STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Kauno technologijos universiteto

GAMYBOS INŽINERIJOS IR TECHNOLOGIJŲ PROGRAMOS (612H70001)

VERTINIMO IŠVADOS

EVALUATION REPORT

OF *MANUFACTURING ENGINEERING AND TECHNOLOGIES* (612H70001)

STUDY PROGRAMME

at Kaunas University of Technology

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Išvados parengtos anglų kalba
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DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	***Gamybos inžinerija ir technologijos***
Valstybinis kodas	612H70001
Studijų sritis	technologijos mokslai
Studijų kryptis	gamybos inžinerija
Studijų programos rūšis	universitetinės
Studijų pakopa	pirmoji
Studijų forma (trukmė metais)	nuolatinė (4)
Studijų programos apimtis kreditais	240
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Gamybos inžinerijos bakalauras
Studijų programos įregistravimo data	2010-05-10

INFORMATION ON ASSESSED STUDY PROGRAMME

Name of the study programme	***Manufacturing Engineering and Technologies***
State code	612H70001
Study area	technological sciences
Study field	production and manufacturing engineering
Kind of the study programme	university studies
Level of studies	first
Study mode (length in years)	full-time (4), part time (6)
Scope of the study programme in credits	240
Degree and (or) professional qualifications awarded	Bachelor of Production and Manufacturing Engineering
Date of registration of the study programme	10-05-2010

CONTENTS

I. INTRODUCTION

In Kaunas University of Technology (KTU), the Faculty of Mechanical Engineering and Mechatronics operates the first cycle study programme *Manufacturing Engineering and Technologies* (further *MET*). The MET programme features mathematical, science, engineering and management subjects aimed to provide knowledge of manufacturing technologies and systems, as well as abilities to design and manage production processes. The programme is taught in Lithuanian.

The programme belongs to the area of Technological sciences and the study field of Production and Manufacturing Engineering according to the register of study and educational programmes by the Order No. 56 of 23 April 1994 of the Minister of Education and Science of Lithuanian Republic. It was registered in the Register of study and education programs in 2010-05-10. The state code is 621H70001.

Graduates of the programme are awarded the qualification of bachelor of production and manufacturing engineering.

II. PROGRAMME ANALYSIS

1. Programme aims and learning outcomes

The programme addresses an identified need from national industry, namely for production engineers who can design and operate conventional and well-known metal processing and parts machining manufacturing processes. This is the dominant market need. In Lithuania, there is also a need for some production engineers who know the most recent and sophisticated manufacturing technologies, but this is not an emphasized aim of the programme. Hence, the programme's view on production is relatively traditional although the use of modern CAD and CAM tools are brought forward.

The name of the programme is thus consistent with its aim and learning outcomes. The aims and outcomes are publicly available.

The programme learning outcomes are derived from the EUR-ACE requirements for 1st cycle degrees and thus established to international standards. The learning outcomes have been contextualized to the production context.

However, the contextualization is modest. It is achieved by editing the specific topics of the EUR-ACE syllabus to the MET context, typically by inserting "production", in the EUR-ACE outcomes, but the learning outcomes are not detailed further. This could have been done for, for example, the Knowledge and Understanding learning outcomes. Moreover, some learning outcomes are unclear or should have been decomposed further. For example, the exact meaning of C2 ("ability to apply knowledge and understanding for realisation of defined requirements of new designs") is not evident to this expert group and F2 ("ability to work independently and as a member of a team") comprises two different objectives, which by nature would be developed in different ways/subjects in the curriculum. A further decomposition of the outcomes would have given them a more precise definition, and thus a clearer description of what students know upon graduation, and what subjects that are responsible for their development. The high level of granulation of the learning outcomes results in a many-to-many mapping between outcomes and subjects. It is difficult to understand the precise contribution of the many subjects that contribute to particular learning outcomes.

There are good routines in place to annually update the learning outcomes, with respect to input from faculty, students and employers.

In conclusion, the programme aims are relevant, well defined and regularly updated. However, the relatively high level of generality of the learning outcomes is associated with some issues with the scope of the programme, as will be discussed in the next section.

2. Curriculum design

The MET programme consists of 240 ECTS credits, of which 63 ECTS are directly related with the speciality. 18 ECTS are allocated for specialization within the subject area. There are three specializations with altogether 9 alternative courses. 12 ECTS are optional. 12 ECTS are dedicated for the final degree project. The number of study subjects does not exceed 7 courses per semester. The MET programme curriculum thus meets the legal requirements set by the Ministry of Education and Science for the first cycle study programme.

The 240 ECTS duration is by international standards rather long for a bachelor degree, well exceeding the 180 ECTS which is the requirements in many countries and which is the baseline for the EUR-ACE standards for the 1st cycle. For the MET programme, the duration allows the programme to provide a good basis in mathematics and science, to develop specialized skills in manufacturing engineering, and to include a substantial practice period.

The MET programme develops specialized knowledge in manufacturing technologies and systems. Core subjects include manufacturing engineering, manufacturing organization and planning, cutting processes and tools, computer-aided process planning, management of production processes etc and are well in line with the area of production and manufacturing area. Topics in the later subjects reflect a specialized knowledge in selected parts of the area.

However, the boundary of manufacturing engineering is drawn rather narrowly, heavily focusing manufacturing of single parts. Automation is included to a very small extent, as is robotics. The information technology element does not seem to include a specific programming language nor are PLC programming skills developed. There is no course in control theory. The curriculum could be revised to substitute some mechanical engineering subjects for automation or to substitute some manufacturing technology for automation.

The sequence of the programme is very similar to that of a mechanical engineering programme with a specialization in manufacturing. In fact, there is only a 3 credit subject (Practice) in the core area of the programme during the first two years. The curriculum could be redesigned to allow for more exposure to its core area already during the first two years.

Drawing and computer-aided design skills are developed in a traditional way, starting with a 6 ECTS subject in the first semester that focused 2D drawings mainly. Solid modelling is not addressed until the 6th semester. Current CAD tools – which are available also at KTU – would enable the programme to start with solid modelling already in the first semester, generating drawings (essential parts of) and projections automatically from the solid model.

The programme further aims to educate engineers who can develop innovative products by having technical expertise, skills in modelling of components and computer aided analysis of structures, and ability to develop and analyse new mechatronic products and technologies. However, the curriculum does not quite live up to this claim. There is no training of programming of embedded systems – essential for the realization of any mechatronic product - in the curriculum, and there is also a lack of subjects that would educate students to apply innovative design methodologies.

It is positive that the curriculum includes a semester project with a particular focus. The project will improve the students' ability to work independently on complex problems. However, there is potential for expanding the project element in the curriculum further by, for example, having at least one semester project in each year of the study while varying the problem focus, the team size and composition and so on. The projects could explore the new capabilities of KTU's existing and renewed workshop facilities and simultaneously develop student skills in project management and communication.

3. Staff

The staff members who teach in the programme meet the legal requirements and have the appropriate qualifications. There is a sufficient number of staff. During the last six-year period four lecturers (out of 44) of the programme have changed, mostly due to retirement. Younger faculty have replaced the retired lecturers. The turnover is thus rather low but nevertheless the staff has a good composition in terms of age of faculty (average age 52 years).

The university provides relevant conditions for the competence development of the staff. Examples of competence development activities include courses in foreign languages, teaching methods, and engineering software. All full-time lecturers of the programme have been successfully certified by KTU for their pedagogic, scientific and public activities during the evaluation period.

The staff members generally have good contacts with Lithuanian industrial companies and some also with universities abroad.

The research profiles of the staff support well the curriculum's profile towards parts manufacturing. This is a strength in the sense that it makes it credible that the teacher group has a good competence across the programme's subjects.

The interviewed students evidenced that teachers give students good access to them, and that they are very helpful. There is a strong element of personal contact between teachers and students.

4. Facilities and learning resources

The programme has access to good auditoriums and to departmental and university libraries. The teaching materials available in the libraries (textbooks, books, electronic papers, journals) are adequate and access is good.

The laboratory equipment is good already and is being further renewed. When some complementary equipment has been acquired it will constitute a very good resource for the programme.

The students have access to a sufficient number of computers which are equipped with a modern suite of mathematics, design, analysis and manufacturing software. However, the software seems to be focused on mechanical and and manufacturing engineering topics; CAD, FEM, CAM. An increased element of automation in the programme should be supported by software for virtual development of production systems.

The programme provides sufficient spaces for individual learning. However, we were not shown any facilities nor are they described in the documentation for team-based projects. Students argued that the buildings are old and not structured for teamwork. A space for creative learning activities is needed. As noted above, such learning experiences could enhance the curriculum and would need support from adequate facilities.

There is adequate support for student's practice through the Department of Manufacturing Techologies and the university's Career Centre which provide for arrangement of student practice, including Career days and student excursions to companies.

5. Study process and student assessment

The program admits students with at least 12 years secondary or equivalent education. There are no specific requirements beyond this.

The self-evaluation report lists a wide range of teaching activities. The description shows that the programme is aware of the multitude of teaching activities needed to reach it learning outcomes. However, assessing whether appropriate learning activities are constructively

applied to achieve the learning outcomes of the programme would require some more specific information. For example, it is said that eight subjects apply problem based learning methods and that students solve complex and incompletely defined problems. However, no examples are provided of such projects, nor in which subjects they are included. The interviewed students and alumni asked for more practical learning activities.

The self-evaluation report further states that students are encouraged to do independent work and present their results in conferences for young scientists. Such achievements would be commendable and demonstrate that the programme develops deep technical knowledge in its students. However, no examples of such papers are listed in the report and it would seem that it is a somewhat premature claim, as no students have completed the programme yet.

The students are provided with adequate opportunities for participation in student mobility programmes. The participation is so far low, the students have not reached the third year when student exchange is recommended to take place. The programme's efforts in promoting international mobility are commendable.

There is good support for students from teachers, administrators, Career service, and the Centre of Academic Advance. Dormitories and sports facilities are satisfactory.

The assessment system is clear and publicly available. The grade is based on a weighted contribution of different assessment components, for example exam and homework. There is no account for the relationship between these components and the learning outcomes of the subject, nor of whether learning outcomes are considered as threshold (minimum) outcomes (everyone who passes the subject should master all of the learning outcomes) or aspirational outcomes (the subject learning outcomes define an excellent performance). A clarification of the relationship between the assessment elements and the learning outcomes would be helpful for students. A clarification of the specific learning outcomes associated with each grade level would be helpful for future employers, facilitating for them to understand the difference in capabilities between "10" and "6" grade students (for example), as well as for students, who would be helped to understand what to improve if they wish to improve their capabilities in a subject.

The interviewed alumni had all easily found employment corresponding to their degree. The interviewed employers were satisfied with the level of the graduates.

6. Programme management

A programme coordinator leads the programme. A programme committee with 15 members advises the programme coordinator. The chairman of the programme committee is the Dean of the Faculty. Most of the programme committee members are professors and one is an industry representative. There is also one student representative in the programme committee.

The programme is revised annually. The roles are clear and there is a programme renewal process: the programme committee and the department can decide on minor changes, whereas essential changes are brought to the Faculty Council for approval. There are student representatives in the Faculty Council. The programme coordinator ensures that changes are implemented.

The university has a new common electronic subject evaluation system under introduction. All subjects are evaluated. Faculty members review the results, and an external representative is also involved in the discussion. Results and published internally and externally.

The university also has a graduate follow-up system in place. The data indicates that the graduates of the programme find work in both Lithuanian and international companies, and often in leading roles.

In conclusion, the programme has a good management structure and an adequate quality system. When the new electronic subject evaluation system is fully operational, it will further support the programme's continuous improvement efforts.

III. RECOMMENDATIONS

1. Redesign the curriculum to include a stronger element of automation engineering, including subjects in PLC programming, manufacturing automation and control engineering
2. Develop a sequence of project-based subjects with varying focus and team composition, and include at least one in each year of the curriculum
3. Develop facilities for supporting student team projects, from creative to implementation phases

IV. SUMMARY

The bachelor programme in Manufacturing Engineering and Technologies at Kaunas University of Technology offers an education with a clear target in Lithuanian industry, emphasizing metals processing and parts manufacturing. It is an excellent starting point for a career as a process planner or production manager. It furthers develops a broad base in mechanical enginering which enables students to acquire the knowledge and skills essential for employment as mechanical design engineers. The programme aims and learning outcomes are derived from 1st cycle EUR-ACE specifications ensuring the programme's compliance to international standards. The 4-year duration of the programme further means that the minimum requirements of the EUR-ACE are well exceeded. The graduates develop knowledge and skills that are in high demand in Lithuanian industry and quickly find employment in their field. There are adequate library, auditorium and laboratory facilities. There is an adequate number of computers and the students have access to a state-of-the suite of design, analysis and manufacturing software. The staff is competent. There is a positive atmosphere between teachers and students. There is a good ecosystem for the students including university support functions, dormitories and sports facilities.

However, the programme's profile is relatively narrow for a production and manufacturing engineering programme. There is a marginal element of automation engineering that could be strengthened both in the compulsory subjects in the curriculum and as electives/as a specialization. The programme further claims to develop the skills to design innovative, mechatronic products. This is not reflected in the curriculum whose design elements rather reflect detail design of purely mechanical products. If the programme is to live up to this claim, some changes are needed. The programme could also develop stronger skills in project management and communication by including a sequence of team-based project subjects.

V. GENERAL ASSESSMENT

The study programme Manufacturing Engineering and Technologies (state code – 612H70001) at Kaunas University of Technology is given positive evaluation.

Study programme assessment in points by fields of assessment.

No.	Evaluation Area	Evaluation Area in Points*
1.	Programme aims and learning outcomes	3
2.	Curriculum design	3
3.	Staff	3
4.	Material resources	3
5.	Study process and assessment (student admission, study process student support, achievement assessment)	3
6.	Programme management (programme administration, internal quality assurance)	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.

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Vertimas iš anglų kalbos

KAUNO TECHNOLOGIJOS UNIVERSITETO PIRMOS PAKOPOS STUDIJŲ PROGRAMOS *GAMYBOS INŽINERIJA IR TECHNOLOGIJOS* (VALSTYBINIS KODAS – 612H70001) 2012-12-20 EKSPERTINIO VERTINIMO IŠVADŲ NR. SV4-175 IŠRAŠAS

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V. APIBENDRINAMASIS ĮVERTINIMAS

Kauno technologijos universiteto studijų programa *Gamybos inžinerija ir technologijos* (valstybinis kodas – 612H70001) 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

Gamybos inžinerijos ir technologijų bakalauro studijų programa Kauno technologijos universitete siūlo aiškiai į Lietuvos pramonę orientuotą išsilavinimą, daugiausia dėmesio skiriant metalų apdirbimui ir dalių gamybai. Tai puikus atspirties taškas procesų projektuotojo ar gamybos vadovo karjerai. Studijuojamos plačios mechanikos inžinerijos sritys, leidžiančios studentams įgyti žinių ir įgūdžių, būtinų norint dirbti mechanikos projektavimo inžinieriais. Programos tikslai ir studijų rezultatai yra suformuluoti pagal 1-osios pakopos EUR-ACE kriterijus, tokiu būdu užtikrinant programos atitiktį tarptautiniams standartams. Programos 4 metų trukmė reiškia, kad EUR-ACE minimalūs reikalavimai yra net viršijami. Absolventai įgyja žinių ir įgūdžių, kurie itin paklausūs Lietuvos pramonėje, todėl greitai randa darbą savo srityje. Studentai gali naudotis gera biblioteka, auditorijomis ir laboratorijų įranga. Kompiuterių pakanka ir studentai gali naudotis naujausios projektavimo, analizės ir gamybos programinės įrangos paketu. Personalas yra kompetentingas. Tarp dėstytojų ir studentų vyrauja teigiama atmosfera. Studentams sukurta gera aplinka, įtraukiant universiteto paramos paslaugas, bendrabučius ir sporto bazę.

Vis dėlto programos aprašas yra sąlyginai siauras gaminių ir gamybos inžinerijos programai. Programoje yra nežymus automatikos inžinerijos elementas, kurį būtų galima sustiprinti tiek studijų programos privalomuosiuose, tiek pasirenkamuosiuose dalykuose / kaip specializaciją. Programoje taip pat teigiama, jog vystomi įgūdžiai, reikalingi projektuojant pažangius, mechatronikos produktus. Šis teiginys neatsispindi studijų turinyje, kuriame projektavimo elementai daugiau atspindi išimtinai mechanikos produktų detalųjį projektavimą. Jei norima, kad minėtas teiginys būtų išpildytas programoje, reikalingi tam tikros permainos.

Programoje galėtų būti vystomi stipresni projektų vadybos ir komunikacijos įgūdžiai, įtraukiant į komandinį darbą orientuotus projektų dalykus.

III. REKOMENDACIJOS

1. Pertvarkyti programos turinį ir įtraukti stipresnį automatikos inžinerijos elementą, įtraukiant PLC programavimo, gamybos automatikos ir kontrolės inžinerijos dalykus.

2. Suformuoti projektais grindžiamų dalykų seką su skirtingomis temomis ir komandomis, ir bent vieną tokį dalyką įtraukti į kiekvienų metų programos turinį.

3. Aprūpinti studentus reikiamais ištekliais komandiniams projektams vykdyti nuo kūrybinio iki įgyvendinimo etapų.

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Paslaugos teikėja patvirtina, jog yra susipažinusi su Lietuvos Respublikos baudžiamojo kodekso[1] 235 straipsnio, numatančio atsakomybę už melagingą ar žinomai neteisingai atliktą vertimą, reikalavimais.

Vertėjos rekvizitai (vardas, pavardė, parašas)

[1] Žin., 2002, Nr.37-1341.