



STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Vilniaus universiteto  
***APLINKOS IR CHEMINĖS FIZIKOS PROGRAMOS***  
**(621F30001)**  
**VERTINIMO IŠVADOS**

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**EVALUATION REPORT OF *ENVIRONMENTAL AND***  
***CHEMICAL PHYSICS (621F30001)***  
**STUDY PROGRAMME**  
at Vilnius University

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Išvados parengtos anglų kalba  
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## DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	<i>Aplinkos ir cheminė fizika</i>
Valstybinis kodas	621F30001
Studijų sritis	Fiziniai mokslai
Studijų kryptis	Fizika
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	Fizikos magistras
Studijų programos įregistravimo data	2000-06-16, Nr. 831

## INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme:	<i>Environmental and chemical physics</i>
State code	621F30001
Study area	Physical sciences
Study field	Physics
Kind 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 Physics
Date of registration of the study programme	16/06/2001, No. 831

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The Centre for Quality Assessment in Higher Education

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## I. INTRODUCTION

The Evaluation Report was prepared about the Study Programme of *Environmental and Chemical Physics* at Vilnius University (hereinafter VU). This second cycle programme is in the Study area of Physical Sciences, its study field is Physics and gives out a qualification degree of Master of Physics. The programme was registered on 16/06/2001 (No. 831). The members of the Expert Team, who were responsible for the Evaluation Report, were selected and appointed by the Centre for Quality Assessment in Higher Education of Lithuania. The personal composition of the Team can be seen on the cover page of the Evaluation Report.

The study programme is one of the nine second cycle programmes in Physics at the Faculty of Physics at Vilnius University. This programme is an important member of the second cycle programme family, because its topics deal with one of the fields of physics, which is very needed by the modern society and by Lithuania in particular. The *Environmental and Chemical Physics* master programme belongs to the field of science, whose graduates care about the environmental problems unavoidably showing up with the technological development of the 21<sup>st</sup> century.

The Evaluation Report has been prepared on the basis of the study of the Self Assessment Report and with the help of a series of group discussions with different teams of affected people on the 10<sup>th</sup> of October, 2013. There was a discussion (already on the 8<sup>th</sup> of October) with the administration staff, on which every responsible partner was present from the side of the Faculty of Physics. A meeting was organized with the staff responsible for preparation of Self-Assessment Report (two members of the staff were there). Then the Expert Team had a meeting with the teaching staff (7 people, about half of the teachers, were present) and with the students (4 students, about a quarter of all the students of the programme were there). The Expert Team - already on the 8<sup>th</sup> of October - visited the auditoriums, libraries of the departments, teaching laboratories used in the educational process. The experts had the possibility to familiarize with the thesis documents of the graduates of the master programme. It was followed by meeting with alumni (3 persons participated) and with a discussion with social partners, with 3 persons representing top managerial positions. The site visit was concluded by a discussion with the partners responsible for the master degree study programme *Environmental and Chemical Physics*.

All these steps of the evaluation process took place without any disturbing affairs, fully according to the rules of the Centre for Quality Assessment in Higher Education of Lithuania. The Expert Team evaluated all the gathered information in closed section. The Evaluation Report of *Environmental and Chemical Physics* was accepted by all members of the Expert Team with a one vote will.

## II. PROGRAMME ANALYSIS

### *1. Programme aims and learning outcomes*

This study programme has four well formulated and interlinked aims. After graduating the students:

- A. Will acquire competences directly related to the application of modern achievements in physics and mathematics in the fields of environmental and chemical physics;
- B. Will become familiar with contemporary tools and methods of materials science experimental research and the ability to apply those tools in practical activities;

- C. Will become aware of the importance and of the methods of the solution to the contemporary global problems in the areas of environmental research, environmental protection, and chemical physics; the awareness of scientific and technological breakthroughs which are applied now or will be applied soon in those areas;
- D. Will acquire the ability, both individually and as a team, to adequately participate in the global discourse on the issues of environmental and chemical physics through work publications and presentations at scientific conventions, as well as in the e-sphere via the Internet networks.

The Experts Team concludes that the aims and corresponding learning outcomes of the study programme are clear, self-consistent and comply with legal, scientific and pedagogical requirements; they are also publicly accessible.

The Expert Team also acknowledges the fact that the learning outcomes of the given study programme focus on deeper understanding of physical principles and the use of natural laws and mathematical relations to solve problems in the fields of environmental research, radiation safety and modern materials science. Therefore there is a clear complementarity with similar type study programmes active in other Universities, that are based more on direct applications and engineering principles.

An additional strength of this programme is that it is well equilibrated in terms of theoretical and practical courses, thanks to wide and modern experimental facilities available. It is also nicely complemented by the concrete examples of various applications in environment, radiation protection and materials research. Without any doubts the graduates from this programme will be able to update and boost their knowledge and to apply it in a rapidly changing labor market, being continued research at doctoral studies or subject related industries.

The Expert Team also acknowledges that the programme has been quite dynamic in the last few years thanks to its continuous upgrading in terms of the structure (new course-units are incorporated instead of less relevant ones) as well as the content (the latest scientific advances in the fields of environmental and chemical physics are presented, new technologies and experimental methods are introduced, etc.). The programme managers should continue their efforts to keep the experimental laboratories up to dated and ensure their necessary funding for justified upgrades, including sufficient budget for operation and maintenance.

## ***2. Curriculum design***

The programme is composed so that the students get familiar with the latest concepts and theoretical approaches together with experimental methods dedicated in the field of environmental and chemical physics. Within this, students have to acquire skills to perform targeted experiments, analyze and summarize their results. Also the latest scientific facilities and recent scientific achievements are included to ensure comprehensive background and fulfill the defined aims of the study programme. A significant part of the programme is dedicated to the experimental work both in educational and scientific laboratories, especially by encouraging the students into scientific research. Both compulsory and optional course units as well as practical tasks are oriented to this activity. Students are encouraged to take part in research work as early as in their first semesters of studies, providing course papers and laboratory tasks in research laboratories; in the second year of studies specialization practical activity is introduced and a lot of time is dedicated for final thesis preparation.

The content of the programme and the sequence of the course units are balanced between theoretical aspects and practical experiences providing basic knowledge, experimental skills and analytic, synthetic and assessment skills in two main directions: 1) environmental research related topics like radiation safety and material science methods, 2) chemical physics methods especially by the use of different spectroscopic approaches. There is also adequate amount of

theoretical courses presented to support experimental methods background. While choosing optional subjects, the students have a possibility to focus on their preferred direction. The choice corresponds to a top-level research performed on these directions in Lithuania. The study programme has updated several courses and introduced also new ones. The main changes were as follows:

In the 1st semester – 'Applied Optics' was replaced by 'Digital Optics'; 'Nuclear Incidents Analysis' was replaced by 'Safety in Nuclear Energy'; 'Process Modeling' was discarded, whereas the contents of 'Physics of Molecular Processes' were extended; 'Physics and Chemistry of Surfaces' was incorporated into a new course-unit 'Physics of Surfaces and Nano-materials'.

In the 2nd semester – the course-unit 'Experimental Spectrometry' was updated (the equipment for laboratory work was substantially replaced and renewed); new course-units were introduced: 'Physics of Surfaces and Nano-materials', 'New Systems of Nuclear Energy' and 'Optical Biosensors'. 'Quantum Fields', 'Elementary Particles and Cosmology', 'The impact of Electromagnetic Radiation on Humans' and 'Application of Group Theory in Spectroscopy' were discarded (the latter two were integrated in other course-units).

In the 3rd semester – the course-unit 'Nuclear Reactor Physics and Neutronics' was removed to the 2nd semester, whereas 'Kinetic Spectroscopy' was shifted to the 1st semester. The following new course-units were introduced: 'Modern Vibrational Spectrometry', 'Spectrometry of Nanosystems', 'Physics of Heat and Mass Transfer' and 'Applied Nuclear Spectrometry'.

The 4<sup>th</sup> semester focuses exclusively on the accomplishment of the final Master thesis. All changes have modernized the study programme. All these topics are related to the environmental issues and therefore have significant impact monitoring Lithuanian environmental situation. Only highly qualified specialists who are able to analyse and assess, can initiate and develop this topic. The programme also contains certain courses improving the students' basic preparation in physics, necessary to master special courses at a higher level. All above-mentioned aspects ensure the balanced and well-spread distribution of lectures. With this Expert Team also confirms the fulfillment of legal requirements of the study program.

However, as many spectroscopic methods are directly related to the biology related investigations, Expert Team recommends including introductory course about biology related challenges. This is directly related with programme aims concerning environmental in chemical physics application aspect and helps to create synergy. The study subjects and modules are well designed and divided rationally between semesters.

The overall list of courses is relevant to the study programme and there are no repetitive courses. The levels of the courses correspond to the study programme level. The scope of the programme covers mostly learning outcomes. Most of the study programme aims are also covered with courses.

Another issue is related with final thesis documents. In most cases the thesis composition was not clearly presented. Only one out of 10 reviewed thesis abstract started with sentence: "The aim of current work is..". Others just described the content, the activities and measurements results. Therefore, Expert Team recommends explaining more in detail to the students the final thesis composition style and format. One possible way for it could be introducing a new course about presentation of scientific articles and thesis documents. As stated in one learning outcome, the student "Will be able to provide scientific content to professional audience in scientific conferences, publications as well as in e-sphere, e-conferences via the Internet networks; will be able to collect the information necessary for work." there should be probably an additional mandatory course about composing scientific reports and thesis documents.

Another issue is with achieving professional knowledge in English. In communication with students they presented their will to have more seminars presented by foreign scientists to

engage more updated knowledge's and therefore improve their scientific language. Expert Team encourages study programme leaders to find more lecturers from abroad.

One of the strongest aspects in this particular study programme is well-motivated lecturers with strong scientific background. It is not typical that study programme lector is also active in teaching and same time successful in high-level science. Most of lectures have related scientific interests and therefore there is a direct link between course content and latest achievements in science.

Students also expressed their will to concentrate weekly based lectures in two days to have more consistent time in scientific labs. One potential improvement issue is to tighten relationships with institutions outside of the University for providing students additional practice opportunities. Therefore it is highly recommended to establish new or strengthen existing contacts with them for students practice places.

### **3. Staff**

The teaching staff is optimal for this study programme. The staff of 16 teachers of the Faculty of Physics work with the students of the second cycle study programme *Environmental and Chemical physics*: 9 professors (6 habilitated doctors, 3 academic doctors) and 7 associated professors (all doctors of science). 5 professors and 3 associated professors work at the University in full-time positions, whereas the other staff are employed under the fixed-time work agreements. Practical work experience of the teachers is approximately 31.5 years, teaching experience – 18.5 years. The average age of the teaching personnel is sustainable as it currently is 56. Only the staff of the Faculty of Physics and of the Centre for Physical Sciences and Technology is involved in the implementation of the study process. The lectures, practical classes and laboratory work are run by habilitated doctors and professors or doctors associated professors. In the Master programme there is one teacher whose main workplace is not Vilnius University, Faculty of Physics. He is a graduate of the Faculty of Physics, now a doctor of sciences who works as the Head of a department at The State Nuclear Power Safety Inspectorate. Expert Team confirms the importance of engagement of the lecturers outside of the University.

The average contact workload of the teachers who work in the second cycle programme *Environmental and Chemical Physics* is 48 working hours. Apart from the pedagogic work, all academic staff is engaged in scientific research participating in various national and international projects. The results of those projects are continuously being used in updating the contents of the course units. This is mandatory for course units related to modern spectroscopic methods. Participation in scientific and methodological projects is directly related to the teachers' qualification development. All teachers are experts in their own topic and that ensures the teaching subject quality. Many lecturers have outstanding H-index that confirms above made statements. Teaching staff is financially encouraged to publish articles by being offered salary bonuses. The majority of the programme's lecturers has experience in working at European universities, have productive academic contacts with foreign scientists.

During the site visit, students expressed their will to have more lectures in English. This could help them into entering to the real scientific work internationally. Expert Team encourages study programme leaders to engage more foreign lecturers into study process through seminars or lecture courses. Faculty administration is also active in recruitment of new teaching personnel. Among the PhD students who have defended their thesis in the faculty the best ones are invited to teach.

### **4. Facilities and learning resources**

The premises for studies are adequate both in their size and quality. Study programme *Environmental and Chemical Physics* has 5 study laboratories and one classroom for lectures and

seminars at the VU Department of General Physics and Spectroscopy. Besides, other classrooms are also available for the students of this and other study programmes. The classroom of the Department of General Physics and Spectroscopy (42 sq. m, 48 working places) underwent repairs in 2010; the classroom furniture was replaced (15 000 Lt) and a stationary multimedia projector was installed. Physical experiments are performed in 5 study laboratories and computer classrooms, which are located in the VU Information Technologies Application Centre (47 computers in total). Some laboratory work is partially performed in the scientific research laboratories of the Department of General Physics and Spectroscopy.

The teaching laboratories are constantly renewed and equipped with new scientific devices by using EU structural funds and National Complex programme. Currently, the existing material resources are sufficient to prepare the students of the Master programme *Environmental and Chemical Physics*. Some equipment was acquired on the initiative of the employees as a result of keeping in touch with the Faculty graduates who work in business companies. The VU students of the programme *Environmental and Chemical Physics* perform their professional practice in various organisations including abroad institutions Dresden Technical University, Germany, Lund University, Sweden, and University of Copenhagen, Denmark etc. Co-operation with businesses (e.g., UAB 'Optolita', 'Altechna', 'Sprana') opens new opportunities both for research and for studies of better quality including potential job opportunities.

Department is gradually renovating teaching premises of the faculty, installing new equipment and launching various teaching programmes, adding new text books to the library funds, and introducing the contents and the materials of the course-units online. In 2011, the library received new books of 25 titles, prepared for the *Environmental and Chemical Physics* study programme. Several textbooks as well as abundant study material available online have been specially prepared for the programme at Vilnius University. This study material is available on the website of the Department of General Physics and Spectroscopy. The current methodological resources are sufficient to efficiently run the programme. New books for the programme are purchased by the VU library on the teachers' recommendation. Teaching materials are adequate and accessible.

VU Library subscribes over 50 global databases which make it possible for the University library users to read different scientific journal articles. VU library is modern, computerized with free internet palaces and free WiFi connections and easily accessible for students. VU library subscribes a number of databases related to the subject-matter of *Environmental and Chemical Physics* study programme. Study literature is added to the library funds every year. New books are purchased in VU library according to teachers' recommendations. The students can also connect to the subscribed databases from their homes by using the University supplied VPN (Virtual Private Network) service.

## **5. Study process and student assessment**

The persons who graduate in the first cycle physical, technological and biomedical university studies and have a Bachelor's qualification degree in these research areas can be admitted to the second study cycle of the *Environmental and Chemical Physics* programme. The candidates who graduate in other research areas need to attend introductory courses of the study programme and to present a thesis on the topic of physical research areas. So, the admission requirements are well-founded.

The organization of the study process ensures an adequate provision of the programme and the achievement of the learning outcomes. The ratios of time in first three semesters are about: for lectures 30%, workshops 10% and autonomous work 60%. Fourth semester is entirely dedicated for thesis preparation by autonomous work and in coordination with thesis supervisor. The students of the study programme *Environmental and Chemical Physics* have an opportunity

to attend scientific seminars that are run at the Faculty of Physics, as well as at the Centre for Physical and Technological Research.

Students are encouraged to participate in research work because they need to prepare final thesis for master degree. The Master final project is carried out at the departments of the Faculty of Physics, research institutes and various manufacturing enterprise. The student's theoretical research or experimental work is supervised by the Faculty teachers with a scientific degree who are actively involved in a corresponding field of research.

Students have opportunities to participate in student mobility programmes, but not many students of the programme *Environmental and Chemical Physics* do so (12 students during 5 years). One of the reasons is: on students' return from the ERASMUS studies, they have to catch up with the rest of the students and finish research projects started, to attend theoretical courses for which they would need the knowledge of the course-units of the Faculty of Physics which they would have missed during their leave. Some flexibility in this regard needs to be worked out.

The higher education institution ensures an adequate level of academic and social support. Parts of the students receive merit-based grants for academic achievement. Previously as many as 30% of the students would receive grants. As the financing procedures changed in 2009, around 13% of students receive grants, which are of two types – ordinary (195 Lt) and increased (325 Lt). Need-based social scholarships can be allocated to students from economically disadvantaged backgrounds. These grants are distributed by the Students' Representation Office.

The assessment system of students' performance is clear, adequate and publicly available. The students' knowledge and progress are assessed on the basis of 'The assessment procedures of study progress at Vilnius University', approved by the VU Senate Committee. The cumulative assessment system applies to most course-units. The specific progress assessment methods for each course-unit are outlined in course-unit descriptions and are well known for students.

Professional activities of the majority of graduates meet the programme providers' expectations. Up to 50 % continue their studies in the third study cycle (PhD studies) to gain a doctor's degree (at Vilnius University, at the institutes of The Centre for Physical Sciences and Technology, and other Lithuanian and foreign universities). The rest of the students usually find jobs in various institutions that are related to environmental protection, materials science, radiation protection, etc. Professional activity field research into the employment of the graduates of the *Environmental and Chemical Physics* programme revealed that employers evaluate the university qualification of most graduates of *Environmental and Chemical Physics* as good or very good.

## **6. Programme management**

Responsibilities for decisions and monitoring of the implementation of the programme are clearly allocated. The study programme is managed by the Study Programme Committee, which is formed from the staff of the Faculty of Physics, the students recommended by Students' Representation Office, department Faculty of Physics and the representatives of social partners. The Head of the Study Programme Committee is elected from the Committee members by the majority of votes. The Study Programme Committee approves course-unit descriptions, previously approved at department meetings, and proposes to the Faculty Council to approve the changes in the programme or changes in the admission procedures. The heads of departments inform the Study Programme Committee about the shortcomings in the programme and possible ways of solution (the Heads of departments are informed by the teachers). The Head of the department is in charge of the quality of course-units related to the profile of the department and the study course of these course-units. The implementation of the study programme is

administered by the Dean's office, i.e. the Dean and the Vice-Dean for academic issues. Programme administration issues are discussed at weekly meetings in the Dean's office.

Information and data on the implementation of the programme are regularly collected and analysed. The Dean's office receives information about problems with the programme from the representatives of students' self-governance. Surveys are organized to help to get feedback. Students have been surveyed online after each semester (after they had already taken their examinations). These surveys are organized by the VU Quality Management Centre. The participation in the survey is obligatory.

The outcomes of internal and external evaluations of the programme are used for the improvement of the programme. While analysing the survey data, the Study Committee of the *Environmental and Chemical Physics* programme and the Faculty Administration meet with the students and try to find out the reasons for dissatisfaction.

The evaluation and improvement processes involve stakeholders. Attention is paid to co-operation with social partners. The ideas and recommendations of the staff of the Centre for Physical Sciences and Technology (the Institute of Physics) have the most significant positive impact on the structure and quality of the study programme, especially since part of the staff teach some course-units of the programme. Data on the opinions from other institutions where VU graduates work (The State Nuclear Power Safety Inspectorate, The Radiation Protection Centre, etc.) is also collected and processed. The co-operation of the Department of General Physics and Spectroscopy with the Division of spectroscopy research of Dresden Technical University also significantly influenced the development of the current programme.

The internal quality assurance of the programme has several right elements; however they do not come together in a well-established system. It is necessary that the programme management adapt a functioning quality assurance method in the near future.

### III. RECOMMENDATIONS

1. The programme managers should make efforts to enhance the mobility and staff exchange, in particular for students. Various available instruments can be used for this purpose, for example, ERASMUS grants, project research grants, bilateral agreements between institutions, etc.
2. The programme managers should continue and strengthen their efforts in providing courses in English. This should be the case if the students' group involves some foreign students. In this regard, the programme might be promoted as capable to offer lectures and practical courses in English. Equally, invitation of more guest lecturers and scientists is strongly encouraged. Finally, students should have a chance to give a seminar or conference presentation in English.
3. The internal quality assurance of the programme is one of the most important prerequisite to maintain its sustainability. Therefore it is recommended that the programme management builds up a closed and detailed system of quality assurance and quality control. It should include all aspects of curriculum development, staff renewal and further training of the members, the review of material resources and all other aspects of the study process. This quality assurance system should interlock in those of the Faculty of Physics and of the Vilnius University.
4. The final thesis composing needs additional attention. The knowledge of presenting results should be strengthened by additional course/seminar dedicated to this topic, in particular explaining the format and structure of the diploma thesis work.
5. Addition of a few courses linked to medical physics and applications of nuclear techniques in modern medicine would further increase the popularity of the programme.

#### IV. SUMMARY

The *Environmental and Chemical Physics* study programme is a needed and by the interest and problems of the country supported member of the second cycle programme family at the Faculty of Physics of Vilnius University.

The study programme gives good knowledge in master level physics and excellent in founding the Master of Physics degree. The structure of the study is well-designed and it is on high scientific level.

The laboratories for the *Environmental and Chemical Physics* had a substantial and positive development in the last years. They are on a remarkable level, even in international comparisons. The teaching staffs of this master degree programme are competent and well motivated. The curriculum design is good, logical and there is no obvious overlapping or drawbacks. The students are knowledgeable persons, who are able to work individually and in research groups.

The teaching materials are in all cases available in Lithuanian and English, as well.

The Expert Team, besides the above appreciation has several recommendations to the management of the *Environmental and Chemical Physics* second cycle programme.

The thesis works are in most cases of appropriate scientific level, sometimes they are very good. However, the structure of the thesis work documents show in many cases a structure, which does not correspond to the best international edition standards. In several cases the motivations of the work are not shown or there are no real conclusions. These parts of the thesis work documents need to be improved.

The programme should make efforts to facilitate and increase the mobility of students and staff exchange. This mobility is in fact too low. Various available instruments can be used for the purpose to change this unfortunate fact, like ERASMUS scholarships, project research grants, or bilateral agreements between institutions. The programme management should study possible other reasons and measures in order to enhance the mobility.

The programme management should continue and strengthen their efforts in providing courses in English. This should be the case if the students' group involves some foreign students. In this regard, the programme might be promoted as capable to offer lectures and practical courses in English. Equally, invitation of more guest lecturers and scientists is strongly encouraged. Finally, students should have a chance to give a seminar or conference presentation in English.

The internal quality assurance of the programme is one of the most important prerequisite to maintain sustainability. Therefore it is recommended that the programme management of *Environmental and Chemical Physics* should build up a closed and detailed system of quality assurance. The programme managers have good contacts to the stakeholders; however they do not seem to be involved in shaping the programme. The quality assurance system should include all aspects of curriculum development, staff renewal and further training of the members, the material resources and all aspects of the study process. This quality assurance system should interlock in those of the Faculty of Physics and of the Vilnius University.

## V. GENERAL ASSESSMENT

The study programme *Environmental and Chemical Physics* (state code – 621F30001) at Vilnius University is given **positive** evaluation.

*Study programme assessment in points by evaluation areas.*

No.	Evaluation Area	Evaluation Area in Points*
1.	Programme aims and learning outcomes	4
2.	Curriculum design	3
3.	Staff	4
4.	Material resources	4
5.	Study process and assessment (student admission, study process student support, achievement assessment)	4
6.	Programme management (programme administration, internal quality assurance)	3
	<b>Total:</b>	<b>22</b>

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

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

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

4 (very good) - the field is exceptionally good.

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Darius Eidukynas

## V. APIBENDRINAMASIS ĮVERTINIMAS

Vilniaus universiteto studijų programa *Aplinkos ir cheminė fizika* (valstybinis kodas – 621F30001) vertinama **teigiamai**.

Eil. Nr.	Vertinimo sritis	Srities įvertinimas, balais*
1.	Programos tikslai ir numatomi studijų rezultatai	4
2.	Programos sandara	3
3.	Personalas	4
4.	Materialieji ištekliai	4
5.	Studijų eiga ir jos vertinimas	4
6.	Programos vadyba	3
	<b>Iš viso:</b>	<b>22</b>

\* 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

*Aplinkos ir cheminės fizikos* studijų programa yra viena iš Vilniaus universiteto Fizikos fakulteto antrosios studijų pakopos programų, jos būtinumas ir poreikis nulemtas šalies interesų bei problemų.

Ši studijų programa suteikia išsamių magistrinio lygio fizikos žinių ir puikiai pagrindžia fizikos magistro laipsnio suteikimą. Studijų struktūra gerai suplanuota ir yra aukšto mokslinio lygio.

*Aplinkos ir cheminės fizikos* studijų programai skirtos laboratorijos pastaraisiais metais buvo nemažai tobulinamos. Jos yra labai aukšto lygio netgi palyginus su tarptautine praktika. Šios magistrantūros programos dėstytojai gerai pasirengę ir motyvuoti. Programos sandara gera, logiška, dalykai iš esmės nesikartoja, nėra pastebimų trūkumų. Studentai yra kompetentingi, sugebantys dirbti savarankiškai ir tyrimų grupėse.

Mokomoji medžiaga prieinama lietuvių, taip pat ir anglų kalba.

Ekspertų grupė, nepaisant palankaus *Aplinkos ir cheminės fizikos* antrosios pakopos programos įvertinimo, jos vykdymui pateikia keletą rekomendacijų.

Baigiamieji darbai dažniausiai yra tinkamo mokslinio lygio, kartais ir labai geri. Tačiau baigiamųjų darbų struktūra dažnai neatitinka aukščiausių tarptautinių leidybos standartų. Yra keletas atvejų, kai nenurodyta darbų motyvacija arba nepateiktos tikrosios išvados. Šias baigiamojo darbo dalis reikia patobulinti.

Įgyvendinant šią programą, reikėtų pasistengti padidinti studentų judumą ir keitimąsi dėstytojais. Judumas iš tikrųjų per mažas. Yra įvairių priemonių šiai problemai išspręsti, pavyzdžiui, ERASMUS stipendijos, mokslinių tyrimų projektams skirtos dotacijos ir institucijų

dvišaliai susitarimai. Programos vadovai turėtų ištirti kitas galimas mažo judumo priežastis ir priemonės judumui padidinti.

Programos vadovai turėtų dar labiau stengtis, kad dalykai būtų dėstomi anglų kalba. Tai turėtų būti daroma, kai studentų grupėje yra keletas užsieniečių. Šiuo atžvilgiu programa galėtų būti reklamuojama kaip galinti pasiūlyti paskaitas ir praktinį kursą anglų kalba. Be to, primygtinai raginama pasikviesti daugiau atvykstančiųjų dėstytojų ir mokslininkų. Pagaliau ir studentams turėtų būti suteikta galimybė pristatyti seminarą ar konferenciją anglų kalba.

Viena iš svarbiausių programos tvarumo išsaugojimo prielaidų yra jos vidinis kokybės užtikrinimas. Todėl rekomenduojama, kad *Aplinkos ir cheminės fizikos* studijų programos vadovai sukurtų uždara ir išsamią kokybės užtikrinimo bei kokybės kontrolės sistemą. Programos vadovai palaiko tamprus ryšius su socialiniais dalininkais, tačiau nepanašu, kad šie dalyvautų kuriant programą. Ji turėtų apimti visus programos tobulinimo, personalo atnaujinimo ir tolesnio jų mokymo klausimus, materialiuosius išteklius ir visus kitus studijų proceso aspektus. Ši kokybės užtikrinimo sistema turėtų būti sujungta su Fizikos fakulteto ir Vilniaus universiteto sistemomis.

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### III. REKOMENDACIJOS

1. Programos vadovai turėtų pasistengti padidinti judumą ir keitimąsi dėstytojais, ypač vardan studentų. Šiam tikslui galima pasinaudoti įvairiomis priemonėmis, pavyzdžiui, ERASMUS stipendijomis, mokslinių tyrimų projektams skiriamomis dotacijomis, dvišaliais institucijų susitarimais ir t. t.
2. Programos vadovai turėtų toliau stiprinti ir didinti pastangas, kad dalykai būtų dėstomi anglų kalba. Tai turėtų būti daroma, kai studentų grupėje yra keletas užsieniečių. Šiuo atžvilgiu programa galėtų būti reklamuojama kaip galinti pasiūlyti paskaitas ir praktinį kursą anglų kalba. Be to, primygtinai raginama pasikviesti daugiau atvykstančiųjų dėstytojų ir mokslininkų. Pagaliau ir studentams turėtų būti suteikta galimybė pristatyti seminarą ar konferenciją anglų kalba.
3. Viena iš svarbiausių programos tvarumo išsaugojimo prielaidų yra jos vidinis kokybės užtikrinimas. Todėl rekomenduojama, kad programos vadovai sukurtų uždara ir išsamią kokybės užtikrinimo ir kokybės kontrolės sistemą. Ji turėtų apimti visus programos tobulinimo, personalo atnaujinimo ir tolesnio jų mokymo klausimus, materialiujų išteklių peržiūrą ir visus kitus studijų proceso aspektus. Ši kokybės užtikrinimo sistema turėtų būti sujungta su Fizikos fakulteto ir Vilniaus universiteto sistemomis.
4. Daugiau dėmesio reikia skirti baigiamojo darbo struktūrai. Reikėtų geriau susipažinti, kaip pateikti rezultatus, tam tikslui rengiant papildomą kursą ir (arba) seminarą, skirtą šiai temai, ypač diplominio darbo formatui ir struktūrai išaiškinti.
5. Programos populiarumas dar labiau išaugtų į programą įtraukus kelis dalykus, susijusius su medicinos fizika ir branduolinių technologijų taikymu šiuolaikinėje medicinoje.

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