STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Vilniaus universiteto

STUDIJŲ PROGRAMOS *KOMPIUTERINĖ FIZIKA IR MODELIAVIMAS* *(valstybinis kodas – 612F30003)* VERTINIMO IŠVADOS

EVALUATION REPORT OF *COMPUTING PHYSICS AND MODELLING* (*state code – 612F30003*) STUDY PROGRAMME

at Vilnius University

Experts' team:

1. **Dr. Terence Clifford-Amos (team leader)** *academic,*
2. **Prof. dr. Janis Spigulis,** *academic,*
3. **Dr. Rynno Lohmus,** *academic,*
4. **Prof. dr. Artūras Jukna,** *academic,*
5. **Dr. Danas Ridikas,** *social partner,*
6. **Mr Benas Urbonavičius,** *student member.*

Evaluation coordinator – Mrs Eimantė Bogdan

Išvados parengtos anglų kalba
Report language – English

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DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	***Kompiuterinė fizika ir modeliavimas***
Valstybinis kodas	612F30003
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	2009-08-31, Nr. 1-73

INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme	***Computing Physics and Modelling***
State code	612F30003
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	31-08-2009, No. 1-73

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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 of the Study Programme Committee meeting at 20/03/2015.
2.	Minutes of the Study Programme Committee meeting at 04/09/2015.

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

The Faculty of Physics is responsible for running the Computing Physics and Modelling study programme in administrative terms. There are contributions from VU faculties other than the Faculty of Physics, for example in the teaching of the mathematics course units and social-humanities course units. The Department of Theoretical Physics takes responsibility for teaching the main theoretical course units, computer-aided modelling course units with the use of the parallel computation superclusters. Computing Physics and Modelling is a science not only of the ways theoretical computations are to be made by means of a computer, but also the designing and controlling the experiment as well as formulating the conclusions of the observations through the use of a computer. The study programme has wide application in providing knowledge necessary for future scientists, employees of the IT companies, directors and teachers.

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. While it is not wholly clear in the SER which material changes have taken place in accordance with and in relation to, the evaluation of 2008, the programme was as that date accredited unconditionally.

The Review Team had the opportunity to visit the laboratories, classrooms and library and familiarized themselves with a number of documents and with students' final theses, presented by University representatives. All personnel involved in the process of evaluation were open and cooperative and both staff and students were articulate in the English language. The Review Team would like to thank everyone involved in organizing the event and participating in the meetings. After the visit, the Review Team discussed and agreed the content of this report, which represents its consensual view.

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 8-9 October, *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

Programme learning outcomes, which are clear incisive and accurately set at the Bologna first cycle are implemented through the main broad aim of the study programme and are realised and achieved through the study modules, the aims and learning outcomes of which are distilled from the programmes aims and learning outcome structures (SER: A-D respectively). The programme *Computing Physics and Modelling BA* evinces a very broad aim, embracing 'the training specialists capable of mastering new technologies based on modern results of natural sciences, faster integration in new technologies and development of ideas; familiarizing students with modern IT, theoretical modelling and forecasting methods in order to apply the acquired knowledge while completing computerized work in the areas of physics and technologies*'* thus enabling graduates to pursue and contribute to national and international developments in the field. The learning outcomes relate to a wider IT application, in use of digital signal processors and computer networks. The learning outcomes, which address cognitive domains in learning, personal and professional development, ethical dimensions, comparative professional systems, qualitative and quantitative skills, communication (and the psychological concomitants appropriate to the understanding of communicative processes), language and creative skills, self-

development and the skills required for evaluation and responsiveness appropriate to the field and beyond, are refined, appropriately focused and interfaced in the respective subject areas, of which there are sixty-six including work-placement and electives.

This is the only programme of its kind in Lithuania. (SER, 2.1, 8)

The broad aims, the necessary skills, the demands and specialisms of study process and learning outcomes are published on the Internet (in Lithuanian): http://www.vu.lt/studijos/apie-studijas/studiju-programos Both websites of Vilnius University and the Physics Faculty contain special sections for students and applicants: http://www.vu.lt/lt/studijos/http://www.vu.lt/en/studies/http://www.ff.vu.lt/studijos/stojantiesiems/bakalauro-studijos A facility for questions about the study programme is also available online http://www.vu.lt/kviecia/klausk/kreipkis. (SER, 2.1, 9)

The first-cycle study programme, *Computing Physics and Modelling* achieves and sustains wide outcomes relating to the destination of the faculty's talented graduates who, for example, are provided with the knowledge necessary for future scientists and employees of the IT companies, directors and teachers. *Computing Physics and Modelling* is a programme which trains specialists for the National Centre of Physical Sciences and Technology (NCPST) and in 2010-2015, together with the Applied Physics and Modern Technologies Physics and Management study programmes of the Physics Faculty, it was updated by means of the EU structural funds project "First and Second Cycle Studies modernization in the perspective areas of materials science, nano- and optical technologies" (LaMeTech studies). (SER, 1, 4)

The faculty is confident that high-level specialists of physical sciences are trained during the programme and that such specialists meet the needs of European countries and can successfully compete in both Lithuanian and international markets. SER, 2.4, 26)

That there are fifteen years' experience in *Computing Physics and Modelling* (the relatively new title) in Vilnius University and that it was unconditionally accredited in 2008, is evidence of soundness both in the national and comparative senses of what levelness means in academic study. There is evidence to suggest that studies in this programme are at the high end of Bologna cycle 1 and that graduates are soundly-equipped for further study, research and professional engagement.

That the learning outcomes of the given study programme focuses on the cutting-edge IT application while solving modelling tasks of theoretical physical, astrophysical phenomena, semiconductor devices, digital signals underpins its highly specialised structure. The study of *Computing Physics and Modelling* comprises sixty-six interrelated subjects, the learning outcomes of which stylishly operate at Bologna level 1. The qualification offered is therefore appropriately representative of the content and is both contextually and universally appropriate and discerningly understood. During interviews with students it became clear that they were aware of learning outcomes and their relevance and application to their studies. While some teaching staff felt that learning outcomes could be a challenge, if not a burden to compose and realise, many saw their benefits, and indeed as part of the entire SER portfolio, appreciated the new opportunities for reflection and revision.

The Review Team formed the view that the aims and learning outcomes were exemplary in design and appropriateness for Bachelor level studies

2.2. Curriculum design

With regard to legal requirements, relating to academic credit allocation, core and elective subjects, final project and student placement, Table 4 of the SER sets out the compliance of the study programme plan to the decrees No. V-501, No. V-1190, No. V-232 of the Minister of Education and Science of the Republic of Lithuania.

The sixty-six programme subject modules examined by the team clearly convey both academic independence and independent properties and comprise a balanced programme without repetition. The overall programme neither repeats nor excessively weights particular modules, one to another.

The content of the subjects is consistent with the type and level of studies in a modern first-cycle programme encompassing the programme *Computing Physics and Modelling*. There is a closely-scaled match between content and methods, towards achieving the stated intended learning outcomes, as illustrated both in overall programme and in subject modules. The scope is readily sufficient, though, as might be expected in a high achieving university some programme content and the learning outcomes seem particularly geared at rather high levels. The replete and well-proportioned programme endeavours to be progressive and reflects particular elements of a modern physics - computing multi-disciplinarity, which includes languages general education and elements of sociology, philosophy and psychology.

Links between subjects and programme learning outcomes illustrate the achievement of the intended learning outcomes, and the aims, content and teaching methods of the subject modules are sufficient to achieve these. The interdisciplinary characteristics is of added value to the students' knowledge in the modern fast-changing world and is a progressive platform from which its graduates can then choose any master's study programme of the field of physics sciences in Lithuania or overseas. (SER, 2.1, 9) *Computing Physics and Modelling* is one of six programmes at Bachelor level and is of four years duration with a volume of 240 credits. The average number of contact hours of the teaching staff of the programme is 90 hours.

The comprehensive, and well-rounded learning outcomes are realisable through the technically robust and varied programme module content, within which there is opportunity for staff to engage in current national and international development.

Company representatives reported on the ‘lack of physical and technical education specialists with deep IT as well as computer network design and management knowledge data safety and especially high level computer network’, causing *Computer Networks Pro I-III* courses to be initiated. (SER, 2.2, 12)

However, the Review Team found that there were students’ concerns regarding their claimed reduction of Physics content. Nevetheless, in response to this point, the University stated that newer students on the programme should be receiving the same basic physical education as students of the *Applied physics* study programme and that at the moment only the first two years of students are influenced by this improvement and other improvements in the *Computing Physics and Modelling* study programme.

The Review Team also learnt that because the programme contains more subjects related to Astrophysics, the programme proves popular with students. It might be the case that the Programme Team might wish to include Astrophysics in the programme title to make it more attractive and visible.

The Review Team also recommends considering more opportunities for students to specialize, and consider whether Quantum Mechanics and Nuclear Physics might come earlier to facilitate Astrophysics in the programme sequencing. Does the study programme have a sufficient balance of Physics content, for students who feel (and who were told, they claim) that it had been reduced?

2.3. Teaching staff

Computing Physics and Modelling is taught by 40 teachers from the Faculty of Physics and other VU faculties. Complementing this number there are 6 teachers whose main employment is elsewhere. Of the 40 teachers whose main workplace is VU have practical work experience comprising 26 years and teaching experience comprising 17 years. 8 teachers hold the title of full professor, 23 are associate professors and 9 are lecturers, as illustrated in Table 5 of the SER. 44 of the total of 46 teachers have PhD research backgrounds. This complies with all Lithuanian legal requirements for the study programme. The age of teachers is quite evenly spread at an average age of 44 years, the breakdown being 11 teachers up to the age of 40, 16 teachers – between 40 and 50 years and 8 teachers between 50 and 60 years of age. There are 11 teachers older than 60 years. There is a better age distribution since the last evaluation. Additionally about 10 doctoral students are employed as assistants to the teaching establishment teachers. They contribute to workshops and supervise the students' scientific work. (SER.2.3) The high-level qualifications held and excellent research indexes confidently ensure the achievement of learning outcomes.

The changes of teaching staff over the past 5 years are in supplement. There have been no significant changes save for a 'few young doctors of physics' who have joined the programme team. Renewal of teaching staff is important and ongoing for academic reasons and also in maintaining a good age balance. Across the programmes staff regard themselves as colleagues rather than competitors.

Besides the pedagogical work in which the teaching staff undertake, they are obliged to carry out research, participate in research projects of the Lithuanian Research Council and make contributions to various other international projects. Research activities and methodological projects directly inform teachers' professional development. Research outcomes are commonly operational in terms of research-informed teaching. All teachers contributing to the study programme of *Computing Physics and Modelling* contribute to scientific conferences in Lithuania and abroad, as their CVs attest. (Appendix 3) However, some staff development is recommended in terms of modern teaching and assessment techniques, which the Review Team believes will balance, if not enhance the current traditions of teaching methodologies and their emphasis. Some pedagogical training is also recommended for lab technicians in terms of the work they do with students.

Monographs, papers, overseas visits and internships reveal a highly-qualified and involved teaching staff, pushing at the frontiers of knowledge in their research work who are also incorporating and disseminating their outcomes in terms of programme teaching activities. This means that there is evidence of teaching which engages with current and relevant international developments, often gleaned from current journal publications as well as engagement with the above-mentioned research-informed teaching. *Computer-based solving of differential equations, Statistical Physics Techniques and Super-computing* were among those mentioned during on-site interview.

2.4. Facilities and learning resources

The study programme in Computer physics mostly uses the facilities and learning resources of Faculty of Physics as well as resources of Centre of Information Technology Development. Auditoria of the Faculty of Physics meet the requirements of modern teaching (equipped with computers, projector and wireless internet access). There are newer computers and equipment since the last evaluation.

Their capacities are generally sufficient for lectures and student practicals, although with some small laboratories (e.g., Astronomical observatory specialized computer modelling room, 6 student places), there may be occasional scheduling problems which need attention. (SER, 2.4, 24)

The Faculty of Physics has recently invested over 555 thousand EUR in research and teaching equipment renovation in the last 5 years. As a result the Faculties of Physics can provide a very good infrastructure for the laboratory teaching. There are also sufficient laboratory consumables and equipment for the research of the students due to a number of well-funded research and EU structural fund projects. Students of the programme use the "HPC Saulėtekis" (www.supercomputing.ff.vu.lt) supercluster administered by the Theoretical Physics department Process modelling laboratory with almost 2000 computing cores. (SER, 2.4, 25)

Almost all the VU *Computing Physics and Modelling* study programme students (over 90%) undergo practise placement at Centre for Physical Sciences and Technology (CPST) and VU (SER, 2.4, 25).

After the opening of the National Open Access Scholarly Communication and Information Centre, the students have gained full access to the Library resources (books, journals, databases) from any computer connected to the University network. Access to the resources from outside the University can be granted by the use of VPN. This facilitates also the use of e-books. The VU library fund of books necessary for Physics Faculty students is constituted of more than 45 thousand units of documents, more than 30 thousand out of which are books and 15 thousand are research periodicals. There is an exhibition of the newest books. The library fund can be used by all VU students, teachers and employees. The University subscribes to over 15 most important scientific databases. Students and staff can be rightly proud of the state-of-the-art library, its exceptional appointments, bespoke facilities and overall command of student academic needs. That school students, levels 10 and 11, are invited to 'taster sessions' in the 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.

Overall, the facilities for teaching and learning and research laboratories are of excellent quality and more than sufficient for successful implementation of the programme. (SER, 2.4, 25, 27-28)

2.5. Study process and students' performance assessment

The admission of students to the programme is competitive and based mainly on the grades of School Leaving Examinations. The admission criteria and principles are clearly described and publicly available through the websites of the VU and The Lithuanian Higher Institutions Association for Organizing Joint Admission. Currently, the admission score includes the scores of the examinations in physics, Lithuanian language, mathematics and one additional subject yearly grade that can be foreign language or other recommended subject by Ministry of Education and Science. (SER, 2.5, 32)

There is a prominent competition during the admission to the programme with student/placement ration fluctuating from 0.79 to 1.38. (SER, 2.5, 33).This is backed up by the fact that admission scores of the students are high with an average score of 7.69 out of 10 possible in 2014. These figures indicate that the programme is popular and is able to attract good students. The admission rules are consistent with the nature of the studies and skills required from the students. There is a noticeable drop-out rate, with up ~30% of the admitted students failing to finish to programme. (SER, 2.5, 33-34) The most prominent reason (based on the SER (SER, 2.5, 33-34)) for such a drop-out rate is academic debt. Although, during on-site interview with the students it was mentioned that this drop-out rate can be related to the lack of individual consultations from the teaching staff, especially regarding the practical lectures. Lack of motivation in some first year students was mentioned as well.

Lectures, seminars, laboratory works and discussions and projects performed in groups, and more individual work like presentations and project work form the teaching base. Often the courses combine theory with practical or experimental work which is mandatory for a programme related to physics. Furthermore, the students are given good possibilities to undertake research practice in the laboratories of the units participating in the programme, and sometimes even be recruited as junior staff in projects supported by external funds. (Annex 1 (Course descriptions), SER 2.5, 37-38)

Motivated students can start doing research early on – as early as 3rd semester. This gives students extra skills and knowledge in the case they continue their studies. This is backed up by the fact that during the last 5 years there were 4 research papers published and 37 presentations made at various scientific conferences by the students of this programme. (SER, 2.5, 42)

The programme administration and the University provide the students with academic and social support. Individual consultations are available and the students receive help regarding academic problems related to Research projects and Final thesis. There is special extra lecture time dedicated for the preparation for the examination. Scholarships are there for the best students, and social scholarships are available for those in poor economic circumstances. Psychological help is available for the students, as well there are social events organized by the student associations. 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. (SER, 2.5, 42-43)

There are options to go abroad as an exchange student. But the use of this option is not popular. Only 3 students have used a long term exchange opportunity in 2011-2015. More effort should be put into making the information related to the exchange possibility more accessible. (SER, 2.5, 36) The operation of ERASMUS should be more equitably organised, so that Bachelor students do not have to compete for places with Master students.

The students´ performance is assessed by various methods in more than half of the study subjects, sometimes combining feedback and evaluation during the course with examinations as a summative assessment. However, some course subjects have just an examination (*Basics of Law, Nuclear and Elementary Particles*) The study subject *Statistical Physics* has an examination with a total value of 80% of the final mark. 60% of the final mark is based on two open questions during the examination, which, according to students, requires learning by heart rather than the achievement of full understanding. 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 work. Such situations can also be found in several study subjects such as: *Electronics, Energy and Environment, Digital Signal*

Processors, *Astrophotometry*, *Computer analysis of molecular species spectra*, *Computer Networks Pro, Computerized Physical and Technological measurements, Higher Mathematics, Laser Physics with Computer*. 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, in their deliberations, might take these comments into further consideration. Study subjects *Experimental physics I+II* do have laboratory work in their description, but the final mark does not include the assessments of such work.

Students are presented with the assessment schedule at the beginning of the course. All relevant information including full course descriptions is available online. The International Certificate in IT is a considerable bonus for students. An important part of the studies is the Final Thesis done under supervision of a senior staff. During the preparation students have to use previously gained skills and knowledge as well as improve upon them. Final Theses are defended as one set 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 which was found during the visit to the University. 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.

Students' opinion about the study quality is collected by the mandatory questionnaires at the end of each subject. These questionnaires evaluate the facilities, schedule of the subject, lecture and/or practical session quality, examination procedure quality. According to the results changes are made to required areas. (Annex 1 (Course descriptions), SER 2.5, 37-38, SER 2.6, 49). Although, during the interviews with students this view was not universal. Students expressed opinion about the lack of feedback to them after the questionnaires are evaluated. This reduces the motivation in students for any further involvement in the development of the study programme and should be addressed.

Graduates are followed up by the use of personal communication; there is no University wide alumni programme. Students and the alumni are largely happy with the teaching methods during the studies, although, again, during interviews, this view was not universal. Over a half of all the graduates of the programme continue their studies at Master level. This shows that the programme takes into account preparation for further scientific work. (SER, 2.5, 46) Some improvements are recommended in the systems being currently operated for the compilation of destination statistics. This will facilitate contact with former students.

The Study Programme Committee should be Formalised and systematised to make it alive and active to the needs and interests of students. Teaching staff should publicise topics for research (Bachelor Thesis) earlier together with a list of tutors and also publicise all opportunities for students including ERASMUS. Virtual learning practices should be used more and be more unified in terms of a policy for staff and students.

2.6. Programme management

The overall management of the programme is in the hands of the Study Programme Committee, a body drawn from the departments of the Physics Faculty, students' self-government and representatives of social partners and Committee's Head an elected office. The work of the Committee comprises approval of course unit descriptions arising from departmental meetings,

makes proposals to the Faculty Council concerning any the changes in the programme or to any changes in admission procedures. Heads of the departments also update the Study Programme Committee about any programme shortcomings in the programme together with the means of addressing them. Information concerning the quality of the programme comes from teachers, Students' Representation Office and social partners for oversight by Heads of Department who is principally concerned with the developmental profile of the programme. The study programme is administered by the Dean's office, via the dean and the vice-dean for academic issues. Programme administration is a weekly agenda issue in the Dean's office. The VU Study Directorate has to be involved where there are proposals to change the study plan of the programme during its running. (SER 2.6) The SER does not mention the *Standards and Guidelines for Quality Assurance in the European Higher Education Area* (ESG) or other European quality management benchmark, such as the *European Foundation for Quality Management* (EFQM).

Evaluations on the specific course units take place following examinations at the conclusion of each semester. Surveys are organized by VU Studies Department, Quality Management division. Student participation is obligatory. Students are encouraged to express their opinion on the study fields for the collective improvement of units and programmes, though this was not endorsed universally by students. Students stated that no feedback is given. All teachers are able to access the data base and read the student responses. The Faculty administration can also access survey results about the work of any teacher; such survey results are taken into account in the assessment of a teacher's work. Student survey data also accounts for the quality of studies at Vilnius University. Table 17 of the SER provides an example of a very comprehensive student questionnaire. There is also the Total Evaluation Average (TER) in operation as a further indicator.

Outcomes for programme improvement are achieved through the Study Programme Committee, though no particular examples are furnished in the SER. Although, a scrutiny of the minutes for SPC dated 04-09-2015 revealed that some improvement to the curriculum design of the programme is being made, ex. Improvement of the Computer Visualization course to include new performance options available at the VU supercomputer. A problem with teaching quality is said to be one of academic emphasis in the teacher evaluation, which tends to be more focussed on research than pedagogy. This 'legal' emphasis is difficult to modify, the SER claims. However, the University does wish to re-emphasise the professional evaluation of teachers.

Centrally, the University now has a strong-quality assurance system, which was positively reviewed in 2014. The programme team should make strong connections with the centre and all that is recommended there. While Stakeholders are keenly supportive and vibrant in their attitudes towards the programme generally and the good graduates who, ultimately - including Barclays Technology Centre (BTC) with their interests in security IT and other technical matters - take up good and profitable employment, the levels of involvement with this programme are variable. The Review Team recommends their more formal involvement in quality assurance mechanisms, feedback, and action planning towards a strong and developmental future, in particular because many sectors are owned and run by VU graduates.

Equally the programme team, largely through the Study Programme Committee, should listen more to the student voice, the positive nature of their drive for stronger internal satisfaction and their wish for stronger engagement with the management of the programme and its development. The articulate, adroit and excellent students interviewed could be said to be 'pleading' to be listened to more systematically. Programme students are highly supportive, highly aware and yearn to be 'partners' in the learning process.

2.7. Examples of excellence *

Exceptional Research Indexes among teaching staff.
A library that will rank amongst the finest in Lithuanian universities.
Super Computer technology.

III. RECOMMENDATIONS

General

1. Consider engaging with some strategic staff development on:
   a) Modern Teaching Methods;
   b) Assessment Strategies;
2. Involve Social Partners and Alumni more operationally with staff students and the Curriculum;
3. Formalise and systematise the Study Programme Committee - 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. Unify virtual learning practices;
6. 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.

Subject: Computing Physics and Modelling

1. Consider more opportunities for specialization (ex. *Astrophysics*, minor degree studies in *Pedagogy*);
2. Be more proactive in attending to the student drop-out rate;
3. Quantum Mechanics and nuclear physics might come earlier to facilitate Astrophysics in the programme sequencing;
4. Consider whether the programme has a sufficient balance of Physics content for those students who were told that it had been reduced; (see section 2.2)
5. Consider some pedagogical development for lab practice technicians;
6. Improve student destination statistics at programme Level;
7. Consider adding Astrophysics to the title of the study programme to make it more attractive and visible.

IV. SUMMARY

Epistemologically, the programme aims and learning outcomes are sound in their cognitive, professional, technical and social domains. They have been designed and purposed by University teachers with high subject ideals. In complement, students are aware of learning outcomes and are attuned as to how they are applied to their work. The content of the programme is again sound in its broad educational principles and is especially relevant to local industry and business. Barclay's is one such business whose interest in the programme is considerable. Students are largely happy with the programme, though they expressed a desire for more inclusion of Physics. (see section 2.2). Astrophysics being a very popular module, the Review Team believed it might be to the advantage of the programme to have it included in the title. The International Certificate in IT is a considerable bonus for students.

Teaching staff are talented members whose research work receives very high index scores. They are highly active in conferencing both nationally and internationally and are well known in their fields and the programme benefits from their celebrated academic achievements. Teaching staff are often well connected with influential social partners. The Review Team respects their professional standing. However, some staff development is recommended in terms of modern teaching and assessment techniques, which the Review Team believes will balance, if not enhance, the current strong traditions of teaching methodologies and their emphasis. Some pedagogical training is also recommended for lab technicians in terms of the work they do with students.

Concerning resources, they are all considered by the Review Team to be very good; 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.

Student academic support in many ways is very good, both academically and socially. Notwithstanding these positives, there are some matters in need of attention. These generally concern student participation in the study process, largely through the Student Study Committee, and in other matters, concerning a feeling of shared ownership of the programme, effective feedback and involvement in programme development and change. Changes should also be considered in terms of assessment strategies and practice as indicated in section 5 of this report. The Review Team believes that some development should be on the programme Team's future agenda in these various respects.

Programme management could be improved with more student involvement. Systems are largely in place, though destination statistics appear to be less strong. Furthermore, the programme team should ensure that all quality assurance mechanisms fully tie into university central systems. The university's quality assurance system was positively appraised in 2014.

While Stakeholders are keenly supportive and vibrant in their attitudes towards the programme generally and the good graduates who, ultimately - including Barclays Technology Centre (BTC) with their interests in security IT and other technical matters - take up good and profitable employment, the levels of involvement with this programme are variable. The Review Team recommends their more formal involvement in quality assurance mechanisms, feedback, and action planning towards a strong and developmental future.

In so many ways, generally, this programme is deserving of high commendation, but from the evidence provided, the Review Team believes there is work to be undertaken in areas outlined in sections 5 and 6 of this report, in particular.

V. GENERAL ASSESSMENT

The study programme *Computing Physics and Modelling* (state code – 612F30003) 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	3
3.	Teaching staff	3
4.	Facilities and learning resources	4
5.	Study process and students' performance assessment	2
6.	Programme management	3
	Total:	**19**

*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

Vertimas iš anglų kalbos

VILNIAUS UNIVERSITETO PIRMOSIOS PAKOPOS STUDIJŲ PROGRAMOS *KOMPIUTERINĖ FIZIKA IR MODELIAVIMAS* (VALSTYBINIS KODAS – 612F30003) 2015-11-27 EKSPERTINIO VERTINIMO IŠVADŲ NR. SV4-310 IŠRAŠAS

<...>

VI. APIBENDRINAMASIS ĮVERTINIMAS

Vilniaus universiteto studijų programa *Kompiuterinė fizika ir modeliavimas* (valstybinis kodas – 612F30003) vertinama **teigiamai**.

Eil. Nr.	Vertinimo sritis	Srities įvertinimas, balais*
1.	Programos tikslai ir numatomi studijų rezultatai	4
2.	Programos sandara	3
3.	Personalas	3
4.	Materialieji ištekliai	4
5.	Studijų eiga ir jos vertinimas	2
6.	Programos vadyba	3
	Iš viso:	**19**

* 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

- Dėstytojai dalyvauja daugelyje mokslinių tyrimų projektų.
- Biblioteka laikytina viena geriausių Lietuvos universitetų mastu.
- Superkompiuterių technologijos.

IV. SANTRAUKA

Vertinant teoriniu požiūriu, programos tikslų ir studijų rezultatų kognityvinės, profesinės, techninės ir socialinės sritys yra tinkamos. Jas parengė ir pritaikė universiteto dėstytojai, puoselėjantys aukštus dalykinius idealus. Be to, studentai yra susipažinę su studijų rezultatais ir žino, kaip šių rezultatų siekiama studentų darbe. Studijų programa – tinkama, nes edukaciniai jos turinio pagrindai yra plačios apimties ir ypač tinka vietos pramonei bei verslui. Viena tokių įmonių, kuri itin suinteresuota šia programa, – „Barclays“. Studentai studijų programa labai patenkinti, nors ir išsakė pageidavimą, kad būtų įtraukta daugiau fizikos dalykų (žr. 2.2 skyrių). Kadangi labai populiarus astrofizikos modulis, ekspertų grupė įsitikinusi, kad studijų programai išeitų į naudą įtraukti jį į pavadinimą. Neabejotinas privalumas studentams – išduodamas tarptautinis IT specialisto pažymėjimas.

Dėstytojai – talentingi specialistai, kurių mokslinis tiriamasis darbas itin aukštai vertinamas. Jie aktyviai dalyvauja šalies ir tarptautinėse konferencijose, yra gerai žinomi savo srities specialistai,

todėl jų pripažinti akademiniai pasiekimai studijų programai išeina į naudą. Dažniausiai dėstytojai palaiko glaudžius ryšius su įtakingais socialiniais partneriais. Ekspertų grupė gerbia dėstytojų profesinę reputaciją, tačiau kai kuriems jų rekomenduoja kelti profesinę kvalifikaciją šiuolaikinio dėstymo ir vertinimo metodų požiūriu, nes, ekspertų grupės nuomone, tai subalansuotų, o gal ir sustiprintų gyvuojančias dėstymo metodikų tradicijas ir jas dar labiau pabrėžtų. Pedagoginiai mokymai rekomenduojami ir kai kuriems su studentais dirbantiems techniniams laboratorijų darbuotojams.

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 įspūdinga ir labai gerai įrengta nauja biblioteka, kuri patenkina visus jų akademinius poreikius. Vertinant estetiniu požiūriu, naujoji biblioteka įrengta patraukliai ir skoningai.

Tiek akademinė, tiek socialinė pagalba studentams daugeliu požiūrių yra labai gera. Nepaisant to, į kai kuriuos dalykus būtina atkreipti dėmesį. Studentai turėtų būti labiau įtraukiami į studijų procesą, visų pirma per Studentų komitetą, ir jaustis programos šeimininkais, teikti veiksmingą grįžtamąjį ryšį ir įsitraukti į programos kūrimą bei pokyčius. Taip pat reikia galvoti, kaip pakeisti vertinimo strategijas ir praktiką (žr. šių vertinimo išvadų 5 skyrių). Vertinimo grupė įsitikinusi, kad minėtieji aspektai turėtų būti numatyti studijų programos kūrėjų ateities darbotvarkėje.

Programos vadybą būtų galima pagerinti labiau įtraukiant studentus. Sistemos didžia dalimi veikia tinkamai, nors statistika apie tai, kur įsidarbina studentai, atrodo prastokai. Be to, studijų programos komandai reikia pasirūpinti, kad visi kokybės užtikrinimo mechanizmai būtų iki galo susieti su universiteto centrinėmis sistemomis. Universiteto kokybės užtikrinimo sistema 2014 m. buvo įvertinta teigiamai.

Nors socialiniai partneriai labai palaiko šią programą ir deda į ją daug vilčių, nes pažangūs absolventai gauna gerą ir pelningą darbą – pvz., įsidarbina „Barclays“ technologijų centre (BTC) IT saugumo ir kitais techniniais darbuotojais, tačiau bendradarbiavimas su socialiniais partneriais nėra nuoseklus. Siekiant užtikrintos ir perspektyvios ateities, ekspertų grupė rekomenduoja socialinius partnerius labiau įtraukti į kokybės vertinimo mechanizmus, grįžtamojo ryšio procesą ir veiksmų planavimą.

Apskritai daugeliu kitų požiūrių ši studijų programa nusipelno aukšto įvertinimo, tačiau, remdamasi pateiktais įrodymais, ekspertų grupė yra įsitikinusi, kad ypač reikėtų padirbėti prie šių išvadų 5 ir 6 skyriuose nurodytų sričių.

<…>

III. REKOMENDACIJOS

Bendrosios rekomendacijos

1. Apsvarstyti dėstytojų kvalifikacijos kėlimo strategiją šiose srityse:
   a) šiuolaikiniai dėstymo 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. Suvienodinti virtualaus studijavimo praktiką.
6. Apsvarstyti, kaip pakeisti praktikai ir baigiamajam darbui keliamus reikalavimus ir vertinimą, kad nekiltų problemos, kai už tas pačias darbo dalis kreditai skiriami du kartus.

Studijų dalykas: Kompiuterinė fizika ir modeliavimas

1. Apsvarstyti daugiau specializacijos galimybių (pvz., *Astrofizika*, gretutinės pedagogikos studijos).
2. Dėti pastangas, kad būtų sumažintas nubyrėjusių studentų skaičius.
3. Atsižvelgiant į studijų programos išdėstymą, kvantinė mechanika ir branduolinė fizika galėtų būti pradedamos dėstyti anksčiau, kad būtų lengviau mokytis astrofizikos kursą.
4. Apsvarstyti, ar programa pakankamai subalansuota fizikos turinio požiūriu tiems studentams, kurie tvirtina, kad šio dalyko apimtis buvo sumažinta (žr. 2. 2 skyrių).
5. Apsvarstyti laboratorijų darbuotojų pedagoginės kvalifikacijos kėlimo galimybes.
6. Pagerinti statistiką apie tai, kur įsidarbina programos studentai.
7. Apsvarstyti galimybę į studijų programos pavadinimą įtraukti žodį „astrofizika“, kad ji taptų patrauklesnė ir labiau matoma.

<…>

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)