



STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Vilniaus universiteto
**STUDIJŲ PROGRAMOS FINANSŲ IR DRAUDIMO
MATEMATIKA (valstybinis kodas - 621G17001)
VERTINIMO IŠVADOS**

**EVALUATION REPORT
OF FINANCIAL AND ACTUARIAL MATHEMATICS (state code -
621G17001)
STUDY PROGRAMME
at Vilnius University**

Experts' team:

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- 2. Prof. Yishao Zhou, academic,**
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- 4. Prof. Jonas Valantinas, academic,**
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- 6. Ms. Dalia Miklaševičiūtė, students' representative.**

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Išvados parengtos anglų kalba
Report language – English

DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	<i>Finansų ir draudimo Matematika</i>
Valstybinis kodas	621G17001
Studijų sritis	Fiziniai mokslai
Studijų kryptis	Matematika
Studijų programos rūšis	Universitetinės studijos
Studijų pakopa	Antroji
Studijų forma (trukmė metais)	Nuolatinė (1.5)
Studijų programos apimtis kreditais	90
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Finansų ir draudimo Matematikos Magistras
Studijų programos įregistravimo data	25 05 2011, Nr. 1-01-62

INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme	<i>Financial and Actuarial Mathematics</i>
State code	621G17001
Study area	Physical sciences
Study field	Mathematics
Type of the study programme	University Studies
Study cycle	Second
Study mode (length in years)	Full-time (1.5)
Volume of the study programme in credits	90
Degree and (or) professional qualifications awarded	Master of Financial and Actuarial Mathematics
Date of registration of the study programme	25 May 2011, Order No. 1-01-62

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I. INTRODUCTION

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).

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.	Action plans
2.	Student publications

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

The study programme of “Financial and Actuarial Mathematics” is implemented by the Department of Mathematical Analysis. The programme has been implemented for 8 years.

The Expert Team had possibility to observe various study support services (classrooms, computer services, library), as well as to familiarize with students’ final works.

The Expert Team conducted also interviews with students. The Expert Team was familiarized with students' attitude towards the study programme. The meeting was carried out in an active and constructive atmosphere. The students expressed positive as well as critical opinions about the programme.

Expert Team met graduates and potential future employers of the students. At the conclusion of the visit, the Expert Team conducted a meeting with staff of the Faculty and highlighted some strengths and weaknesses of the programme.

In the following, the findings of the Expert Team are outlined. The Self-assessment report submitted by the Faculty, the observations made at the time of the visit, and the supplementary material received during the visit form the basis of these assessments.

The Review Team

The review team was completed according *Description of experts' recruitment*, approved by order No. V-41 of Acting Director of the Centre for Quality Assessment in Higher Education. The Review Visit to HEI was conducted by the team on 27 April March, 2017.

1. **Prof. Neda Bokan (team leader)**, *Former Professor of the University of Belgrade, Serbia, Serbia;*
2. **Prof. Yishao Zhou**, *Professor of Mathematics, Department of Mathematics, Stockholm University, Sweden;*
3. **Assoc. Prof. Thomas Hausberger**, *Associate Professor, Department of Mathematics , University of Montpellier, France;*
4. **Prof. Jonas Valantinas**, *Professor at Kaunas University of Technology, Applied mathematics department (Lithuania);*
5. **Mrs. Aldona Savičienė**, *CEO of insurance mediation company UADBB "AM sprendimai" (Lithuania)*
6. **Ms. Dalia Miklaševičiūtė**, *student of Kaunas University of Technology study programme Big Data Analytics (Lithuania).*

II. PROGRAMME ANALYSIS

2.1. Programme aims and learning outcomes

The objectives of Financial and Actuarial Mathematics study programme are to improve students' competencies gained during first cycle study programme Financial and Actuarial Mathematics BSc, and to prepare professionals who have high-profile education in financial and actuarial mathematics with an emphasis on theoretical foundation of various methods and techniques of probability theory, stochastic analysis, risk theory, and related fields. Graduates of the programme are qualified to analyze and solve problems in theoretical models of finance and insurance, with implementation of obtained solutions in practice.

The competences developed and intended learning outcomes of the study programme are given in proper details and presented in Table 1.1.1 (SER, p.7). Competences are separated into two sets in a logically consistent way emphasizing their different role in graduates' professions:

- Generic competences: 1. Abstract and critical thinking; 2. Work in a team and individually; 3. Carrying on research work;
- Subject-specific competences: 4. Advanced theoretical knowledge in financial and actuarial mathematics; 5. Ability to apply mathematical knowledge and skills to analyzing and solving actuarial problems; 6. Ability to apply mathematical knowledge and skills to analyzing and investigating financial instruments and markets.

The review team concludes the study programme was changed to acquire the requirements of the adoption to the new description of Mathematics study field (especially of Financial and Actuarial Mathematics) approved by the Ministry of Education and Science of the Republic of Lithuania and the objectives correspond with Dublin descriptors and the Lithuanian legal acts.

According to SER the formulated intended learning outcomes of the Financial and Actuarial Mathematics master study programme students suppose to acquire fundamental and conceptual knowledge of the mathematical aspects of financial theory and insurance techniques including advanced insights in the actuarial aspects of life insurance, general insurance and risk theory; knowledge of the methods and models of actuarial mathematics, including their applications to real-life problems solving as well as knowledge of modelling financial instruments and financial markets, etc.

Carrying on research work covers development of students' skills in analysing, systematizing and evaluating data necessary for the research, professional activity, innovation and problem solving, also, in applying new research results and appropriate methods to the analysis and solution of problems and/or situations, as well as in presenting adequately research results to specialists and non-specialists. Expected learning outcomes to acquire abstract and critical thinking are also described and soft skills as well.

Consequently, the review team concludes that generic and subject-specific competences and learning outcomes are in compliance with the concept of mathematics and the description of knowledge and abilities necessary for Mathematics according to "Description of Study Cycles", Order No. V-2212, 21 November 2011, of the Minister of Education and Science and "Confirmation of the Description of Study Programme in Mathematics" approved by order No. V-813, 23 July 2015, of the Minister of Education and Science.

According to SER this programme is adjusted to the requirements of the Lithuanian Actuarial Society (LAS) and Actuarial Association (AAE). Also, the courses and contents of Study Programme are adjusted to the exams of the Institute and Faculty of Actuaries (IFA) from United Kingdom. After successful completion of this study programme, graduates are essentially acquainted with the majority of exams at IFA. This was also confirmed during different meetings.

Finally, a qualification obtained upon the completion of the second-cycle study programme Financial and Actuarial Mathematics is in conformity with qualification VII as specified in the Qualification Framework of the Republic of Lithuania.

Information on the purpose, learning outcomes, content of the study programme and admission requirements is accessible on the Internet to all prospective students, academic community and the society at large. The information is freely accessible at:

- In the catalogue of study programmes of Vilnius University on its official website <http://www.vu.lt/studijos/apie/-studijas/studiju-programos/magistranturos-studijos/>
- On the official website of the Faculty <http://mif.lt/lt3/studijos/studiju-programos/financu-ir-draudimo-matematika/>
- On the official website of the University intended to prospective students <http://www.vu.lt/kviecia/>
- On the official website of the Open System of Providing Information, Tutoring and Vocational Orientation, or AIKOS (a Lithuanian acronym) <https://www.aikos.smm.lt/studijuoti/SitePages/Noriu%20studijuoti.aspx?ss=807adefe-19bb-42dc-8f25-a9e3acdfbe34>.

There exist also some publications available during a variety of promotional events: “Vilnius University is calling. Second study cycle”, etc.

During the meetings with Senior management, social partners and Alumni representatives the review team have learned that learning outcomes and subject-specific competencies acquired studying Financial and Actuarial Mathematics are well adopted to the state, societal and labour market needs. Graduates can easily find a job in various companies, such as banks, insurance companies, etc. Moreover, the majority of this study programme students are employees in proper companies according to their competencies.

The study programme of “Financial and Actuarial Mathematics” is implemented by the Department of Mathematical Analysis. The programme has been implemented for 8 years. During 2012-2013, up to 20% of the Master level programme was renewed while implemented the project FEDRA “The renewal of the study programmes in Econometrics and Financial and Actuarial Mathematics and their adaption to the needs of the international labour market” financed by the Ministry of Education and Science of the Republic of Lithuania and the European Social Fund.

The learning outcomes were also revised in 2015-2016, by the renewed programme committee in view of market tendencies, feedback from students, graduates, social partners, and recommendations of Department of Quality Control of Study Programmes of Vilnius University. In particular, the elements of teamwork have been implemented in the courses (for example, students were asked to study material in groups and then to give a presentation of the group work to other students and teacher). Each semester, at least two meetings of the Study Programme Committee take place.

Social partners emphasized the significance of soft skills development, such as problem-solving, ability to think analytically, time and stress management, etc. The majority of these skills are acquired during the study and others might be developed through the career centre of the Vilnius University. Except already mentioned above results of good cooperation with social partners, the review team points out regular consultations in master thesis choice and its preparation.

The Senior management showed the review team in the frame of the reorganization of the Vilnius University the action plan to improve the feedback of students on possible evolutions of learning outcomes of the study programme.

The review team concludes that Programme objectives and intended learning outcomes are linked to the state, societal and labour market needs and continuously analyzed to improve that link. Programme objectives and intended learning outcomes correspond to the mission, operational objectives and strategy of the Vilnius University.

Since this programme is focused on a strong theoretical (mathematical) basis and elements of research, upon completion of the Master study programme of Financial and Actuarial Mathematics a graduate may engage in further studies at the doctoral level in mathematics and/or statistics or work in the insurance company, banks, pension and investment funds, consulting firms, government agencies, etc. (e.g. as actuaries, financial analysts, risk assessors, consultants for Lithuanian and foreign institutions supervising financial and insurance markets).

The title of the programme Financial and Actuarial Mathematics, intended learning outcomes, the content of the programme and the qualification to be obtained are well-tuned with the needs of modern labour market.

2.2. Curriculum design

The curriculum design is in line with the Lithuanian legal acts regulating the structure of study programmes. That is, the programme comprises 90 ECTS credits (three semesters) and

5 units in the first and second semester, 60 credits within the study field of second cycle (50 credits for compulsory courses (modules) and 10 credits for optional course units (modules) offered by the university are intended for specialized subjects and 30 credits for final thesis in the third semester. There is more than 50% of individual work.

The review team finds that the courses are taught in a consistent manner; the content of subjects is up-to-date and corresponds to the second cycle study programme leading to a master's degree in mathematics. The structure of classes and the study methods are effective and appropriate to achieve the intended learning outcomes; the scope of the programme is satisfactory for achievement of the learning outcomes; moreover, the content of subjects corresponds to latest academics achievements due to the fact that the majority of teaching staff is highly competent and active in the research of the subjects related to the study programme.

The review team believes that the study programme can be improved further and thus provide the following analysis. Although the review team does not notice specific redundancy in the subjects' content, it is possible to integrate some courses or part of them in order to release study volume for new modern courses with both mathematical and practical aspects. This would also provide a natural place for IT that students and graduates discussed about. In general, non-linear filtering and optimal control theory will cover topics such as time series analysis, stochastic models of financial mathematics, basics of risk theory and also basics of financial derivatives.

The review team has learned Alumni representatives recognize the possibility to improve the quality of subject-specific competencies. In this spirit, they have proposed to introduce into the content of the study programme: artificial intelligence, new statistical methods, as well as to develop accountancy skills. This feedback is worth taking in mind to improve programme curriculum further.

As mentioned in SER, all courses in the future will be 5 credits. The review team found that the content of the subjects are adequate, the modalities of classroom teaching and the study methods are appropriate. The content of subjects provided in the subject descriptors reflects the level set up for a master's degree. The review team also recognized that the study methods such as case studies, proofs of various statements, demonstration of examples, discussions, group work, and problem solving have increased and students' creativity in research work is stimulated at a higher level than the traditional way of teaching and learning. This was also confirmed during various meetings. The review team agrees to SER that the students are motivated by such learning after interviews with students, graduates and social partners. Unlike the Bachelor's programme, there is no official internship but many students do have a job in the financial sector or in an insurance company.

A common observation is that the curriculum design, due to the theoretical focus, is in favour of future studies at the doctoral level. The review team does not see it as a drawback if the course design and teaching can be achieved in a way that does not neglect applications of theoretical mathematical constructs. Flexibility of the educational programme is crucial in relation to the labour market. This programme should contribute to enhance students' analytic skills and ability to acquire autonomy and show scientific responsibility for their work. Most parts of the curriculum and its implementation do meet this requirement.

On the other hand, the review team recognizes some under-represented mathematics subjects in the program: algebra, geometry and basic algebraic topology. These topics should not be seen as confined to pure mathematics since they nowadays play a significant role in data mining, complex systems and networks, especially for the design of effective algorithms to solve large scaled problems. In fact, this issue of somewhat under-represented mathematics subjects seems to be a nationwide problem that would need to be dealt with on the level of several faculties and study programmes.

2.3. Teaching staff

There are 9 academic staff members engaged in the programme: 5 Professors (Dr Habil. or Prof. Dr.), 2 Associate Professors (Dr) and 2 Lecturers (Dr). The staff is stable and experienced with an average teaching experience of about 28 years. The average teachers-to-students ratio during the evaluation period is 0.6 (the number of admitted students varies in the range 12-21). In average, each teacher is the supervisor of 2 master degree thesis, which is appropriate for good learning.

The teaching staff meets the legal requirement and even surpass it with 100% of academic staff having a doctoral degree and about 90 % doing research in mathematics, the remaining 10% having practical work experience. Moreover, above 70% of course units are taught par professors. The fields of expertise of the teachers cover mathematical domains ranging from pure mathematics (Functional Analysis & Probability Theory) to applied mathematics (Mathematical Modelling, Actuarial mathematics, Risk Theory). These fields of expertise are coherent with the taught courses and ensure that the qualifications of the teaching staff are adequate to achieve the learning outcomes regarding generic competencies in mathematics and specialised competencies in financial and actuarial mathematics.

The vast majority of teachers (7/9) are above 55 years of age. This situation is serious for the viability of the programme and should be dealt with. The SER mentions plans to recruit younger teachers, but the current salary and heavy teaching loads are not motivating, especially for younger teachers. VU is currently planning a salary reform to improve the situation. The review team found that the problem is well known in the faculty and certain actions are already taking place. According to the SER, the SPC intends to hire 7 doctoral students who are currently doing their PhD in the department. This raises the issue of inbreeding and the necessity of setting up a more open hiring policy. Mobility within Lithuania is indeed a viable option on the basis of 20 university in Lithuania. The SER reports that, since 2013 at VU, the teaching and research staff is recruited and promoted on the basis of the result of an open competition. Unfortunately, it was discovered during the interviews that the calls are not open in practice, since a candidate is most of the time in mind when the position is proposed, and the positions are not advertised as broadly as possible through the existing academic networks. Indeed, positions were advertised for the first time in 2017, at the website of Lithuanian Science Council. Communication with SPC confirmed that SPC and VU Faculty are aware of the necessity of setting up a proper plan of recruitment based on more open calls in order to potentially attract the best researchers from Lithuania and other Baltic and neighbouring countries.

The international recognition of the research carried out by the staff members is acknowledged by scientific publications in international journals and participation in international conferences. The SPC has invited 5 academic staff from abroad in 2012-16, which is also a positive sign. The teachers are doing their best to develop as skilled researchers in the international community but the current very alarming situation of 973 hours of teaching load for a lecturer and 561 hours for a professor hinders the potential of development and is bound to affect the quality of the learning programme in short or middle-term.

In this respect, the SER relates that VU is currently working on the issue of the teachers' overload of teaching hours that needs to be reduced to guarantee decent research conditions as required by law. The envisaged distribution of teaching loads varies from 384 contact hours / year for lecturers to 224 contact hours / year for professors. The external expert teams stresses that the number of contact hours should be reduced to meet the international standards of about 200 contact hours / year for a professor or assoc. prof. It should also be pointed out that 384 h doesn't give a lecturer decent conditions for professional development as a researcher. In order to guarantee the provision of the programme, lower contact hours should be offered to lecturers who are planning for professorship. Moreover, it was also discovered during the interviews that a great number of teachers, and especially young doctors, only teach half-time as they need to take a second job to compensate low salaries in the academic carriers. This situation certainly affects the research outcomes and explains the low mobility of the teaching

staff (international mobility is limited to short stays on the occasion of conferences or workshops, a single staff member went abroad for a teaching visit). This situation should be improved and the international mobility of the teaching staff should be encouraged and developed.

Finally, the professional development of teachers is supported by the participation of teachers in the project EFDRA “The renewal of the study programmes in Econometrics and Financial and Actuarial Mathematics and their adaptation to the needs of the international labor market”. As stated in the SER, the professional development is mainly due to joint work with social partners from finance and insurance. Attention should also be given to the pedagogical professional development of teachers, which is not covered in the SER. As this aspect is detailed in the SER of the related Bachelor programme, it is possible to assert that pedagogical professional development of teachers is encouraged by the university policy through the participation in courses focusing on pedagogy and the use of ICT in teaching, in relation to the creation of the Vilnius University Pedagogy Center. Nevertheless, the interviews permitted to clarify that this training program was currently suspended due to the restructuring of the university. In fact, very few teachers attended these seminars, partly due to their focus on secondary education. A proper plan of professional development for university teachers should include seminars in the didactics of the scientific disciplines adequate to transfer to teachers the results of the international research in education at the tertiary level and in particular the didactics of mathematics. The training proposed by the Vilnius University Pedagogy Center did not cover content-specific issues in the teaching and learning of mathematics (e.g. probability and statistics, the epistemology of mathematical models, etc.). It was discovered during the meetings that this may be explained by a lack of researcher in the didactics of mathematics. It may be worth hiring an experienced researcher in University Mathematics Education (UME), or at least give volunteering staff members the opportunity to attend international conferences in this field. These teachers may, after suitable training, contribute to the international research in UME and organize locally seminars on university pedagogy and didactics. Initial teacher training of PhD students and young doctors should be systematically encouraged.

2.4. Facilities and learning resources

There is a sufficient number of classrooms and laboratories. The lectures of study programme takes place mainly in two buildings: Naugarduko St. 24 (classrooms and teachers’ offices) and Šaltinių St. 1A (computer laboratories). But students have optional courses at the Didlaukio St. Building, and general university courses (GUS) at the other university facilities, depending on their choice.

There are 17 classrooms (total number of seats 983), 6 computer laboratories (total number of seats 157). The building at Didlaukio St. was renovated, and 8 new computer classes were installed. The three largest rooms in the Didlaukio St. building are equipped with remote control cameras for online broadcasting of lectures for disabled students.

Classrooms for lectures are equipped with blackboards and projectors. Bigger lecture rooms are all equipped with laptops, projector, sound system, computer for presentations. In the laboratories students may work on different operating systems. Wireless internet connection is available in all Faculty buildings. Students and staff can use EDUROAM or MIF open wireless connection, they can also use the supercomputer²¹ located at the Faculty of Mathematics and Informatics for scientific research purposes or educational activities free of charge. Vilnius University Centre of Information Technology Development provides various core IT services for staff and students. Vilnius University E-learning and Examination Centre provides Virtual Learning Environment for lecturers and enables examination of large groups of students simultaneously in large computer classes in Saulėtekio St. buildings.

The premises for studies are good for successful studies, available software and computer equipments meet the teaching and learning needs.

The Faculty library owns around 70.000 various resources and publications on mathematics, statistics, probability theory, economics, informatics, information technologies, and other subjects in different languages, mostly in English and Lithuanian. The students and the academic staff have access to the Central Vilnius University library and the library of the Lithuanian Science Academy. The budget spent on Faculty library resources renewal decreased in year 2015/2016 due to the fact that students started using more often electronic resources, such as electronic books, databases. There is a library reading room in Naugarduko St. with 90 seats (8 of them with computers). Students can also use the resources and self-study environment at the new modern Vilnius University library (MKIC) located at Saulėtekio St. 5, open on a 24/7 basis and close to dormitories.

There are possibilities to use Vilnius University Virtual Learning Environment (based on Moodle). Teachers use Moodle as a supplement to face-to-face communication. Other teachers usually also use some platform for virtual communication.

Teaching materials and technical resources (textbooks, books, periodical publications and databases) are sufficient and accessible. The premises meet the safety and hygiene norms requirements. The Faculty is currently being renovated to make it more accessible for people with disabilities; their needs are prioritized when conducting a timetable - all lectures with disabled students are usually planned on the ground floor, so that they have an easy access to the rooms.

2.5. Study process and students' performance assessment

The admission requirements in the Financial and Actuarial Mathematics programme are clearly elaborated and they follow all requirements applied for the 2nd cycle studies at the VU and are laid out according to the Senate-prescribed Rules of Admission to the Study Programmes of the Vilnius University. The competition score for entering the programme is elaborated and set in accordance with the formula prescribed by the admission rules. As stated in SER, a prerequisite for admission is the completion of the first-cycle studies in financial and/or actuarial mathematics or related fields. The entrance score is calculated according to a formula, by adding up the mean value of the marks enumerated in the Diploma Supplement and a mark for the graduation thesis or marks for the final examinations.

The general trend in Lithuanian HEIs is that the number of students is decreasing. Nevertheless, the programme does not face with significant changes in the number of the admitted student (2014-21, 2015-12, 2016-21). The increasing numbers prove that the programme should be considered as popular by students and sustainable. Additionally, the dropout rate in the study programme is relatively low while on average 1 student leaves the programme per year. The most common reasons are student's free will and inability to manage studies and work.

Although the entrance score is considered high among the Mathematics programmes, it is not stable during the years (2014 – 18,94, 2015 – 20,79 and 2016 – 17,84). Nevertheless, it is remarkable that in 2016 Vilnius University has started a new project for preparing academic consultants who have the purpose to help students, who have different difficulties during their study process. Usually these students have already several failed courses and they are probable drop-outs. This solution is considered positive by the expert to reduce the risk of early dropouts and reaching learning outcomes for all the students in the programme.

The general rules for the assessment of students' achievements are clearly elaborated in the faculty and VU. Students are well-informed about all requirements they have to follow during the study process as well as appealing procedure. At the beginning of each course, students are introduced to the module description, learning outcomes and the upcoming learning

process. The feedback culture is also being established in the programme as students are able to fill in the questionnaire at the end of the semester. Although programme management is changing the questionnaire for student's feedback, it is also suggested having more face-to-face conversations with the students during each module.

The students of this programme have the opportunity to get variety of support such as career development, job openings, psychological assistance, accommodation, cultural activities etc. Additionally, students are able to receive different types of financial support such as special grants for academic excellence, social grants, single social allowances and single special social allowances. Additionally, the faculty encourages students to get interested into research activities:

- talented students with an exceptional academic excellence and taking part in research may be eligible for special VU grants according to study and research fields – no such examples in this programme.
- The faculty encourages publishing student's master theses. However, the majority of students prioritize their work and do not continue the research activities.

The faculty encourages students to participate in international exchange while using Erasmus+ opportunity. Students are aware of such opportunity but usually decline the offer regarding the financial reasons or they are already employed. According to SER only in Spring 2017, it is expected that 3 students will go on a exchange programme. Nevertheless, there are also 3 exchange students coming to study in this programme which is a great asset for current students to increase the internationalization and intercultural skills. Additionally, the faculty should consider more subjects taught completely in English or inviting guest lecturers from abroad as students feel the need to improve their communication in English skills in order to be more competitive in the market.

The faculty is also taking measures to increase academic honesty. It is working according to the Code of Academic Ethics of Vilnius University, which defines general norms of academic, teaching, studies and research ethics. The students are familiarized with this document and have to adhere to the principles stated in it. Additionally, the academic honesty is also ensured by the MIFSA programme Sąžiningai (Honestly): upon teacher's request, the voluntary observers are sent to the exams.

According to SER, the employability rate is very high as students enrolling in this programme already have jobs and want to deepen their knowledge. The examples of occupations for this programme graduates consist of economists, financial analysts, statisticians, mathematicians, business services and administration managers, etc. According to the SER, the graduates are working in the largest companies and public institutions in Lithuania. The most recent graduates are switching their careers to the IT related occupations as there is a high demand of this kind of specialists in Lithuania. The graduates of this programme are highly valued by the stakeholders who employ the students during their for full-time jobs.

2.6. Programme management

The implementation of the study programme is administered by the Department of Studies, which is also responsible for ensuring the quality of studies. The monitoring process of the programme under assessment is organized and carried out in accordance with adopted documents, such as 'VU Quality Manual', 'Regulation of Study Programmes of Vilnius University', etc. In this process, the main role is played by the Study Programme Committee (SPC). Taking into consideration all the circumstances (self-evaluation report, experts' team meetings), conclusion can be made that SPC spares no efforts in accumulating and analysing data about the programme, monitoring feedback from students, graduates, academic staff and social partners and preparing preliminary decisions on the updates to the programme. Objectives and responsibilities of the Committee, as well as that of all individuals and subdivisions, having higher priority (Faculty Council, Senate), are well presented and explained in the self-evaluation

report. It should be emphasized that majority of social partners (ERGO Lietuva, Danske Bank, Bank of Lithuania, AVIVA, Lithuanian Actuarial Society) are in close and fruitful cooperation with the implementers of the programme. They take regular (quarterly) part in meetings of SPC and seminars of Financial and Actuarial Mathematics (on Tuesdays). Prof. G. Bakštys (ERGO Life Insurance SE) is the member of SPC.

To assure quality of the programme, many diverse and informative measures (most often, on-line questionnaires, including social partners) are explored. Once the results of questionnaires' or other recourses become available, SPC discusses them with Faculty teachers, summarizes their importance and benefits, comes to the decision for necessary changes in the programme and presents them (at least once a year) to the Faculty Council. Unfortunately, quite low per cent of respondents show activity in these actions. Despite the low number of respondents with an undeniable help of the University information system of studies (VUSIS), the internal study quality assurance system operates efficiently and at a proper level. The previous external evaluation conclusions (e.g. concerning contribution of students' feedback to the programme) also have been taken into consideration. Additionally, the programme administrators do know all the weak parts of the programme and have real action plans planning of corrective measures.

The Faculty community (students, teachers, etc.) have good access to data recourses and information on the study process and monitoring of the programme. In particular, official websites of the University and Faculty, AIKOS, Discovery Days, Study Fair (Learning, Studies and Career), special annual publications and others. So, it may be added that the availability and transparency of the information is good.

The study programme gives strong theoretical knowledge towards applications to financial and actuarial mathematics, and this is an undeniable strength of the programme. To stress it more, it's a consequence of an efficient and well-tuned internal study quality assurance system.

On the other hand, during the visit, the experts' team emphasized that the process of gaining competences and career making steps, especially among the young generation of teachers, was too slow and should be accelerated, because the lack of human recourses is foreseeable and impending.

2.7. Examples of excellence *

The competences developed and intended learning outcomes of the study programme are given in proper details. Competences are separated into two sets in a logically consistent way emphasising their different role in graduates' professions:

- Generic competences: 1. Abstract and critical thinking; 2. Work in a team and individually; 3. Carrying on research work;
- Subject-specific competences: 4. Advanced theoretical knowledge in financial and actuarial mathematics; 5. Ability to apply mathematical knowledge and skills to analyzing and solving actuarial problems; 6. Ability to apply mathematical knowledge and skills to analyzing and investigating financial instruments and markets.

III. RECOMMENDATIONS*

1. To meet recommendations on the unbalanced subjects in pure and applied mathematics it is recommended to reorganize and relocate volume of some courses to create theoretical courses that do have very strong applicable flavour, as mentioned in the analysis of curriculum design.
2. The number of contact hours should be limited to approach the international standard of 200 contact hours / year and therefore guarantee research conditions of staff members for the viability of the graduate study programme.
3. International mobility of the teaching staff should be encouraged through exchange programmes, taking advantage of the possibility of a sabbatical. Initial teacher training of PhD students and young doctors should be systematically encouraged. This training shouldn't restrict to general pedagogical concerns and ICT skills but also include an opportunity for reflective thinking on the teaching and learning of mathematical topics.
4. The level of internationalization of the programme should be enhanced by increasing the mobility of students and academic staff as well as introducing more courses held in English.
5. It should be expedient to introduce into the syllabus of the programme some modern study modules (subjects), such as "Machine learning techniques", "Artificial intelligence", "Statistical networks", etc.
6. The project-based teaching and learning methods, as well as group work, should be developed and applied on a regular basis in the study process. It would "soften" the gap between theory and practice, which is noticeable at the moment.
7. The process of gaining competences and advancing through career should be accelerated for the younger generation of teachers.

IV. SUMMARY

The objective of Financial and Actuarial Mathematics study programme is *to improve students' competencies gained during first cycle study programme Financial and Actuarial Mathematics BSc, and to prepare professionals who have high-profile education in financial and actuarial mathematics with an emphasis on theoretical foundation of various methods and techniques of probability theory, stochastic analysis, risk theory, and related fields*. Graduates of the programme are qualified to analyze and solve problems in theoretical models of finance and insurance, with implementation of obtained solutions in practice. The competences developed and intended learning outcomes of the study programme are given in proper details. Competences are separated into two sets in a logically consistent way emphasizing their different role in graduates' professions:

- Generic competences: 1. Abstract and critical thinking; 2. Work in a team and individually; 3. Carrying on research work;
- Subject-specific competences: 4. Advanced theoretical knowledge in financial and actuarial mathematics; 5. Ability to apply mathematical knowledge and skills to analyzing and solving actuarial problems; 6. Ability to apply mathematical knowledge and skills to analyzing and investigating financial instruments and markets.

The synergy of demanding students, programme management and teaching staff is exemplary for a good implementation of the study programme. Lecture notes are given in advance through Moodle platform yet well articulated with classroom inputs, as attested by a high attendance rate of the students. The programme has a good number of enrolled students and offers a coherent study opportunity for students, since the bachelors lead to the master programme which in turn responds to the need of the labour market.

The review team would like also to emphasize the level of internationalization of the programme is still insufficient. It might be enhanced by increasing the mobility of students and academic staff, including exchange programmes and taking advantage of the possibility of a sabbatical. The workload of teaching staff in education and research activities are not balanced. Therefore it is uncertain that the reform of the Vilnius University will be successful in these circumstances.

V. GENERAL ASSESSMENT

The study programme *Financial and Actuarial Mathematics* (state code – 621G17001) 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	3
5.	Study process and students' performance assessment	4
6.	Programme management	4
	Total:	21

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

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

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

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

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