STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

KAUNO TECHNOLOGIJOS UNIVERSITETO STUDIJŲ PROGRAMOS *APLINKOSAUGOS INŽINERIJA* *(valstybinis kodas* – 621H17001*)* VERTINIMO IŠVADOS

EVALUATION REPORT of STUDY PROGRAMME *ENVIRONMENTAL ENGINEERING* (*state code* – 621H17001) STUDY PROGRAMME at KAUNAS UNIVERSITY OF TECHNOLOGY

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Išvados parengtos anglų kalba
Report language – English

DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	***Aplinkosaugos inžinerija***
Valstybinis kodas	621H17001
Studijų sritis	Technologijos mokslai
Studijų kryptis	Bendroji inžinerija
Studijų programos rūšis	Universitetinės studijos
Studijų pakopa	Antroji
Studijų forma (trukmė metais)	nuolatinė (2)
Studijų programos apimtis kreditais	120
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Aplinkos inžinerijos magistras
Studijų programos įregistravimo data	1992-12-16

INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme	***Environmental Engineering***
State code	621H17001
Study area	Technological Sciences
Study field	General Engineering
Type of the study programme	University studies
Study cycle	Second
Study mode (length in years)	Full-time (2)
Volume of the study programme in credits	120
Degree and (or) professional qualifications awarded	Master of Environmental Engineering
Date of registration of the study programme	16-12-1992

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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	Paper on Market need for Environmental engineers, 20.04.2016
2	Document about Marketing of Environmental Engineering study programmes
3	Description on up-dated study programme Management

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

Kaunas University of Technology (KTU) has evolved from the higher education courses established in 1920. KTU consists of 9 faculties, 10 research institutes, library and departments of administration and support. Structure and activities of the KTU are oriented towards research in the

area of sciences and technologies. KTU offers study programmes in six main fields: engineering, physical and social sciences, arts, humanities and biomedicine.

The second-cycle study programme in *Environmental Engineering* (Programme) is provided by the Faculty of Chemical Technology. The Department of Environmental Technology is in charge of the Programme delivery. Other structural units of KTU also participate in delivering the Programme. The previous evaluation of this Programme was conducted in 2012 and the programme was accredited for three years. The following recommendations were formulated: Revise the Master´s curriculum, eliminate repetitive subjects or themes and align with the curriculum of the Bachelor´s programme; Consider to change the name of the program as its content is heavily oriented towards Chemistry; "Environmental Chemistry" could be more appropriate for the current content of the curriculum; Encourage students to participate in mobility programmes and more actively participate in scientific research activity; Some of core subjects can be given in foreign language; Implement a course management system (e.g., e-learning software platform "Moodle") as a mandatory platform for all staff members; Modelling tools (numerical models) should be more widely promoted in the Master's theses; Outcomes of internal (especially students) and external (especially employers) evaluation of the program should be more effectively used for improvement of the programme.

The self-evaluation report (SER) for the external evaluation has been prepared by the self-analysis preparation group established by the Faculty of Chemical Technology Dean's order, No. V22-F-02-137, October 9, 2015. The group of eight member included a student representative and an employer's representative.

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 by the team on *2nd May 2016.*

1. **Prof. dr. Olav Aarna (team leader),** *International expert for quality assessment in HE, Adviser to the Managerial Board of Estonian Qualification Authority Kutsekoda, Vice-Rector for Research and Development, Estonian Business School, Estonia.*
2. **Prof dr. Judit Padisák,** *Director of Institute of Environmental Sciences, University of Pannonia, Hungary.*
3. **Prof. dr. Soon-Thiam Khu,** *Professor of Urban Water System Engineering, Head of Civil Engineering Department, School of Engineering, Monash University, Australia.*
4. **Ms. Lina Šleinotaitė-Budrienė,** *expert for environment protection, director of JSC "Ekokonsultacijos", Lithuania.*
5. **Ms. Inga Bačelytė,** *Master student of study programme "Applied ecology", Aleksandras Stulginskis University, Lithuania.*

II. PROGRAMME ANALYSIS

2.1. Programme aims and learning outcomes

The Programme aim and objectives are clear and well defined, and are broadly in-line with the KTU's strategy and also the vision of the Faculty of Chemical Technology. The Programme objectives are defined in terms of three expected competences of graduates (SER, p. 22):

1) knowing models and methods for collecting and analysing environmental information;
2) to be capable to combine in-depth knowledge of local and global environmental impact, with expertise on technologies and sustainable management to address environmental challenges;
3) to maintain the need for life-long professional perfection.

Whilst objectives (1) and (2) can be evaluated and verified by comparing the Programme structure, intended LOs, subjects' content and assessment methods, objective (3) is difficult to ascertain through the Programme. At a Masters' level, it may be more prudent to develop an alumni engagement programme, which could serve to not only gauge graduates life-long professionalism, but also ensure long-term interest and commitment of alumni to the Programme.

On the other hand, the SER (see p. 18) declares: "Graduates acquire deep fundamental and applied knowledge in environmental processes & engineering and are able to implement, supervise and maintain environmental protection technologies, analyse and assess efficiency of these technological systems as well as employ methods of environmental quality assessment and measures of pollution prevention. The graduates have skills of applying modern methods of instrumental analysis and carrying out complex laboratory research work, processing scientific, technical and legislative information as well as employ information technologies for the control of environmental systems. The graduate can carry out research, technological, expert, and consulting work in industrial enterprises dealing with water treatment, gaseous emission exhaust abatement and solid waste treatment or implement and maintain environment-friendly technologies, provide environmental services, assess and forecast the status of environment in various industries." This description of the graduates' competence profile derived from the Programme expected learning outcomes (LOs) is much more demanding and adequate. The expert team recommends revising of the Programme aim and objectives, to better explain the target profile of a specialist the Programme is aiming at, and making them coherent with the expected LOs.

The SER (see p. 25) declares: "The graduates of the study programme have research based knowledge in wastewater treatment, waste management, reduction of gaseous emission exhausts, but also a strong core in instrumental analysis, modelling of environmental processes and

technologies as well as experimental design and data analysis." After a detailed examination of the curriculum and the subject courses offered, the expert team revealed that although water environment and air environment are covered adequately, the same cannot be said for the soil. The task of an environmental engineer is not simply preventing pollution but also remediating polluted sites, that can be air, water or the solid phase (soil, rock). Success of any remediation can be judged only by having a clear understanding on the natural (original) status that needs knowledge of this status. For this reason, students must also gain knowledge on soil (formation, types, structure, properties). Therefore, the name of the Programme, its LOs, the content and the qualifications offered are only partially compatible with each other since one of the basic area of environmental issues, the soil component, is missing. For that reason, the expert team recommends to revise the Programme assuring balanced coverage of all three basic elements of environment – air, water and soil.

The programme learning outcomes (LOs) are formulated in accordance with the EUR-ACE framework, and are divided into six categories with a total of 17 LOs. The LOs of the individual subjects are well defined and contribute toward the programme LOs. Nevertheless, there are certain issues requiring revision. The tendency is to cover all the Programme LOs with maximum number of subjects (SER, Table 5), while having forgotten that all these LOs need to be assessed properly. In the subject descriptions LOs are listed in detail, but teaching and assessment methods are almost or exactly the same for different LOs. This indicates that the LOs are not incorporated intrinsically at subject level.

This is particularly true in the coverage of Engineering Analysis LOs B1-B4, and Engineering Design LOs C1-C3. For example, the LO B1 focusses on the "ability to solve non-typical, non-strictly defined and incompletely specified environmental problems and tasks" and is essentially addressing open-ended problems in environmental engineering. It would be extremely challenging to set tasks or problems to attain this LO for typical experiment-based analysis that focussed on delivering fundamental concepts and principles, such as Chemicals in Environment T270M123 (Table 5, p. 13, SER) with the aim "To understand behaviour of chemicals in the environment and to acquire skills of risk assessment" or in Thermal Analysis and X-Ray Phase Analysis P300M001 (ibid.) with the aim „To explore fundamentals of thermal analysis and X-ray powder diffraction methods, their use in qualitative and quantitative analysis". Thus, the assignments of LOs in subject courses ought to be looked into much more carefully.

The subject course in „Modelling of Environmental Processes and Technologies", (T270M121) has the aim: „Gain knowledge of environmental processes and environmental technologies modelling and be able apply them in a professional activities" (Annex A1). The aim is

about gaining knowledge, while the subject 12 LOs and their relations to the Programme LOs imply more than only knowledge. An interesting aspect is that all LOs should be assessed at oral examination. Again, such number of subject LOs is not feasible, and the method of assessment is unrealistic.

Another example of inappropriate relation between the Programme LOs and subject description is the Final Degree Project PR00M123 (Table 5, p. 13, SER). It has the aim: "To develop skills to analyse problems, reasonably choose experimental research methodology and perform research work, evaluate and interpret experimental data, draw conclusions". The aim and six LOs of the Final Degree Project are not contextualised, i.e. are irrelevant of the Environmental Engineering context. At the same time they are declared to cover all 17 LOs of the Programme, which is unrealistic, especially taking into account that all this has to be assessed.

The above issues point towards the need to take a constructive alignment approach in designing the Programme aims and expected LOs, subject LOs, delivery mode, and students' assessment. Starting from 1 September 2016 the Programme design should follow the requirements of *General Regulation of Technological Sciences (Engineering) Study Field* with six categories of LOs compatible with the EUR-ACE structure. The expert team recommends review the Programme aim and LOs following the principle of constructive alignment.

The Programme fulfils relevant academic and professional requirements. As revealed from the survey on the market needs and employability of graduates conducted by the SER team, and from the interviews with the students and the social partners, the Programme meets the labour market needs.

2.2. Curriculum design

The duration of the study programme is two years of full-time studies (120 ECTS). Studies are organised in semesters, the duration of one semester is 16 weeks. Semester load of full-time studies is 30 ECTS. Schedules of lectures are designed considering specificity of subjects and individual plans of the students (SER, p. 41). The curriculum design meets the legal requirements for second-cycle study programmes, and is sufficient to ensure the Programme LOs. The subject courses are spread evenly and the topics are not repetitive. The content of the subject courses ensures a good coverage of topics in Environmental Engineering, reflects the latest achievements in science and technology, while maintaining consistency with the type and level of a second cycle studies. Summarising, the scope of the Programme is sufficient to ensure the expected LOs.

The subject courses delivery methods are appropriate for the achievement of the intended LOs (except that the LOs do not address soil issues, see p. 2.1). As mentioned in p. 2.1, the

assessment methods should be further elaborated to be constructively aligned to the Programme and subject LOs. The curriculum is organised in a logical manner to ensure that students are able to acquire systematic knowledge in specific fields before advancing to comprehensive knowledge over broad spectrum of topics in environmental engineering.

The curriculum has been changed in accordance to the previous panel recommendations in 2012. In particular, six new courses covering a broader range of subjects and topics were introduced. Repetitive subjects were deleted and grouped and aligned with first-cycle study programme in Environmental Engineering. The expert team agrees that the current set of subject courses provides for a better second-cycle environmental engineering study programme. The students and alumni interviewed seemed to be satisfied with such changes.

In terms of process modelling content, there is some attempt to include a number of software packages, e.g. Modelling of Environmental Processes and Technologies T270M121, but it is not clear how are they being taught and in which courses are these software tools used.

It is expected that a second-cycle study programme in environmental engineering would embed the subject and concept of sustainable development across many courses. The expert team recommends to consider ways to include sustainable development issues in the core and compulsory subjects of the Programme. Such considerations should be viewed in conjunction with the Constructive Alignment approach (see p. 2.1).

2.3. Teaching staff

The Programme is provided by qualified academic staff meeting legal requirements. All academic staff have PhD degree or equivalent, and based on the scope and number of publications (SER Annex A2) demonstrate different degree of experiences in scientific research during the evaluation period. The scientific achievements of the Programme teachers appear to be adequate.

The number and composition of the teaching staff is adequate to ensure the delivery of programme content. The staff providing core and major field subjects comprised of two professors, four associate professors and four lecturers, with pedagogical experiences ranging from two to 36 years. This composition is adequate to ensure transfer of pedagogical knowledge from professors to lecturers and meeting teaching demands in the foreseeable future. Considering the small cohort, 10 academic staff gives a very good staff-student ratio of 1:2.8, and should create a positive learning environment to students. Although, the qualification of the teaching staff is adequate to ensure achievement of intended LOs, they need systematic training in constructive alignment and LOs based approach (see p. 2.1 and 2.6).

The expert team noted that there is an intention by the Department to tap into the international market to increase the student numbers. However, this must be accompanied by a systematic increase in the number of subject courses delivered in English as well as English proficiency training for the teachers.

In the area of pedagogical training, many teachers in the programme still employ traditional teaching methods. It was also noted that bureaucracy takes too much time from teachers and especially from those who are involved into administration process. While this is not an excuse for lack of continuous pedagogical improvement and embracement of information technologies in teaching, the panel hope to see progress in adoption of new teaching methods such as active learning or "flip learning". **Moodle** could be utilised more, not only in terms of expanding list of courses available but also in terms of more interactive delivery of tasks. Staff should be encouraged to participate in pedagogical training activities thereby adopting and developing new methods of course delivery. It is expected that at the second-cycle of study, students should be given more opportunity to self-study/ learn and to have more open-end exercises and assignments.

2.4. Facilities and learning resources

The premises for studies, such as classrooms, laboratories, and computing facilities are adequate both in size and quality for the delivery and practical training needs of the Programme. In addition, there are sufficient teaching materials (textbooks, books, periodical publications, databases) and they are readily accessible to students in the departmental library.

The "open access" principle adopted at the KTU, allowing the use of more than 800 pieces of research equipment for all researchers and students should be applauded. The opening of the Open Access Centre greatly facilitates the usage of specialised equipment which would otherwise be inaccessible without specialised training. This facility should encourage researchers to work better with both first and second students. It remains to be seen whether an increase in open access usage would lead to an enhancement in the quality and scope of final degree projects.

In the previous evaluation, it was suggested that the Programme should enhance teaching of modelling and usage of modelling software, which is appropriate at second study cycle. The expert team noted the inclusion of three subject courses to cater for some form of environmental modelling (T270M121, T270M122, and T270M829). However, only one of these courses is dedicated to environmental modelling (T270M121), while the other two provide basic knowledge of modelling, such as spatial analysis, time series analysis, etc. The expert team also observed the inclusion of a very good collection of specific software for use in the Programme. On the other hand, only a small

number of final degree projects were using these software tools. Hence the utilisation rate of the software could be better.

The Libraries have adequate collections of printed and on-line electronic resources such as books, periodicals, journals and magazines. The Department of Environmental Technology managed to maintain a good collection of essential reference books for easy accessibility.

Moodle is highlighted in the SER document as a depository of learning resources and expanding the list of courses available. The Department noted that Moodle has somewhat limited usage in the Programme, particularly to develop more innovative learning and teaching, delivery and assessment tools in order to help students enhance their learning experience. One of the reason for this may be due to inadequate training on the full capability of Moodle for both staff and students. The expert team encourages the Department and the Faculty take measures to activate the use of this important resource to enhance student learning as well as staff-student interaction.

2.5. Study process and students' performance assessment

The student admission procedure is well formulated, publicly available and follows legal regulations. The admissions is done in two stages, while the second stage is used to fill vacant study places. The number of applicants is increasing: 11 in 2011 and 28 in 2015, although this not a monotonous process. However, the number of places finally offered and accepted is constrained by the number of state-funded places. This has posed a severe limitation to expanding the size of the cohort. The Programme has not been able to attract self-funded students since the inception of the Programme. A major source of applicants is Bachelor's programme graduates who want to continue their studies to improve their employability. The expert team recommends developing of a long-term strategy to increase the student numbers.

The organisation of the study process ensures adequate provision of the Programme and the achievement of expected LOs. The students are given the opportunity to participate in research activities in the general areas of environmental engineering through their final degree projects.

The Final Degree Project is an essential component of any engineering curriculum. The expert team found the final degree project topics are rather very research focussed, with limited practical application or case study. It should be noted that this problem has also been raised during the meeting with stakeholders. Given the willingness of stakeholders and having in mind the aim of the Programme and better employability of graduates, the expert team recommends to broaden the scope of the final degree project topics, and involve stakeholders closely in proposing problems to be solved in the final degree projects.

A detailed examination of the final degree project also showed that the range of grades awarded to the projects is rather narrow. While this is in itself not necessary an area of concern, there is no evidence to demonstrate how these grades were formed.

The final degree projects are publicly defended, with the qualification (examination) commission consisting of at least seven members. The grade awarded to the final degree project consists of reviewers' evaluation, commissions' evaluation, and defence performance. Ten grade criterion scale is applied for assessing the final degree project. All members of the qualification commission participating in the thesis public defence give two separate grades for the thesis and the defence. The lever coefficient for the defence grade may compose up to 0,2 of the final grade. Final grade is the arithmetic average grade of all grades given by the commission members. The average grade is rounded down or up integer number (SER, Annex 1). This is sound and technically defensible and in-line with practices in different European universities. Unfortunately, there are no publicly available criteria for grading the thesis and the public defence.

The assessment system of students' performance seems clear to the students and publicly available on Moodle. Students and alumni seem to be satisfied that the current system is fair and they do not question the transparency of the process of assignment of grades. However, one of the areas of concern mentioned by the students is the lack of availability and adequacy of feedbacks of assignments.

The existing students' assessment system is not based on LOs approach. Therefore, the expert team recommends to reconsider it in the context of revising the Programme aim, expected LOs, Programme delivery and students' assessment using constructive alignment approach.

The Programme is designed in an appropriate manner (blocks of 6 credits) to facilitate mobility of students in Europe and internationally. Students are encouraged to study abroad for 3-6 months under the ERASMUS (currently ERASMUS +) scheme, and the university has agreements with many universities. Many students interviewed stated that they have the intention to participate but there are constraints of family and language. The expert team encourages KTU to increase the number of courses delivered in a foreign language, thus reducing one of the barriers.

Professional activities of the majority of graduates meet the programme providers' expectations.

2.6. Programme management

The quality management system at KTU, covering the areas of management and administration, student support, infrastructure and human recourses, management of studies, research and applied activities monitoring, analysis and improvement processes, are carried out in

compliance with the Senate decisions, orders of the Rector, regulations, rules, and procedure descriptions. The study programme administration and quality assurance are managed by the Vice-rector for studies with the help of Departments of Academic Affairs, Study Programs, Student Affairs and other administrative units.

In 2013 KTU started and has been implementing the study programme management system renewal. Since 2014 the new Study Programme Committees (SPCs) have been established according to the groups of study fields. The Programme in Environmental Engineering is assigned to the SPC of Chemistry, Physics, Chemical Engineering, Environmental Engineering, Biotechnology, Food Science fields of study.

The Programme is managed, renewed and improved by this SPC. The committee cooperates with the Studies and Academic Culture Committee of the KTU Senate and has the Programme manager from the Department of Chemical Technology. Changes to the programme are approved by the Faculty Council. The SPC meetings are held as and when required, averaging 3–4 meetings per semester with more frequent meetings during the Fall semester. It was mentioned that the Fall semester is devoted to renew study subjects, with the study programmes accredited / re-accredited for the next academic year (SER, p. 30).

Manager of the Programme carries responsibility for the content and quality of the Programme. The manager is responsible for forming of the Programme aim and LOs, prepares proposals for changes of the Programme or subjects content, consults students, teachers and administration on preparation of the Programme and subjects' content, individual study plans, analyses results feedback form students and teachers and prepares plans for further improvements (SER, p. 195).

From the previous description it is clear, that in the present programme management system the Programme manager is personally responsible for all strategic decision, because the SPC is managing a larger group of diverse study programmes. This has led to the lack of wider ownership of the Programme, and limited involvement of internal and external stakeholders in the Programme design, development and implementation processes. The lack of ownership has severe consequences in strategic planning and implementation of changes to the Programme. Therefore, the expert team recommends establishing of a dedicated SPC for each study programme, involving representatives of students, alumni and employers. The membership of the SPC should be made publicly available. Additionally, documented evidence about decisions taken by the SPC should also be made publicly available.

Information and data on the implementation of the programme are collected and analysed. There is some evidence that teachers analyse students' results as a surrogate of LO attainment, but

they do not discuss the findings with the students. Thus, a process of feedback is apparently informal and not documented. Such lack of documentation does not allow the programme committee to assess the effectiveness of course feedbacks as well as structural programme review.

Most of the problems encountered in this report with respect to the Programme aim and LOs, curriculum design, Programme delivery, and students' assessment are caused by the fact that the implementation of the LOs approach does not follow the constructive alignment paradigm (see p.2.1, 2.2 and 2.5). Therefore, the expert team recommends:

1. the KTU management to organise university-wide systematic training and support of teaching staff in implementing the constructive alignment approach in programme design and delivery;
2. the Study Programme Committee to follow the constructive alignment approach in the Programme design and implementation, and develop students' and other stakeholders' understanding of LOs based approach.

III. RECOMMENDATIONS

1. Revise the Programme aim and objectives, better explaining the target profile of a specialist the Programme is aiming at, and making them coherent with the expected LOs.
2. Revise the Programme assuring balanced coverage of all three basic elements of environment – air, water and soil.
3. Constructive alignment principles must be embedded in programme structure, programme outcomes, course assessment methodologies and learning outcome. Teachers must be made aware of the principle when they structure their courses, and develop assessment criteria for their assignments.
4. Motivate teachers to utilise different modes of teaching including the virtual learning platform and to develop innovative teaching methods to enhance students' learning experience.
5. Broaden the scope of the final degree project topics, and involve stakeholders closely in proposing problems to be solved in the final degree projects.
6. Develop a long-term strategy to increase the student numbers.
7. Establish a dedicated Study Programme Committee for each study programme, involving representatives of students, alumni and employers.
8. KTU management to organise university-wide systematic training and support of teaching staff in implementing the constructive alignment approach in programme design and delivery.
9. Study Programme Committee to follow the constructive alignment approach in the Programme design and implementation, and develop students' and other stakeholders' understanding of LOs based approach.
10. International mobility of students should be enhanced.

IV. SUMMARY

The Programme aims and objectives are clear and well defined, and are broadly in-line with the KTU's strategy and also the vision of the Faculty of Chemical Engineering. The Programme objectives broadly conform to the national requirements for the second-cycle of studies (Master degree). The Programme learning outcomes (LOs) are formulated in accordance with the EUR-ACE framework. The LOs of the individual subjects are well defined and contribute toward the Programme LOs. The curriculum design meets the legal requirements for second-cycle study programme in Environmental Engineering. The sequence of subject courses is also organised in a logical manner. The curriculum has been changed to include a broader range of subjects and topics. The current set of subject courses provides for a better second-cycle environmental engineering study programme. The students and alumni interviewed seemed to be satisfied with such changes. The Programme meets the labour market needs. Nevertheless, the programme should be re-examined to ensure although balanced coverage of all three basic elements of environment – air, water and soil, and embed the subject and concept of sustainable development across many courses in the Programme. The most important issue to be solved is fully implementing the constructive alignment approach in designing the Programme aims and expected LOs, subject LOs, delivery mode, and students' assessment. Starting from 1 September 2016 the Programme design should follow the requirements of *General Regulation of Engineering Study Field.*

The Programme is delivered by a qualified academic staff meeting legal requirements. The number and composition of the teaching staff is adequate to ensure the delivery of Programme content. Considering the small student cohort, the Programme has a very good staff-student ratio, and creating a positive learning environment. On the other hand, teaching staff needs systematic training and support in implementing the constructive alignment approach in Programme design and delivery.

The premises for studies, such as classrooms, laboratories, and computing facilities are adequate both in size and quality for the delivery and practical training needs of the programme. The "open access" centre at the University greatly facilitates the usage of specialised equipment which would otherwise be inaccessible without specialised training. This facility should encourage researchers to work better with both first and second cycle students, and should be applauded. The provision of Moodle is at a minimal level and this or other virtual learning platform should be explored to enhance student learning as well as staff-student interaction. The assessment system of students' performance seems clear to the students and publicly available on Moodle, while contextualised assessment criteria need to be developed to all subject courses offered. One of the

areas which was mentioned by the students was the lack of availability and adequacy of feedbacks of assignments.

The responsibilities for decisions, and monitoring and implementation of the Programme is clearly stated and Programme is managed by the Programme manager. This has led to lack of wider ownership of the Programme, which has severe consequences in strategic planning and implementation of changes to the Programme. Therefore, it is recommended to establish a dedicated Study Programme Committee for each study programme, involving representatives of students, alumni and employers.

V. GENERAL ASSESSMENT

The study programme *Environmental Engineering* (state code – 621H17001) 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	2
2.	Curriculum design	3
3.	Teaching staff	3
4.	Facilities and learning resources	3
5.	Study process and students' performance assessment	2
6.	Programme management	2
	Total:	**15**

*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: **Prof. dr. Olav Aarna**

Grupės nariai:
Team members: **Prof. dr. Judit Padisák**

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Vertimas iš anglų kalbos

KAUNO TECHNOLOGIJOS UNIVERSITETO ANTROSIOS PAKOPOS STUDIJŲ PROGRAMOS *APLINKOSAUGOS INŽINERIJA* (VALSTYBINIS KODAS – 621H17001) 2016-09-22 EKSPERTINIO VERTINIMO IŠVADŲ NR. SV4-210 IŠRAŠAS

<...>

V. APIBENDRINAMASIS ĮVERTINIMAS

Kauno technologijos universiteto studijų programa *Aplinkosaugos inžinerija* (valstybinis kodas – 621H17001) vertinama teigiamai.

Eil. Nr.	Vertinimo sritis	Srities įvertinimas, balais*
1.	Programos tikslai ir numatomi studijų rezultatai	2
2.	Programos sandara	3
3.	Personalas	3
4.	Materialieji ištekliai	3
5.	Studijų eiga ir jos vertinimas	2
6.	Programos vadyba	2
	Iš viso:	**15**

* 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)

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IV. SANTRAUKA

Magistrantūros studijų programos *Aplinkosaugos inžinerija* tikslai ir uždaviniai yra aiškūs ir apibrėžti, jie iš esmės atitinka KTU strategiją ir Cheminės technologijos fakulteto viziją. Šios programos tikslai iš esmės atitinka antrosios pakopos (magistrantūros) studijoms keliamus nacionalinius reikalavimus. Numatomi studijų rezultatai formuluojami laikantis EUR-ACE inžinerijos programų akreditavimo standarto nuostatų. Numatomi atskirų dalykų studijų rezultatai yra apibrėžti ir prisideda prie numatomų programos studijų rezultatų. Programos sandara atitinka teisės aktų reikalavimus antrosios pakopos aplinkosaugos inžinerijos studijoms. Studijų dalykai išdėstyti nuosekliai. Atlikti programos turinio pakeitimai – įtraukta daugiau temų ir dalykų. Dabartinis studijų dalykų rinkinys užtikrina geresnę antrosios pakopos studijų programos *Aplinkosaugos inžinerija* kokybę. Atrodo, kad studentai ir absolventai, su kuriais buvo kalbėtasi, yra patenkinti šiais pakeitimais. Programa atitinka darbo rinkos poreikius. Tačiau ją reikėtų persvarstyti siekiant užtikrinti, kad į studijas būtų vienodai įtraukti visi trys pagrindiniai elementai – oras, vanduo ir dirvožemis, o į daugelį šios programos dalykų – tvaraus vystymosi tema bei

koncepcija. Svarbiausias spręstinas klausimas yra visiškas darnaus išdėstymo metodo įgyvendinimas numatant programos tikslus ir numatomus studijų rezultatus, dalykų studijų rezultatus, dėstymo būdą ir studentų vertinimą. Nuo 2016 m. rugsėjo 1 d. šios studijų programos sandara turėtų atitikti *Inžinerijos studijų krypčių grupės aprašo* reikalavimus.

Šią programą įgyvendina kompetentingi dėstytojai, kurių kompetencija atitinka teisės aktų reikalavimus. Dėstytojų skaičius ir sudėtis užtikrina tinkamą programos turinio perteikimą. Atsižvelgiant į tai, kad šios programos studentų yra nedaug, dėstytojų ir studentų santykis yra labai geras, ir tai lemia palankią studijų aplinką. Antra vertus, reikia sistemingai mokyti dėstytojus ir teikti jiems pagalbą, susijusią su darnaus išdėstymo metodo įgyvendinimu rengiant ir įgyvendinant šią programą.

Studijoms skirtos patalpos, pavyzdžiui, auditorijos, laboratorijos ir kompiuterių įranga, yra tinkamos kokybės, jos pakanka šiai programai vykdyti ir praktinio mokymo poreikiams tenkinti. Universitete esantis atviros prieigos centras labai palengvina naudojimąsi specializuota įranga – tai nebūtų įmanoma be specialaus mokymo. Tai sveikintina priemonė, kuri turėtų paskatinti tyrėjus geriau dirbti su pirmosios ir antrosios studijų pakopos studentais. *Moodle* aplinka užtikrinama minimaliai, taigi reikėtų ištirti galimybę naudoti šią ar kitą virtualią mokymosi aplinką siekiant sustiprinti studentų mokymąsi ir dėstytojų bei studentų bendravimą. Atrodo, kad studijų rezultatų vertinimo sistema studentams yra aiški ir viešai prieinama *Moodle* aplinkoje, nors visų siūlomų studijų dalykų vertinimo kriterijus reikia kontekstualizuoti. Viena iš sričių, kurią studentai minėjo per pokalbius, buvo grįžtamojo ryšio apie užduotis stoka.

Aiškiai nustatyta atsakomybė už sprendimus ir šios programos įgyvendinimo stebėseną; programai vadovauja programos vadovas. Dėl šios priežasties nesidalinama platesne atsakomybe (*ownership*) už šią programą, kas tai turi sunkių pasekmių strateginiam planavimui ir programos pakeitimų atlikimui. Todėl rekomenduojama kiekvienai studijų programai steigti specialų atskirą studijų programos komitetą, į kurį būtų įtraukti studentų, absolventų ir darbdavių atstovai.

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III. REKOMENDACIJOS

1. Persvarstyti magistrantūros studijų programos *Aplinkosaugos inžinerija* tikslus ir uždavinius ir geriau išryškinti tikslinį siekiamo parengti specialisto profilį bei suderinti juos su numatomais studijų rezultatais.
2. Persvarstyti programą užtikrinant, kad ji vienodai apimtų visus tris pagrindinius aplinkos elementus – orą, vandenį ir dirvožemį.

3. Programos sandaroje, programos studijų rezultatuose, dalykų vertinimo metodikoje ir numatomuose studijų rezultatuose turi būti įtvirtintas darnaus išdėstymo principas (*constructive alignment approach*). Su šiuo principu būtina supažindinti dėstytojus, kurie sudaro dalykų turinį ir nustato užduočių vertinimo kriterijus.
4. Skatinti dėstytojus taikyti įvairius mokymo būdus, įskaitant virtualią mokymo(si) aplinką, ir kurti naujoviškus mokymo metodus siekiant sustiprinti studentų mokymosi patirtį.
5. Didinti studentų baigiamųjų darbų temų įvairovę ir siekti, kad socialiniai dalininkai glaudžiai bendradarbiautų, siūlydami, kokios problemos turi būti sprendžiamos baigiamuosiuose darbuose.
6. Parengti ilgalaikę strategiją, skirtą studentų skaičiui padidinti.
7. Kiekvienai studijų programai steigti specialų studijų programos komitetą, į kurį būtų įtraukti studentų, absolventų ir darbdavių atstovai.
8. KTU vadovybė (turi) universiteto mastu organizuoti sisteminį dėstytojų mokymą ir teikti pagalbą, susijusią su darnaus išdėstymo metodo taikymu jiems sudarant bei įgyvendinant programą.
9. Studijų programos komitetas (turi) laikytis darnaus išdėstymo metodo, taikytino sudarant ir įgyvendinant šią programą, ir formuoti studentų bei kitų socialinių dalininkų supratimą apie studijų rezultatais pagrįstą požiūrį.
10. Turėtų būti didinamas tarptautinis studentų judumas.

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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)