques are missing from the core curriculum of the study programme as currently constituted. However, one of the elective subjects, *Innovative Production Technologies* includes most of the missing elements such as concurrent engineering and lean production, environmental protection, quality management, industrial safety, rapid prototyping, computer-aided process planning etc. It should replace *Mechanical Vibrations* which should become an elective subject, to ensure that all students are provided with all the knowledge and skills that a graduate of the second cycle of production engineering should have. The course content should be reviewed to ensure that students are acquainted with modern concepts of the Digitalized Industry and widely used terms and their applications such as *"Industry 4.0", "Data security", "Smart Industry", Enterprise Resource Planning (ERP), software integration to process control systems (PCS), Additive Manufacturing* etc.
2. Sheet metal, plastics and Composites manufacturing technologies should be included in the content of the compulsory subjects. These topics are already included in *Innovative Production Technologies* which is recommended to be made a compulsory subject (recommendation 1). In addition, selection methods of technological equipment of production processes should be included in the subject.
3. The contents of *Manufacturing Strategy*, *Computer-Aided Design*, *Automation of Production Processes* and *Integrated CAD/CAE/CAM Systems* should be reviewed to ensure that any duplication is eliminated
4. It is vital that CNC programming be taught as part of a compulsory subject but it was erroneously reported that it is part of an elective course. However, we found that CNC programming is actually taught in the subject *Automation of Production Processes* which is a compulsory subject. It is important to ensure that it is actually taught as part of this subject.
5. Information about the program should be made available in English as well as Lithuanian language.
6. The publication efforts of some of the lecturers currently limited mainly to local journals should be oriented more towards international journals.
7. More powerful computers should be provided to enable the efficient use of the suite of engineering software available for student use.
8. Efforts should be made to increase the participation of students in Erasmus and other international mobility programmes
9. Results from the surveys should be more widely published for students.

10. Social partners should be more involved in the study programme and give more lectures on industrial application of knowledge as well as provide real engineering problems to solve and resources to facilitate them.
11. The use of scientific laboratories, especially for projects of master students should be increased.

IV. SUMMARY

The main strengths and weakness of the master programme in *Production Engineering* at Kaunas University of Technology, according to each one of the analysed standards, are:

2.1. Programme aims and learning outcomes

Strengths:

- Skills and competences provided to the students in the course of this program are properly described and readily available in Moodle.
- The description found on the internet is indicative of a programme with modern content, able to provide the required skills, competences and career opportunities.
- The main aim of the program is presented concisely and clearly.
- Program self-evaluation indicates that labour market every year clearly needs universal production engineers, who would be able to quickly switch to different production areas.

Weaknesses:

- Information about the program can be found only in Lithuanian language.
- The number of external specialists giving lectures to students on the programme could be bigger.

2.2. Curriculum design

Strengths:

- The fact that the study programme is completed in 1,5 years is attractive to prospective students
- The curriculum design meets legal requirements.
- The content of the subjects and/or modules is consistent with the type and level of the studies and this is confirmed by the social partners.
- The program contains some innovative subjects such as *Automation of Production Processes*, *Innovative Production Technologies* and *Computer Integrated Manufacturing*.

Weaknesses:

- The following elements are missing in the set of compulsory courses: Production Management including modern management methods, Quality Management, Industrial Safety, sheet metal, plastics and Composites manufacturing technologies etc. One subject offered as an elective, *Innovative Production Technologies*, covers a lot of these elements, combining elements of Production Management and innovative manufacturing systems. It should be offered as a compulsory subject.

- The titles of some subjects seem quite similar (e.g. *Computer-Aided Design and Design for Automated Assembly; Integrated CAD/CAE/CAM Systems and Computer Integrated Manufacturing)* and there is some duplication in content.
- Mechanical Vibrations should be an elective rather than compulsory subject
- Most of the elective subjects, *Product Development*, *Computer-aided analysis of structures*, *Advanced metallic materials*, *Melting and Crystallization processes*, *Formation of Material properties* and *Analysis of materials structure and properties* are specific to the metal industries.
- It is not clear whether any of the study subjects introduces students to the technological equipment of production processes and their selection methods.
- Production engineers must be prepared to work in a leading position, but there is currently no study subject providing leadership excellence, the anticipation of change and knowledge of changes in production management.

2.3. Teaching staff

Strengths:

- Study program‘s staff is well-balanced.
- There is an optimal number of professors, associate professors and other specialists.
- The share of workload is optimal as well good. Personnel working age is balanced, there is a good proportion between the young specialists and experienced professionals.
- The teaching staff of the programme is involved in research directly related to the study programme being reviewed.

Weaknesses:

- The publication efforts of some of the lecturers are limited mainly to local journals rather than international journals.

2.4. Facilities and learning resources

Strengths:

- Students have good conditions to listen to lectures, there are no over-crowded classrooms, and the number of students in the group is optimal.
- The facilities of KTU library fully meet the needs of the study programme.
- Laboratories use most of the modern industrial software which is used in industry.
- Students have enough of individual working places, it is easy to find recent publications and books in the library, and the amount of them there is sufficient.

- Laboratories are well equipped with new technological equipment which is necessary for laboratory work organization. The equipment is being continually renewed.
- Good dormitories.

Weaknesses:

- While classrooms are equipped with computers, audio and video appliances, internet, laboratories – with effectively functioning and safe laboratory appliances, main computers could be renewed.
- The laboratory facilities are not being fully utilised for projects by students of the study programme.

2.5. Study process and students‘ performance assessment

Strengths:

- Teachers and students relationship is good and organisation of lectures is flexible to suit students, most of who are working. A mentoring programme is provided for academic, career, and social support according to the student’s needs.
- The University has excellent conditions for students to participate in the Erasmus+ exchange program as there are 23 cooperation agreements
- Graduates are employed in the advanced Lithuanian engineering industry companies and employment rate is 100%. Many graduates are working as heads of company’s departments, engineers and managers of projects so professional activities of the majority of graduates meet the programme providers' expectations.
- Study process, system of student’s assessment and support are clear, descriptions are publicly available. They are communicated to the students during the first lecture of the subject.
- The social partners are involved in the implementation and improvement of study process.

Weaknesses:

- Students have opportunities to participate in student mobility programmes but their participation in such kind of programmes is very poor.

2.6. Programme management

Strengths:

- A clear system of internal quality assurance of the studies in KTU; traditions of quality assurance in Department; involvement of employers, social partners, students and representatives of industry into improvement of study content, clear process and evaluation; good and publicly accessible academic information system;
- Periodic evaluation of each study subject is made by the students using questionnaires.
- The stakeholder's feedback system is based on periodical surveys and round tables. Students, graduates, teachers and employers are periodically asked to evaluate study subjects, study programmes and other aspects of academic life.

Weaknesses:

- Results from the surveys not published for students.

V. GENERAL ASSESSMENT

The study programme *Production Engineering* (state code – 621H70004) at Kaunas University of Technology is given **positive** evaluation.

Study programme assessment in points by evaluation areas.

No.	Evaluation Area	Evaluation of an area in points*
1.	Programme aims and learning outcomes	3
2.	Curriculum design	3
3.	Teaching staff	3
4.	Facilities and learning resources	3
5.	Study process and students' performance assessment	3
6.	Programme management	3
	Total:	**18**

*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 exceptionally good.

Grupės vadovas: Team leader:	Dr. Oluremi Olatunbosun
Grupės nariai: Team members:	Prof. Marti Casadesus
	Prof. Mats Hanson
	Mr. Audrius Jasėnas
	Ms. Dovilė Kurpytė

<…>

V. APIBENDRINAMASIS ĮVERTINIMAS

Kauno technologijos universiteto studijų programa *Gamybos inžinerija* (valstybinis kodas – 621H70004) vertinama **teigiamai**.

Eil. Nr.	Vertinimo sritis	Srities įvertinimas, balais*
1.	Programos tikslai ir numatomi studijų rezultatai	3
2.	Programos sandara	3
3.	Personalas	3
4.	Materialieji ištekliai	3
5.	Studijų eiga ir jos vertinimas	3
6.	Programos vadyba	3
	Iš viso:	**18**

*1 - Nepatenkinamai (yra esminių trūkumų, kuriuos būtina pašalinti)
2 - Patenkinamai (tenkina minimalius reikalavimus, reikia tobulinti)
3 - Gerai (sistemiškai plėtojama sritis, turi savitų bruožų)
4 - Labai gerai (sritis yra išskirtinė)

<…>

IV. SANTRAUKA

Kauno technologijos universiteto vykdomos magistrantūros studijų programos *Gamybos inžinerija* pagrindinės stiprybės ir silpnybės pagal kiekvieną išanalizuotą sritį:

2.1. Programos tikslai ir studijų rezultatai

Stiprybės:

- gebėjimai ir kompetencijos, kurie suteikiami studentams studijuojant pagal šią studijų programą, yra tinkamai aprašyti ir lengvai prieinami *Moodle* aplinkoje;
- internete rastas aprašymas rodo, kad programos turinys yra šiuolaikiškas, galintis išugdyti reikiamus įgūdžius, gebėjimus ir suteikiantis karjeros galimybių;
- pagrindinis studijų programos tikslas išdėstytas glaustai ir aiškiai;
- studijų programos savianalizėje nurodoma, kad darbo rinkai kasmet reikia universalių gamybos inžinierių, kurie gebėtų greitai persiorientuoti į skirtingas gamybos sritis.

Silpnybės:

- informacijos apie studijų programą galima rasti tik lietuvių kalba;

- išorės specialistų, skaitančių paskaitas studentams šioje studijų programoje, skaičius galėtų būti didesnis.

2.2. Programos sandara

Stiprybės:

- tai, kad studijų programa baigiama per 1,5 metų, patrauklu būsimiesiems studentams;
- programos sandara atitinka teisės aktų numatytus reikalavimus;
- dalykų ir (arba) modulių turinys atitinka studijų rūšį ir lygį, tai patvirtino ir socialiniai partneriai;
- į studijų programą įtraukti keli inovaciniai dalykai, pavyzdžiui, *Gamybos procesų automatizavimas*, *Inovacinės gamybos technologijos* ir *Kompiuterinės gamybos integravimas*.

Silpnybės:

- privalomųjų dalykų rinkinyje trūksta šių elementų: *Gamybos valdymas*, įskaitant šiuolaikinius vadybos metodus, *Kokybės vadyba*, *Pramonės sauga*, lakštinio metalo, plastikų ir kompozitų gamybos technologijos ir t. t. Vienas dalykas *Inovacinės gamybos technologijos*, kuris siūlomas kaip pasirenkamasis, apima daugumą šių elementų, derina *Gamybos valdymo* elementus ir inovacines gamybos sistemas. Jis turėtų būti privalomasis dalykas;
- kai kurių dalykų pavadinimai atrodo gana panašūs (pvz., *Kompiuterinis projektavimas* ir *Projektavimas automatizuotam rinkimui*; *Integruotosios CAD/CAE/CAM sistemos* ir *Kompiuterinės gamybos integravimas*), kai kurių turinys dubliuojamas;
- dalykas *Mechaniniai virpesiai* turėtų būti pasirenkamasis, ne privalomasis;
- dauguma pasirenkamųjų dalykų: *Produkto kūrimas*, *Kompiuterinė konstrukcijų analizė*, *Modernios metalinės medžiagos*, *Lydymo ir kristalizacijos procesai*, *Medžiagų savybių formavimas* ir *Medžiagų struktūros ir savybių tyrimas* yra būdingi metalo pramonei;
- neaišku, ar kuris nors iš studijų dalykų studentus supažindina su gamybos procesų technologine įranga ir jos pasirinkimo metodais;
- gamybos inžinieriai turi būti pasirengę dirbti vadovaujančiose pozicijose, tačiau šiuo metu nėra studijų dalyko, kuris ugdytų lyderystės meistriškumą, mokytų, kaip numatyti gamybos valdymo pokyčius ir juos išmanyti.

2.3. Personalas

Stiprybės:

- studijų programos personalas tinkamai suderintas;
- optimalus profesorių, docentų ir kitų specialistų skaičius;
- darbo krūvio paskirstymas taip pat optimalus. Personalo amžius demonstruoja pusiausvyrą, geras jaunų specialistų ir patyrusių profesionalų santykis;
- studijų programą vykdantys dėstytojai dalyvauja moksliniuose tyrimuose, kurie tiesiogiai susiję su vertinama studijų programa.

Silpnybės:

- kai kurie dėstytojai publikuoja straipsnius tik vietos, o ne tarptautiniuose žurnaluose.

2.4. Materialieji ištekliai

Stiprybės:

- studentams sudarytos geros sąlygos klausyti paskaitų, auditorijos nėra perkrautos, studentų skaičius grupėje optimalus;
- KTU bibliotekos patalpos visiškai atitinka studijų programos poreikius;
- laboratorijose naudojama daugiausiai šiuolaikinės pramonės programinė įranga, kuri yra naudojama gamyboje;
- studentai turi pakankamai darbo vietų dirbti savarankiškai, bibliotekoje lengva rasti naujausių leidinių ir knygų, jų skaičius yra pakankamas;

- laboratorijos gerai aprūpintos nauja technologine įranga, kuri yra būtina darbui laboratorijoje organizuoti. Įranga nuolat atnaujinama;
- geri bendrabučiai.

Silpnybės:

- nors auditorijos aprūpintos kompiuteriais, garso ir vaizdo įranga, interneto prieiga; laboratorijos – efektyviai veikiančia ir saugia laboratorijų įranga, tačiau pagrindiniai kompiuteriai galėtų būti atnaujinti;
- laboratorijos patalpos nėra visiškai išnaudojamos studijų programos studentų projektams.

2.5. Studijų eiga ir jos vertinimas

Stiprybės:

- dėstytojų ir studentų santykiai geri, paskaitos organizuojamos lanksčiai, atsižvelgiant į studentų, iš kurių dauguma dirba, poreikius. Mentorystės programa numatyta akademinei, karjeros ir socialinei paramai teikti atsižvelgiant į studento poreikius;
- Universitetas sudaro puikias sąlygas studentams dalyvauti „Erasmus+“ mainų programoje, nes yra sudarytos 23 bendradarbiavimo sutartys;
- absolventai įsidarbina pažangiose Lietuvos inžinerijos pramonės bendrovėse. Įsidarbinimo lygis – 100 proc. Dauguma absolventų dirba bendrovių padalinių vadovais, inžinieriais ir projektų vadovais, todėl daugumos absolventų profesinė veikla atitinka studijų programos vykdytojų lūkesčius;
- studijų eiga, studentų vertinimo sistema ir parama jiems yra aiški, aprašai viešai prieinami. Studentai supažindinami su jais per pirmąją dalyko paskaitą;
- socialiniai partneriai dalyvauja įgyvendinant ir tobulinant studijų programą.

Silpnybės:

- studentai turi galimybes dalyvauti studentų judumo programose, tačiau jų dalyvavimas tokio tipo programose yra labai menkas.

2.6. Programos vadyba

Stiprybės:

- aiški studijų KTU vidaus kokybės užtikrinimo sistema; kokybės užtikrinimo tradicijos katedroje; darbdavių, socialinių partnerių, studentų ir pramonės atstovų įtraukimas į studijų turinio tobulinimą, aiški eiga ir vertinimas; gera ir viešai prieinama akademinė informacijos sistema;
- studentai reguliariai vertina kiekvieną studijų dalyką pildydami klausimynus;
- dalininkų grįžtamojo ryšio sistema grindžiama periodiniai tyrimais ir apskritojo stalo diskusijomis. Studentai, absolventai, dėstytojai ir darbdaviai nuolat prašomi įvertinti studijų dalykus, studijų programas ir kitus akademinio gyvenimo aspektus.

Silpnybės:

- apklausos rezultatai nebuvo pateikti studentams.

<…>

III. REKOMENDACIJOS

1. Dabartiniame studijų programos pagrindiniame turinyje trūksta tam tikrų šiuolaikinių *Gamybos valdymo* technologijų elementų. Tačiau vienas iš pasirenkamųjų dalykų – *Inovacinės gamybos technologijos* įtraukia daugelį trūkstamų elementų, tokių kaip vienalaikė inžinerija ir taupi gamyba, aplinkos apsaugos, kokybės valdymas, pramonės sauga, greitasis prototipavimas, kompiuterizuotas procesų planavimas ir t. t. Tai turėtų pakeisti dalyką *Mechaniniai virpesiai*, kuris turėtų tapti pasirenkamuoju dalyku, siekiant

užtikrinti, kad visi studentai įgytų žinių ir įgūdžių, kurių privalo įgyti antrosios pakopos studijų programos *Gamybos inžinerija* absolventas. Kurso turinį reikia peržiūrėti, siekiant užtikrinti, kad studentai būtų supažindinti su šiuolaikinėmis *Skaitmenizuotos pramonės* koncepcijomis ir plačiai vartojamais terminais, pavyzdžiui, „4-oji industrinė revoliucija“ (angl. *Industry 4.0*), „duomenų saugumas“, „išmanioji gamyba“, „įmonės išteklių planavimas“ (angl. *Enterprise Resource Planning* ERP), „programinės įrangos integracija į procesų valdymo sistemas“ (angl. *Process Control Systems PCS*), „adityvinė gamyba“ (angl. *Additive Manufacturing*) ir t. t., ir jų taikymu.

2. Lakštinio metalo, plastikų ir kompozitų gamybos technologijos turėtų būti įtrauktos į privalomųjų dalykų turinį. Šios temos jau įtrauktos į modulį *Inovacinės gamybos technologijos*, kurį rekomenduojama padaryti privalomuoju dalyku (1-a rekomendacija). Be to, į dalyką reikėtų įtraukti gamybos procesų technologinės įrangos atrankos metodus.

3. Peržiūrėti dalykų *Gamybos strategija, Kompiuterinis projektavimas, Gamybos procesų automatizavimas* ir *Integruotos CAD/CAE/CAM sistemos* turinį, siekiant išvengti bet kokio dubliavimosi.

4. Labai svarbu, kad CNC programavimas būtų privalomojo dalyko dalis, tačiau buvo klaidingai informuota, kad tai – pasirenkamojo dalyko dalis. Mes nustatėme, kad CNC programavimas iš tikrųjų dėstomas dalyke *Gamybos procesų automatizavimas*, kuris yra privalomasis dalykas. Svarbu užtikrinti, kad CNC programavimas iš tikrųjų būtų dėstomas kaip šio dalyko dalis.

5. Informacija apie studijų programą turėtų būti prieinama ir anglų, ir lietuvių kalbomis.

6. Šiuo metu kai kurie dėstytojai savo straipsnius publikuoja daugiausiai tik vietos žurnaluose, tačiau jie turėtų stengtis orientuotis į tarptautinius žurnalus.

7. Kompiuteriai turėtų būti galingesni, kad juose būtų įgalima efektyviai naudoti inžinerinę programinę įrangą, reikalingą studentams.

8. Skatinti studentų dalyvavimą „Erasmus“ ir kitose tarptautinėse judumo programose.

9. Apklausų rezultatai turėtų būti plačiau skelbiami ir prieinami studentams.

10. Socialiniai partneriai turėtų aktyviau dalyvauti studijų programoje, skaityti daugiau paskaitų apie žinių pritaikymą pramonėje, taip pat pristatyti realias inžinerijos problemas, kurias reikia išspręsti, konsultuoti, kokie ištekliai padėtų jas įveikti.

11. Aktyviau naudoti mokslines laboratorijas, ypač magistrantūros studijų studentų projektams.

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Paslaugos teikėjas patvirtina, jog yra susipažinęs su Lietuvos Respublikos baudžiamojo kodekso 235 straipsnio, numatančio atsakomybę už melagingą ar žinomai neteisingai atliktą vertimą, reikalavimais.

Vertėjos rekvizitai (vardas, pavardė, parašas)