



STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Vilniaus universiteto

**STUDIJŲ PROGRAMOS *MODERNIŲJŲ TECHNOLOGIJŲ FIZIKA*  
*IR VADYBA (valstybinis kodas – 612F30004)*  
VERTINIMO IŠVADOS**

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**EVALUATION REPORT  
OF *MODERN TECHNOLOGIES PHYSICS AND MANAGEMENT*  
(state code – 612F30004)  
STUDY PROGRAMME  
at Vilnius University**

**Experts' team:**

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Išvados parengtos anglų kalba  
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## DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	<i>Moderniųjų technologijų fizika ir vadyba</i>
Valstybinis kodas	612F30004
Studijų sritis	Fiziniai mokslai
Studijų kryptis	Fizika
Studijų programos rūšis	Universitetinės studijos
Studijų pakopa	Pirmoji
Studijų forma (trukmė metais)	Nuolatinė (4)
Studijų programos apimtis kreditais	240
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Fizikos bakalauras
Studijų programos įregistravimo data	2006-01-25

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## INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme	<i>Modern Technologies Physics and Management</i>
State code	612F30004
Study area	Physical Sciences
Study field	Physics
Type of the study programme	University studies
Study cycle	First
Study mode (length in years)	Full-time (4)
Volume of the study programme in credits	240
Degree and (or) professional qualifications awarded	Bachelor of Physics
Date of registration of the study programme	25-01-2006

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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.	Minutes # 38 of the Study Programme Committee meeting at 20/03/2015 (unsigned).
2.	List of lecturers giving courses of Economics and Management

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

The *Modern Technologies Management* study programme was registered in 1998 and is implemented jointly by the Faculty of Physics and the Faculty of Economics in Vilnius University. In year 2011 the programme title was changed to “Modern Technologies Physics and Management”, and the study structure has been modified with emphasis on physics-related courses.

The self-evaluation preparation group members were proposed by the administration of the Faculty, the Department of Theoretical Physics, Astronomical Observatory, the Department of General Physics and Spectroscopy and the Students' Representation Office. Group members were assigned specific responsibilities in its composition.

The Review Team would thank for the hospitality and opportunity to meet and discuss with the faculty administration, authors of the self-evaluation report, teaching staff, students, alumni and social partners of this programme.

#### **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 08/10/2015 and 09/10/2015.

- 1. Dr. Terence Clifford-Amos (team leader)** *academic*, Université Catholique de Lille/International Consultant, UK.
- 2. Prof. dr. Janis Spigulis**, *academic*, University of Latvia, professor of Physics Department, Latvia.
- 3. Dr. Rynno Lohmus**, *academic*, University of Tartu, Senior Research Fellow, Institute of Physics, Estonia.
- 4. Prof. dr. Artūras Jukna**, *academic*, Vilnius Gediminas Technical University, Head of Department of Physics, Lithuania.
- 5. Dr. Danas Ridikas**, *social partner*, Research Reactor officer, IAEA, Austria.
- 6. Mr Benas Urbonavičius**, *student member* (PhD), Kaunas University of Technology, Lithuania.

## **II. PROGRAMME ANALYSIS**

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

As stated in the self-evaluation report (SER), the aim of this study programme is training of highly skilled specialists, executives and organizers of economic activities with a good background of technology physics, i.e., understanding of principles of modern technologies and also with sufficient knowledge in the areas of economics and management. The learning outcomes meet the current market demand for qualified managers in the high technology production, research and service sectors. The aims and learning outcomes were established according to Dublin Descriptors, the decision No. 535 of May 4, 2010 of the Government of the Republic of Lithuania and decree No. V-2212 of November 21, 2011 of the Minister of Education and Science of the Republic of Lithuania. The aims and learning outcomes are publicly available online: <http://www.vu.lt/studijos/apie-studijas/studiju-programos>. They are clearly defined at Table 2 of SER. The programme aims and learning outcomes generally are consistent with the type and level of studies. The offered qualification level after graduation is Bachelor of physics.

The programme goal declared in SER - to provide initial knowledge about technology physics and management – generally is in line with the National Strategic Plan of Social and Economic Development of Lithuania stating that new university study programmes are to be created, improved and implemented for biotechnology (e.g., biochemistry, microbiology, genetics, bioinformatics), laser technologies (e.g., laser physics, optical mechanics, laser electronics, optical technologies),

information technologies (telecommunications) and other strategic scientific research sectors, including integrated, interdisciplinary study programmes.

Evidently, the adoption of high technologies in real business requires highly skilled technology managers who are directly involved in the design, manufacture and usage processes, and appearance of specialists with this qualification in Lithuania grows with time together with increasing country's international competitiveness. The programme aims and learning outcomes are based on high academic and professional standards; they meet public needs for new high-tech products and also the labour market needs for professionals in the high-tech development and production.

This programme differs from the classical physics BSc level programmes but involves the major general subjects on mathematics, basic domains of physics and sufficient amount of laboratory exercises. So the name of the programme, its learning outcomes, content and the qualifications offered (bachelor of physics) can be considered as compatible with each other. Eventually, the English translation of the programme name could be slightly changed – the Review Team learned that in fact the Lithuanian meaning corresponds to "Physics and Management of Modern Technologies", which seems to be more appropriate to the content of this programme.

## ***2.2. Curriculum design***

The study programme meets the requirements for the first-cycle higher education study programmes and the General Regulation of study programmes of the study field "Physics" (decree No. ISAK-276 of February 27, 2007 of the Minister of Education and Science of the Republic of Lithuania). Compliance with other legal acts is listed at Table 4 of SER. Lectures make approximately 24 % (or 1520 h) of the entire time of studies; practical classes, seminars and laboratory work – approximately 22 % (or 1390 h), independent individual work – approximately 45 % (or 2856 h). The remaining 9 % correspond to work placement, final thesis and tutorials. Such study time division meets all legal requirements.

However, rearrangement of this study programme in 2011 (accordingly to the previous evaluator's recommendations) extended the share of physics-related subjects and inadequately decreased the share of economy/management-related courses. This is an issue to be addressed on the way towards the major-minor (physics-management) diploma, which would be appreciated by graduates to confirm their managerial knowledge and skills. It requires at least 60 credits of the minor degree (management) and is achievable by slight rearrangements of study subjects to gain the missing 6 credits - for example, by switching extended course units and/or replacing some course units of general university education to subjects of management and/or economics. The Review Team learned that such amendments have already been proposed by students but it seems no real actions have been taken so far by the programme managers.

An equal number (30) of ECTS credits has to be earned each semester, which makes 240 credits in total. Table 3 at SER lists all programme courses and their distribution over semesters. The content of the "Free choice course – elective subject", marked as BU – course unit of general university

education (2<sup>nd</sup>, 5<sup>th</sup> and 8<sup>th</sup> semesters) - remains unclear. Study subjects are spread evenly, their themes are not repetitive as seen from analysis of Table 4 at SER.

The course units corresponding to the study field “Physics” predominate, but there are also basic courses of the study programme in “Management”, many of them being electives. SER states that a number of courses are common and compulsory (e.g. Probability theory, Database management, Computer information technologies). Some other course units starting from semester 5 and increasingly in later semesters are optional, and the students may select them depending on which study field (physics or management) is preferred by them. As it turned out during the on-site meetings, the suggestions to students for choosing specific elective courses in both domains could be better elaborated.

The physics course units are compulsory for all students of the programme. According to SER, they include: *Higher Mathematics, Mechanics and Thermodynamics, Electricity and Magnetism, Optics and Atomic Physics, Physical Principles of Nuclear Power, Solid State Physics, Theoretical Mechanics, Statistical Physics, Electrodynamics, Basics of Quantum Mechanics.*

One can note that none of them is related to management. There are 14 specialized course units related to modern physical technologies: *Chemical Technology* (semester 3), *Industrial Electronics* (semester 4), *Physical and Technical Basics of Information Registration* (semester 5), *Practical Material Science* (semester 5), *Lasers for Biomedical Applications* (semester 6), *Modern Technologies of Materials* (semester 6), *Applied Spectrometry* (semester 6), *Technological Processes and Measurements* (semester 6), *Computer Networks* (semester 6), *Functional Electronics* (semester 7), *Microprocessor Technologies* (semester 7), *Light Technologies* (semester 7), *Principles of Telecommunications* (semester 8), *Environmental Protection and Management* (semester 8). The remaining 4 course units are related to management: *Finance and Banking Basics* (semester 4), *Economics and Administration of Enterprises* (semester 7), *Information Systems of Management* (semester 7), *Human Resource Management* (semester 8).

The number of the ECTS-credits awarded to particular courses could be better justified. On-site discussions revealed that, during transfer from the previous credit system to the new one, insufficient attention was paid to how much time students really spend to acquire the required knowledge and skills; their suggestion was to start counting individual learning hours to re-consider the number of credits related to particular courses. The Expert Team would support such initiative.

One more area of concern was identified during the on-site evaluation: students have no access to descriptions of the offered study courses, so they are unaware what to expect if the specific course is chosen. Furthermore, the optional subjects are chosen blindly as the choice is based only on the title of a particular course. Only occasionally professors send their subject descriptions to students, if specially asked.

The learning outcomes are both academic- and business-oriented; the latter requires lots of practical skills. The SER (p.14) shows that practical classes and workshops comprise about 50 % of the total lecture time. In order to develop practical skills, about 300 hours are set for laboratory experiments.

So the scope of the programme appears to be sufficient to ensure the expected learning outcomes from the point of physics and technologies. As for the “managerial” part, the development of practical skills seems to be less covered, so the possibility for students to obtain more hands-on in management is a curricular issue to be further improved.

The set of specialized courses provide good insight in the latest technological achievements. Independent preparation for seminars involve own presentations and discussions on presentations of other students. In this process students become acquainted with latest research literature and critical approach to solution of problems. As mentioned in SER, the discussions create a basis for the most important elements of modern scientific research: the ability to work in a team, to analyse data and results, to interpret critically own work, to exploit the most recent achievements in science. Most of the final Thesis projects are directly related to solving current problems in physics and technologies. The review team also noticed that none of the examined Thesis topics was management-related. Therefore, the challenge for programme leaders is to propose in future some Thesis topics also on problems related to technology management. Combined topics in Physics with interdisciplinary management aspects could be a compromising option.

### ***2.3. Teaching staff***

According to SER, teaching staff for the programme is selected by open tender procedure for 5-year period. All candidates must conform to requirements set by the law for educators of certain categories. The performance criteria are: teaching and total work experience, fields of research interests, the number of published research papers related to the subject(s) being taught, students’ feedback on the lecturer and the quality of his/her courses. All the legal requirements are clearly met.

The presented CVs confirm the high qualifications of the teaching staff. There are 10 professors, 22 associated professors and 16 lecturers employed (Table 6 of SER). Their mean age is 51 year; the average professional work experience - 26 years; average educational work experience - 16 years. 44 out of 48 teachers have doctoral degree, which meets the general requirements for the study programmes in Lithuania. The number of the teaching staff (48) is adequate to ensure the expected learning outcomes. During the academic year 2014 – 2015, the average contact workload of the teaching staff employed in the programme was 69 working hours, which seems to be reasonable. Some subjects, or at least separate lectures, are also presented by invited lecturers from industry and/or abroad.

In the opinion of students, most professors are highly qualified in their fields of physics. However, some of economics/management courses could be more elaborated and better presented (as example – “Economics theory”, 1st semester).

Some examples of teaching staff turnover are given in SER. Senior teachers who are about to retire are being replaced by younger lecturers. Teachers are sometimes replaced due to other reasons, for example, replacement in the course “Thermodynamics”. However, there is no cumulative data on teacher’s turnover during the whole evaluation period.



Professional development of teaching staff is facilitated by international exchanges. The SER specifies (p. 16-17) that 4 to 5 teachers of the Faculty of Physics are lecturing annually in the frame of the ERASMUS exchange programme at universities of Dresden, Stockholm, Lund, Poznan, Warsaw, Vienna, Ghent, Copenhagen. SER data (p. 16-19) illustrates that the professional development in research is more supported. The Faculty of Physics is frequently visited by scientists of foreign universities (e.g. Germany, Czech Republic). A number of foreign universities participate in joint research projects with the Department of General Physics and Spectroscopy and the Department of Solid State Electronics, including Royal Institute of Technology (Sweden), Paris Sud-11 University (France), Lund University (Sweden), Dresden Technical University, Institute of Bioorganic chemistry, PAS (Poland), Jozef Štefan Institute of Physics (Slovenia), Darmstadt Technical University (Germany), Toronto University (Canada), Pueblo University (Mexico), and others. Educational development courses are not mentioned in SER; the on-site discussions revealed that teachers have not attended such courses. As for the local support and dedicated efforts for enhancing teachers' professional development, e.g. acquaintance with modern teaching methods, they seem to be less in evidence.

The programme-associated research is reflected in titles of bachelor thesis projects. The lecturers participating in this study programme do research at VU institutes and scientific centres, as well as taking short research visits abroad and publish joint scientific papers with researchers of foreign universities. 22 papers published at international journals in 2012–2015 by staff members of the Faculty of Physics are listed in the database of ISI Web of Science (p.17-19 of SER), all of them in the domain of physics. The publications of several teachers are widely cited, resulting in high Hirsch index (>10). No data on teacher's publications in the domain of management were found in the SER; also during the on-site visit such publications in highly ranked journals were not identified.

#### ***2.4. Facilities and learning resources***

According to SER and witnessed during the site visit, there are 16 classrooms with capacity of 800 working places in the Faculty of Physics. Lectures, seminars and workshops take place in the Great Physics Auditorium adapted for demonstrations (165 working places) and in several smaller classrooms (76, 40, 20, 12 working places). The classrooms are adequately equipped for lectures and laboratory experiments, *wi-fi* is available everywhere.

6 general physics teaching laboratories of the Faculty of Physics are used, along with 8 specialized laboratories and ~20 research laboratories. Their capacities are generally sufficient for lectures and student practicals, although with some small laboratories (e.g., Teaching laboratory of Atomic and Nuclear Physics II, 1 student place available in laboratory), there may be occasional scheduling problems which needs attention. The SER states that some laboratory experiments, work placement and final projects are performed in laboratories of the Centre for Physical Sciences and Technology which will be relocated close to the faculty soon. Some practical classes, which require the use of computers, take place in computer classrooms, which are located nearby in the VU Centre of Information Technology Development (5 computer rooms with 47 computers in total).

All laboratories, where students perform physical experiments and other practical work, are listed in Table 7 of SER (in total ~80 working places). The computing-related subjects are taught in 7 computer classrooms and specialized computer laboratories. Through support of EU Structural Funds projects, ~175 000 EUR were spent for renovating laboratory equipment of the Faculty of Physics. Renovation works of educational laboratories that were carried out recently are specified in Table 8 of SER (p. 21). Invitation of school students, levels 10 and 11, to ‘taster sessions’ in these newly renovated laboratories is excellent practice in the quest to popularise science among students and motivate the school graduates to join the University. It was noted, impressively, that the Dean himself visits schools and delivers some teaching.

VU library subscribes to a number of international databases related to the programme courses. Over 47 thousand units on physical subjects are found at modern facilities of the National Open Access Scholarly Communication and Information Centre (SCIC) <http://www.mkic.mb.vu.lt/en/> which are located next to Faculty of Physics. The Centre has more than 670 working places, many of them computerized with Internet access. Students can also work at the University computer classroom of common use, located in VU Centre of Information Technology Development, as well as at other computer classrooms of the Faculty. Almost all premises of Physics Faculty, as well as Student dormitories, have internet access.

All of the VU *Modern Technologies Physics and Management* study programme students undergo practise placement either at Centre for Physical Sciences and Technology (CPST) or VU itself, e.g. Department of General Physics and Spectroscopy, Department of Solid State Electronics, Department of Semiconductor Physics. (SER, 2.2, 20).

Generally, all necessary teaching materials are accessible to students and lecturers; so the facilities and learning resources at VU Physics Faculty can be considered as excellent.

## **2.5. Study process and students’ performance assessment**

The common procedure of admission to Vilnius University first cycle and integrated studies is applied, involving examination in physics (weight coefficient 0.4), examination in mathematics (weight coefficient 0.2), examination in the Lithuanian language (weight coefficient 0.2), average grade of a foreign language (weight coefficient 0.2). The number of applicants choosing this programme as the first priority so far has exceeded the number of admitted students. Those who are enrolled can apply for a state-funded study places. SER states that the number of admitted students is determined by the potential number of jobs in companies and associations, university and research institute laboratories, as well as the available state funding. According to current resources and the percentage of dropouts, up to 30 students are admitted (SER, p.23). However, this number is not consistent with the data presented at Table 9 of SER (p.24) where 40 admitted students in years 2011 and 2012 are reported.

A serious issue is the decreasing tendency of the 1<sup>st</sup> study year applications. Table 9 of the SER (p.24) shows that the number of admitted students (22) decreased almost by half in 2014, if

compared to years 2010-2012 (39-40 admitted). The SER authors assume (p.24) that this decrease could be caused by appearance of similar (although not directly related to physics) technology management study programmes in other higher-education institutions of Lithuania, which do attract some potential applicants. The on-site discussions showed that there is no faculty's general strategy about the measures to be taken in order to increase the number of applicants in coming years.

There is consistent drop-out rate of the students, with up to ~15% students leaving the programme every year. Most prominent reason for such a drop-out rate is academic debts and possibility to stop studies without paying any study fee. (SER, 2.5, 47). Although during the interview with the students lack of motivation in some first year students was mentioned as well.

The theoretical background provided during lectures is consolidated during practical classes. Laboratory experiments provide information about experimental research techniques and develop the skills needed for work in research laboratories and manufacturing facilities. The problem-solution workshops and seminars train student to determine logical relationships between various phenomena and to draw appropriate conclusions, as well as the skills to develop/defend own opinions. However, the students often face some difficulties to find appropriate practice placement - they are allowed to have practice anywhere they like as long as it lies in the field on physics; however, from the on-site interviews, it was found that very limited choices exist.

Social partners from industry sometimes are invited to present lectures for students; unfortunately, they are not included in the review committees for assessment of final thesis, which would be highly recommended to assist in the evaluation of the measured learning outcomes and probably also to facilitate for students finding jobs in industry.

The more active students start joining research laboratories as early as at the second study year. According to SER (p.32), they typically choose topic and supervisor of the final Thesis project according to their own research interests. Initially students perform the basic experimental research and are introduced to the issues of a narrow research area or a new technology, but later start working with more complex items. Students who are engaged in research activity prepare research publications together with their supervisors and participate in various national and international scientific conferences. Table 15, p.33 of SER shows increasing number of student papers in respected IF-journals; more details on students' publications and presentations are provided in Appendix A of SER, p.40: 1 paper in 2011, 2 papers in 2012, 2 papers in 2013, 8 papers in 2014. During the period 2010-2013, 30 students from various foreign universities studied in the Faculty of Physics under the ERASMUS scheme (Table 13 of SER). VU students also participate in the international mobility (Table 14 of SER). Over the period 2010-2014, 24 students (or 17 % of all students in this programme) undertook such opportunity, which exceeds the mean percentage at the Faculty of Physics. However, students are allowed to participate in mobility exchanges only from the 6<sup>th</sup> semester - the requirement is to pass "Basics of Quantum Mechanics" first, so only two semesters are left for eventual studies abroad. Just a few students from bachelor programmes (those who already have scientific publications) can really be selected since the master students normally have more publications as an added advantage. For instance, this semester only one bachelor student of this programme obtained a place in Erasmus exchanges while ~10 places were awarded to the

master students, which is considered as unfair competition. For the future, fixed quota for bachelor and master level students may be a solution.

The students' performance is assessed by variety methods in more than half of the study subjects, sometimes combining feedback and evaluation during the course with examinations as a summative assessment. Although the assessment system appears diverse, some course subjects have just an examination (*Basics of Law, Differential equations of Physics, Environmental protection and Management*). During the on-site interview with the students it was stated that examination mark of some study subjects (*ex. Differential equations of Physics, Environmental protection and Management, Statistical Physics*) is based on 2-3 open questions during the examination, which, according to students, requires learning by heart rather than the achievement of full understanding. This issue diminishes the motivation amongst students and should be addressed. Other study subjects have a large emphasis on a theoretical knowledge assessment examination with weighting factors of 70-80%, while the rest of the final mark (20-30%) is the assessment of laboratory/practical work. Such situations can also be found in several study subjects such as: *Finance and Banking Basics, Functional Electronics, Lasers for Biomedical applications, HR Management, Modern Materials Technologies, Statistical Physics*. Having only an examination for theoretical knowledge assessment may, or may not be the most effective means of achieving the learning outcomes. The programme team might take these comments into further consideration.

An important part of the studies is the Final Thesis, pursued under supervision of a senior staff. During the preparation students have to use previously gained skills and knowledge as well as improve upon them. The Final Thesis is defended at the end of the studies. The programme team should seriously consider changes in the requirements/evaluation of practical work and final thesis work, so there is no issue in attributing the credits twice for some parts of the same work. This matter was discussed on-site with a senior member of staff and the Dean of the Faculty by providing clear evidence through comparison some reports of practical work and final thesis work. The programme team should also ensure that theoretical work should be consistently related to practical applications where relevant and possible.

Academic and social support provided to students by Vilnius University is adequate and sufficient. Studies are undertaken in well-equipped learning facilities and students have access to internet everywhere and can use various sports facilities (including swimming pool), as well as living in University dormitories during their studies.

Professional activities of the majority of graduates meet the programme providers' expectations. This is confirmed by the employment data provided in Table 16 and, more detailed – in Appendix B of the SER A number of graduates continue their studies in Lithuania or abroad, but the majority of others are employed in managerial or technology/engineering positions at Lithuanian high-tech companies, including Altechna, EKSMa, EKSPLA. For instance, out of 34 graduates in 2012, 19 are in managerial or engineering positions and 13 are post-graduate/doctoral students.

## **2.6. Programme management**

The programme management structure is clearly defined in SER (p. 34-35). The programme is managed by the Study Programme Committee, which is formed from representatives of the departments of the Faculty of Physics, students' self-governance and 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 approved in the department meetings and proposes to the Faculty Council to approve the changes in the programme or changes in the admission procedures. The Head of Department informs the Study Programme Committee about the shortcomings in the programme and possible ways of solution (the Heads of Departments are informed by teachers, Students' Representation Office and social partners). 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 course 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 in weekly meetings in the Dean's office.

On the other hand, the on-site interviews indicated that the Study Programme Committee seems to be more formal than real and fails to respond to the initiatives of students. The Committee has to hold meetings at least twice a year, but the Review Team learnt that student's representatives have not been involved there at least for a year. During the interviews, it was found that students' suggestions regarding the potential programme improvements are only occasionally discussed with the Vice-Dean.

The programme implementation is monitored by means of the students' feedback. Students' opinion about the study quality is collected by the mandatory questionnaires that evaluate the facilities, schedule of the subject, lectures and/or practical sessions and examination procedures. Students are surveyed online after each semester; participation in the survey is mandatory. Every teacher can have access to his/her data base in VU information system and find information about students' feedback for his/her courses. According to the results changes are made to required areas. The VU internal quality assessment system is based on student's feedback collection and analysis, as described in SER (p.35), seems to be efficient. The issue concerning academic honesty of students was identified, so now the student's papers are verified by the plagiarism control software of VU. As mentioned in the SER (p.35), the Dean's office receives information about problems of the programme from students' self-governance representatives.

Faculty administration is also informed about survey results and takes into account the opinion of students when teacher's performance is evaluated. Students' feedback results are summarized in Table 17 of SER (p.35). Despite a number of critical opinions, >3/4 of students participating in the 2010-2015 surveys would recommend this study programme to their relatives, friends or acquaintances (to compare – the VU average is only 23.3%). However, the feedback process seems to be insufficiently transparent and lacks publicly visible follow-up actions: no “feedback to feedback” is provided. Therefore students may lose motivation to fill in such surveys as nothing is done with them; besides, students are not sure if professors are informed about their opinions expressed in the feedback surveys.

The Review Team did not form the impression that the evaluation and improvement processes involved stakeholders; this is important, in particular because many sectors are owned and run by VU graduates. This is an issue to be improved in future, e.g., by organizing meetings or dedicated e-mail chains. It would be useful to include stakeholders in the assessment process of final Thesis, e.g., as opponents and/or commission members. With respect to such matters, the creation of a regularly-updated specific database for the potential employers to post their job vacancies and for the faculty – their offer (skills of the graduates - potential employees, related to technology management). Long-term agreements with high-tech companies on practical placements of students during the 7<sup>th</sup> semester would be helpful as well.

Finally, the programme management team is encouraged to discuss the options and take decision(s) regarding the future activities that would ensure increased number of the 1<sup>st</sup> year applicants to this attractive inter-disciplinary study programme. Reaching consensus on the double-degree (management -minor additionally to the physics bachelor) would also be appreciated

## **2.7. Examples of excellence**

The gained experience in running the unique inter-disciplinary programme.

Good employment records of graduates.

Super Computer technology

A library that will rank amongst the finest in Lithuanian universities.

## **III. RECOMMENDATIONS**

1. Consider engaging with some strategic staff development on:
  - a) Modern Teaching Methods;
  - b) Assessment Strategies;
2. Consider involving Social Partners and Alumni more operationally with staff, students and the Curriculum;
3. Formalisation and systematisation of the Study Programme Committee should be considered - make it alive and active;
4. Publicise topics for research (Bachelor Thesis) earlier together with a list of tutors and publicise all opportunities for students, including ERASMUS – which needs some attention in terms of fairness for all;
5. Consider changes in requirements/evaluation of practical work and final theses work, so there is no issue in attributing the credits twice for some parts of the same work.
6. Consider solving, legally, the double-degree problem; as an option – bachelor degree in physics (major) and management (minor);
7. Find a way for students to obtain more practical skills in the technology management;
8. Management should be incorporated into the Final Thesis research.
9. Intensify the local activities for enhancing teacher's professional development;
10. Social partners should be involved in evaluation of Final Thesis

11. Department needs to discuss (and, eventually, change) the number of the ECTS-credits awarded to particular courses;
12. Develop the strategy how to increase the number of programme's applicants in coming years.

#### **IV. SUMMARY**

There is a global tendency of decreased interest of high-school graduates in classical sciences such as physics, therefore study programmes combining physics with some specific application area (including technology management) are deserving special attention and therefore acknowledged. From this point the experience gained by the programme “Modern technologies physics and management” at Vilnius University is very valuable also outside Lithuania. A large number of programme graduates now take leading or key-technological positions at high-tech enterprises in Lithuania and abroad, which confirms usefulness of this programme.

In order to ensure sustainability of the programme, several improvement measures are recommended. Revision of the curriculum in order to comply with the formal requirements for awarding the graduates with double-diploma (major physics + minor management) might be helpful; this would meet expectations of already enrolled students and attract to the programme more secondary school graduates in the future. Concerning resources, they are all considered by the Review Team to be largely excellent; in particular they were impressed with the super computer, available to all students. The programme’s students can also be rightly proud of the outstanding new library, substantially equipped to meet their academic needs. Aesthetically, the new library is attractive and tasteful.

The number of credits related to particular courses and improved subject’s grading system are also important issues to be considered. More active involvement of stakeholders in the programme realization and assessment would be beneficial, as well. Students of this programme are very motivated and willing to gain as much as possible from their studies, but sometimes they could be somehow disappointed by the teaching variety/quality and the examination system and/or other aspects of the programme, so more attention and real improvements in response to the student’s feedback would be highly welcomed.

The programme offers exciting change and senior responses to requirements in industrial technical management. Changes, as indicated in this report and a more desired attempt to involve students in educational partnership, will help to secure a bright future for the programme.



## V. GENERAL ASSESSMENT

The study programme *Modern Technologies Physics and Management* (state code – 612F30004) at Vilnius University 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	4
2.	Curriculum design	2
3.	Teaching staff	3
4.	Facilities and learning resources	4
5.	Study process and students' performance assessment	2
6.	Programme management	2
	<b>Total:</b>	<b>17</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.

Grupės vadovas: Team leader:	Dr. Terence Clifford-Amos
Grupės nariai: Team members:	Prof. dr. Janis Spigulis
	Dr. Rynno Lohmus
	Prof. dr. Artūras Jukna
	Dr. Danas Ridikas
	Mr Benas Gabrielis Urbonavičius

**VILNIAUS UNIVERSITETO PIRMOSIOS PAKOPOS STUDIJŲ PROGRAMOS *MODERNIŲJŲ TECHNOLOGIJŲ FIZIKA IR VADYBA***

**(VALSTYBINIS KODAS – 612F30004)**

**2015-11-27 EKSPERTINIO VERTINIMO IŠVADŲ NR. SV4-311 IŠRAŠAS**

<...>

**VI. APIBENDRINAMASIS ĮVERTINIMAS**

Vilniaus universiteto studijų programa *Moderniųjų technologijų fizika ir vadyba* (valstybinis kodas – 612F30004) vertinama **teigiamai**.

<b>Eil. Nr.</b>	<b>Vertinimo sritis</b>	<b>Srities įvertinimas, balais*</b>
1.	Programos tikslai ir numatomi studijų rezultatai	4
2.	Programos sandara	2
3.	Personalas	3
4.	Materialieji ištekliai	4
5.	Studijų eiga ir jos vertinimas	2
6.	Programos vadyba	2
	<b>Iš viso:</b>	<b>17</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)

<...>

**2.7. Išskirtinės kokybės pavyzdžiai**

- Patirtis, sukaupta vykdant unikalią tarpdisciplininę studijų programą.
- Geri absolventų įsidarbinimo rezultatai.
- Superkompiuterių technologijos.

- Biblioteka laikytina viena geriausių Lietuvos universitetų mastu.

#### IV. SANTRAUKA

Visame pasaulyje vyraujanti tendencija – sumenkęs aukštųjų mokyklų absolventų susidomėjimas tokiais klasikiniais mokslais kaip fizika, todėl studijų programos, apjungiančios fiziką su kokia nors konkrečia taikomąja sritimi (įskaitant technologijų vadybą), nusipelnė ypatingo dėmesio ir yra itin vertinamos. Šiuo požiūriu patirtis, sukaupta Vilniaus universitete vykdant programą *Moderniųjų technologijų fizika ir vadyba*, yra itin vertinga ir už Lietuvos ribų. Daugelis programos absolventų šiuo metu užima vadovaujančias arba pagrindines technologų pozicijas Lietuvos ir užsienio aukštųjų technologijų įmonėse, o tai tik įrodo, kokios naudingos šios studijos.

Siekiant užtikrinti studijų programos tvarumą, rekomenduojami keli patobulinimai. Būtų naudinga taip peržiūrėti mokymo programą, kad ji atitiktų oficialius reikalavimus, keliamus dvigubiams diplomams (pagrindinis fizikos laipsnis ir gretutinis – vadybos laipsnis); tai atitiktų jau įstojusių studentų lūkesčius ir ateityje pritrauktų į programą daugiau vidurinių mokyklų abiturientų. Studijų programos materialinė bazė, ekspertų grupės manymu, yra itin puiki; vertintojams ypač didelį dėmesį paliko superkompiuteris, kuriuo gali naudotis visi studentai. Programos studentai taip pat gali pagrįstai didžiuotis išpūdinga ir labai gerai įrengta nauja biblioteka, kuri patenkina visus jų akademinis poreikius. Vertinant estetiniu požiūriu, naujoji biblioteka įrengta patraukliai ir skoningai.

Konkrečių dalykų kreditų skaičius ir patobulinta dalykų vertinimo sistema – ne mažiau svarbūs svarstyliniai klausimai. Būtų naudinga, jei į programos įgyvendinimą ir jos vertinimą labiau įsitrauktų socialiniai partneriai. Šios programos studentai labai motyvuoti ir iš studijų tikisi gauti kuo daugiau, tačiau kartais jiems gali tekti nusivilti dėstytojų permainingumu ir kokybe, egzaminavimo sistema ir (ar) kitais programos aspektais, todėl būtų naudinga atkreipti dėmesį į studentų atsiliepimus ir imtis realių patobulinimų.

Programa siūlo išpūdingus pokyčius ir rimtą atsaką į pramonės technologijų vadybos reikalavimus. Pokyčiai, išvardyti šiose vertinimo išvadose, ir didesnės pastangos įtraukti studentus į edukacinę partnerystę padės užtikrinti šviesią šios programos ateitį.

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#### III. REKOMENDACIJOS

1. Apsvarstyti dėstytojų kvalifikacijos kėlimo strategiją šiose srityse:
  - a) šiuolaikiniai dėstytojų metodai;
  - b) vertinimo strategijos.

2. Socialinius partnerius ir alumnus skatinti aktyviau bendradarbiauti su darbuotojais ir studentais, raginti prisidėti prie studijų programos.
3. Formalizuoti studijų programos komitetą ir sukurti jo veiklos sistemą, kad komitetas taptų gyvybingas ir aktyvus.
4. Iš anksto paskelbti mokslo tyrimų (bakalauro darbo) temas ir darbo vadovų sąrašą visiems studentams, įskaitant atvykusius pagal programą ERASMUS, ir sudaryti sąlygas su šia informacija susipažinti viešai – tai būtų sąžininga visų besimokančiųjų atžvilgiu.
5. Apsvarstyti, kaip pakeisti praktikai ir baigiamajam darbui keliamus reikalavimus ir vertinimą, kad nekiltų problemos, kai už tas pačias darbo dalis kreditai skiriami du kartus.
6. Apsvarstyti, kaip teisiškai išspręsti dvigubo laipsnio problemą; kaip išeitis galėtų būti fizikos bakalauro laipsnis (pagrindinės studijos) ir vadybos laipsnis (gretutinės studijos).
7. Rasti būdų, kaip studentams įgyti daugiau technologijų vadybos praktinių įgūdžių.
8. Į baigiamojo darbo mokslinius tyrimus turi būti įtraukta vadyba.
9. Vietoje imtis aktyvesnės veiklos, skirtos dėstytojų profesinei kvalifikacijai kelti.
10. Į baigiamojo darbo vertinimą įtraukti socialinius partnerius.
11. Katedrai būtina aptarti (ir galiausiai pakeisti) kreditų, suteikiamų už konkrečius dalykus, skaičių.
12. Parengti strategiją, kaip per artimiausius metus padidinti stojančiųjų į šią studijų programą skaičių.

Išsamesnio aprašymo ieškokite silpnybėse, kurios pateiktos kiekvienoje šių vertimo išvadų dalyje.

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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)