

VILNIUS UNIVERSITY

**STUDY FIELD: MATHEMATICS**

**FIRST-CYCLE STUDY PROGRAMME**

**CODE:612G17001**

**SELF-EVALUATION REPORT**

Pro-rector of Vilnius University ……..............……………Assoc. Prof. Dr. Valdas Jaskūnas

(signature)

Head of self-evaluation group .......…………………….. Assoc. Prof. Dr. Martynas Manstavičius

 (signature)

Vilnius

7 February 2017

**Key data on the study programme**

|  |  |
| --- | --- |
| Title | **Financial and Actuarial Mathematics** |
| Code | 612G17001 |
| Study area | **Physical Sciences** |
| Study field | Mathematics |
| Kind of study | University studies |
| Language of instruction | Lithuanian |
| Study cycle | First |
| Mode of study and length in years | Full-time, 4 years |
| Scope in credits | 240 |
| Qualification awarded | Bachelor of Financial and Actuarial Mathematics |
| Date of registration and Order No | **2001-08-02**, No. 1187 |

Abbreviations used in the Self-Evaluation Report:

VU – Vilnius University

FAM – Financial and Actuarial Mathematics

SP – Study Programme

MIF – Lithuanian acronym for Faculty of Mathematics and Informatics

SPC – Study programme Committee

VU SA – Lithuanian acronym for Vilnius University Student Representation

**Composition of the self-evaluation group (SEG)\* and their responsibilities**

|  |  |  |
| --- | --- | --- |
| **Name, surname, contact information** | **Position** | **Area and scope of responsibility in SEG** |
| Martynas Manstavičius, martynas.manstavicius@mif.vu.lt | Associate professor | head of SEG, chairman of the Study programme committee, responsible for chapters 1,3, 6 |
| Aldona Skučaitė, aldona.skucaite@mif.vu.lt | Lector | Responsible for chapters 2 and 5 |
| Jonas Šiaulys, jonas.siaulys@mif.vu.lt | Professor | Communication with programme graduates |
| Gintaras Bakštys, gintaras.bakstys@ergo.lt | Partnership professor | Communication with social partners |
| Aistė Dargvilaitė, aiste.dargvilaite@mif.stud.vu.lt | student representative | Communication with programme students |

\*Approved by the Dean of the Faculty (Order No. D-42, 20 October 2016).

**Schedule of task implementation**

|  |  |
| --- | --- |
| **Task** | **Date of implementation** |
| Collecting all relevant information for the self-evaluation  | 23 December 2016 |
| First draft of the text of the Self-evaluation Report (SER) | 8 January 2017  |
| Discussing the first draft of SER focusing on three areas of evaluation: purpose and learning outcomes, curriculum design and academic staff | 24 January 2017 |
| Discussing the first draft of SER focusing on three areas of evaluation: facilities and teaching/learning resources, study process and assessment of academic progress, study programme (SP) management | 24 January 2017 |
| Presentation of the SER to the teaching staff, social partners of the SP, discussing their feedback | 24 January 2017 |
| Final draft of SER | 30 January 2017 |

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## INTRODUCTION

Vilnius University (hereafter also University or VU), founded in 1579, is the oldest and largest institution of higher education in Lithuania. The University management structure is defined in the *Statute of Vilnius University* (approved 6 May 2014 by Law of the Republic of Lithuania No XII-862), which states that the University community shall exercise its self-governance through the bodies of governance of the University: *The Senate*, *the Council* and *the Rector*. As of 1 October 2016, the University had 3662 employees (including 1370 teaching staff and 1164 research staff) and 20864 students. The University comprises 23 core academic units: twelve faculties, seven institutes (two of them with faculty status), four research and study centres, and seven core non-academic units.

The University implements study programmes of three study cycles in the areas of the humanities, social, physical, biomedical, and technological sciences. The total number of undergraduate (bachelor) study programmes is over 87. The number of (graduate) master and integrated study programmes exceeds 123. Doctoral students may enrol in almost 30 and residents in more than 50 study programmes.

Mathematics has been taught at Vilnius University since its foundation in 1579. First, the Department of Mathematics belonged to the Faculty of Philosophy. The Faculty of Mathematics and Informatics (hereafter also Faculty) was founded as The Faculty of Mathematics and Mechanics in 1965. In 1971 at the Department of Applied Mathematics a new study program has been started - Informatics, although at that time it was called Science of Calculating Machines or Science of Computing. In 1998 the Faculty of Mathematics and Mechanics was renamed as the Faculty of Mathematics and Informatics. The Faculty operates in accordance with the Statute of Vilnius University. The Faculty is headed by the Faculty Council and the Dean. Presently, the Faculty comprises 10 departments (*Computer Science I, Computer Science II, Didactics of Mathematics and Informatics, Differential Equations and Numerical Mathematics, Econometric Analysis, Mathematical Analysis, Mathematical Computer Science, Mathematical Statistics, Probability Theory and Number Theory, Software Engineering*) and 3 centres (*Digital Science and Computing Centre, Information Technology Research Centre, Mobile Application Laboratory*). They are engaged in research and studies. The main research areas of the Faculty include Fundamental and Applied Mathematics, Informatics and Information Technologies. There are 2 journals published by the Faculty - “Proceedings of the Lithuanian Mathematical Society, Series A” and “Nonlinear Analysis: Modelling and Control”. The research results are disseminated in national and international conferences.

The Faculty offers 8 first cycle (Bioinformatics, Information Technologies, Informatics, Software Engineering, Mathematics and Applications of Mathematics, Econometrics, Financial and Actuarial Mathematics, Statistics) and 8 second cycle (Computer Modelling, Informatics, Software Engineering, Mathematics, Modern Didactics of Mathematics, Econometrics, Financial and Actuarial Mathematics, Statistics) study programmes. The Faculty also offers doctoral studies in the fields of Mathematics and Informatics.

Presently, the Faculty has 208 staff members (teaching, research and administrative), including 28 professors and chief research fellows, 38 associate professors and senior research fellows, 45 lecturers with a PhD, 56 lecturers, assistant lecturers and 2 junior research fellows, 39 administrative staff. There are about 2190 students in the Faculty: about 1850 enrolled in Bachelor programmes, about 300 Master’s level students and about 40 PhD students.

The study programme of Financial and Actuarial Mathematics is implemented by the Department of Mathematical Analysis. The programme has been implemented for 15 years. During 2012–2013, up to 20% of the programme was renewed while implementing the project „The renewal of the study programmes in Econometrics and Financial and Actuarial Mathematics and their adaptation 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 programme was adapted to comply with the Bologna process guidelines, ECTS credit system was adopted, but the layout of the programme remained essentially the same. The changes were approved by the Faculty Council (12 December 2012, protocol No. 5) and Vilnius University Senate Board (10 January 2013, No SK-2013-1-8). Additional extensive changes were made after the last **external assessment in 2014**. The overall assessment of the programme was positive and it was accredited for 3 years. Nevertheless, the experts suggested a few further changes; several of them have already been implemented since then. The Assessment Report Recommendations and Summary are included in Appendix No. 5, and the changes induced thereof are discussed in below in appropriate sections.

## ANALYSIS OF THE STUDY PROGRAMME

### Purpose and learning outcomes of the study programme

##### **Purpose and learning outcomes of the study programme. Learning outcomes across course units (modules)**

The purpose of the study programme is to prepare *professionals who have fundamental background in pure mathematics and information technologies, together with detailed understanding of demographical, economical, insurance, financial risks, and are able to apply theoretical knowledge to solve practical problems. Program graduates are capable of thinking abstractly, logically and critically, operating in various professional environments, and demonstrating necessary skills to pursue academic careers.*

The competences developed and expected learning outcomes of the study programme (hereinafter also SP) are as follows (see Table 1):

Table 1 **Generic and subject-specific competences and learning outcomes of the SP**

|  |  |
| --- | --- |
| **Generic competencies**  | **Expected learning outcomes****Program graduate**  |
| **1.** | **Communication and team working skills** | **1.1** | Will be able to effectively present information, ideas, problems and solutions to peers, managers and clients |
| **1.2** | Will be able to work in an interdisciplinary environment |
| **2.** | **Abstract / logical thinking**  | **2.1** | Will be able to demonstrate abstract and logical thinking in various environments |
| **2.2** | Will be able to critically evaluate obtained results and their implications  |
| **3.** | **Life-long learning skills** | **3.1**  | Will be able to organize individual learning and work, manage time and resources – select appropriate objectives, methods and tools  |
| **3.2** | Will be able to individually analyse study literature, critically reflect on the need for a higher level of knowledge and personal improvement |
| **3.3** | Will be socially responsible. Will be able to understand importance of academic and professional standards  |
| 4. |  **Research fundamentals** | **4.1** | Will be able to demonstrate skills in problem solving, logical argument, deductive reasoning and analysis, abstraction and generalisation |
| **4.2** | Will be able to locate, retrieve, synthesise, and use information from a variety of different sources; to present results of research to the audience of peers. |
| **Subject-specific competencies** | **Expected learning outcomes****Program graduate**  |
| **5.** | **Fundamental knowledge and skills in pure mathematics** | **5.1** | Will be able to demonstrate understanding of the main mathematical fields (Mathematical Analysis, Linear Algebra, Geometry, etc.) and to apply this knowledge when solving problems |
| **5.2** | Will be able to demonstrate mathematical reasoning by critically following and presenting mathematical arguments, proofs, appropriately using various mathematical propositions, etc. |
| **5.3** | Will be able to demonstrate proper usage of mathematical formalism by showing understanding of mathematical language and role of symbols, to read and write mathematical text |
| **5.4** | Will be able to construct proofs of new simple propositions, related to known results |
| **6.** | **IT knowledge and application skills**  | **6.1** | Will be able to demonstrate understanding of basic IT concepts and apply this knowledge in practice |
| **6.2** | Will be able to use specialized software (e.g., R, Matlab, Latex, etc.) in practice |
| **6.3** | Will be able to write simple codes in a programming language (e.g., C, VB.NET, SQL, etc.) |
| **7.** | **Applications in Financial / Actuarial field** | **7.1** | Will be able to demonstrate understanding of the core principles of financial and insurance business, including (but not limited to) main laws of micro/macroeconomics; socio-economic and demographic environment, etc. |
| **7.2** | Will be able to practically explain relationships between different socio-economic/demographic variables and their importance |
| **7.3** | Will be able to demonstrate broad understanding of fundamental financial/actuarial principles, models, methods and to choose appropriate software when solving basic unknown problems |
| **7.4** | Will be able to critically evaluate problem under investigation from data and assumptions to results and appropriate conclusions |
| **7.5** | Will be able to recognize financial risks, critically evaluate associated losses and apply basic risk management methods |

Following the last programme assessment in 2014, the set of learning outcomes was substantially revised several times focusing on needs of modern labour market, on the competences that are crucial for professional operating in the area of insurance / finance and excluding those that are not crucial. Another reason for change was the adoption of the new description of Mathematics study field programmes, approved by the Ministry of Education and Science of the Republic of Lithuania.[[1]](#footnote-1) This document lists the minimum set of skills and competences that each graduate with a Mathematics diploma must possess. They are discussed in Section 1.4 in more detail. Our list of learning outcomes complies with these requirements and is adapted to the field of Financial and Actuarial Mathematics.

Learning outcomes are now formulated more precisely. We included fundamental research and life-long learning skills as part of generic competences, while communication/team and abstract/logical thinking skills were slightly reformulated. Subject-specific competences highlight broad knowledge/application skills in pure Mathematics, IT, and Financial/Actuarial fields. Further improvements to the learning outcomes will likely be needed once further feedback from the graduates and social partners becomes available.

Upon completion of the SP students may engage in further studies at the Master's level in Financial and Actuarial Mathematics as well as other programmes in Mathematics, Statistics or Economics, or successfully work as actuaries, financial analysts, consultants in the financial/insurance sector (insurance companies, pension/investment funds, etc.) and / or in public organizations, such as health care and social security and also in every area where general financial and risk management skills are required.

A qualification obtained upon the completion of the first-cycle study programme conforms to 6th qualification level as specified in the Qualifications Framework of the Republic of Lithuania.

##### **Availability of information about the purpose and learning outcomes of the SP**

Information on the purpose, learning outcomes, content of the SP and admission requirements is freely accessible on the Internet, e.g.:

* On the official website of the University intended to prospective students;[[2]](#footnote-2)
* On the official website of the Faculty;[[3]](#footnote-3)
* On the official website of the *Open System of Providing Information, Tutoring and Vocational Orientation*, or AIKOS (a Lithuanian acronym).[[4]](#footnote-4)

Every year, University issues a special newsletter intended for the dissemination of information about the first-cycle study programmes “*Kviečia Vilniaus universitetas. Pirmoji pakopa ir vientisosios studijos“* („*Vilnius University is calling. First-cycle and integrated studies*”).[[5]](#footnote-5) The publication is circulated during a variety of promotional events, including meetings at secondary schools, where university teachers offer advice on further studies and on the website of Vilnius University.

Moreover, our Study Programme is advertised during the following promotional events:

* Vilnius University *Discovery Days*, when the administration, the teaching staff and the students of the Faculty of Mathematics and Informatics explain with study-related issues for prospective students on an individual basis.
* Study Fair *Mokymasis, studijos, karjera* (Learning, Studies and Career) held at LITEXPO, where all information related to the studies in the SP is given by the administration, the teaching staff and the students of the Faculty of Mathematics and Informatics.
* During Vilnius University visits to secondary schools, where study programmes of all levels are introduced.
* Some course units (modules) are accessible to secondary school students when they come to Vilnius University in autumn and spring during an event called “S*tudent for a day*.” At that time, secondary school students have an opportunity to attend lectures held at the Faculty of Mathematics and Informatics together with the University students.[[6]](#footnote-6)
* The Faculty of Mathematics and Informatics has a tradition to invite secondary school mathematics/informatics teachers from surrounding areas (in January 2017, there was a group of teachers from Vilnius region) and discuss programmes offered by the Faculty and forthcoming changes. This presents opportunities to reach future potential students through their teachers.

##### **Information about the revision of learning outcomes and participation of social partners in the SP implementation**

Improvements to the learning outcomes are the responsibility of the study programme committee (SPC). Revisions are typically made once every 2-3 years, if needed, after some feedback from the students, social partners or the Directorate of Studies of Vilnius University becomes available. Changes made from the last programme evaluation were already summarized in Section 1.1. Just to emphasize the role of social partners, the recent survey of major employers (organized with the help of Lithuanian Actuarial Society) of our programme graduates revealed the need to strengthen knowledge in the area of financial accounting/reports analysis and a certain class of models. Subsequently, a new course “Financial Reports and Their Analysis” was added to the elective courses list and will be offered in Spring 2017 for the first time. Employers also pointed to the need to strengthen IT skills and ability to apply theory in practice, among other things. Course contents of informatics subjects was modernized (e.g. Pascal programming language was replaced with C), only essential topics needed for financial and actuarial mathematics were left, and incorporated into different other subjects, where possible. We believe, suggestions of the employers were successfully incorporated into the list of learning outcomes as well as subject contents, fostering those skills in reality is now our major objective.

##### **Conformity of learning outcomes to the requirements specified in international and domestic documents focusing on academic and professional standards**

While compiling the list of learning outcomes, we closely followed the requirements put forth in the description of the Mathematics study programmes as already mentioned in Section 1.1. The document lists five major groups of competences that each Mathematics graduate in Lithuania must have:

* Theoretical knowledge in Mathematics and in a particular branch of Mathematics (in our case, Financial and Actuarial Mathematics) as well as ability to apply this knowledge in practice when solving various problems.
* Ability to conduct research: gather data; choose, analyse and apply appropriate models; locate and analyse literature and information in general; present obtained results.
* Subject-specific skills: ability to reason and communicate mathematically, understand and critically follow mathematical proofs, construct new simple propositions and furnish their proofs.
* Social skills: taking responsibility for the obtained results, being able to critically assess them, being able to work individually and in a team, to present obtained results to a diverse audience, to adhere to the norms of academic ethics.
* Individual skills: ability to organize own work and learning, choose appropriate resources, understand moral responsibility as part of a society, implications of the work results to its well-being, strengthening of the economy, culture and environmental conditions, etc.

While our learning outcomes are grouped differently, they definitely comply with the above-mentioned description.

Another guiding source of learning outcomes was the Competency Framework for Actuaries,[[7]](#footnote-7) which is employed by Society of Actuaries (USA) and lists eight core competences important to an actuary in practice: communication, professional values, external forces and industry knowledge, leadership, relationship management and interpersonal collaboration, technical skills and analytical problem-solving, strategic insight and integration, results-oriented solutions.

We believe that our programme learning outcomes are in agreement with such a list of competences, even though reaching the advanced level of, e.g. professional values is unrealistic at the level of a Bachelor programme and might require several years of practical experience.

Directly related to the above mentioned Competency Framework are Education requirements adopted by the Lithuanian Society of Actuaries (Lietuvos aktuarų draugija – LAD). Those requirements are applicable for those who wish to become Fully Qualified Actuary (Full Member of LAD). Education requirements used by LAD are in agreement with the Education Syllabus adopted by the International Actuarial Association (IAA). In spring of 2016, the SPC, together with LAD representatives, checked how much the Programme’s syllabus conformed to the existing education requirements employed by LAD. Taking into account all subjects taught in our first-cycle programme (including optional ones) and those taught in a companion second-cycle program, we think that we currently cover about 60–70%, which is acceptable for a first cycle program. An MS Excel sheet with full matching is available upon request. More information on this may be found in Section 2.2.

Finally, our programme and its learning outcomes comply also with the Lithuanian Qualifications Framework,[[8]](#footnote-8) describing the 6th level (or first-cycle study programmes) of qualifications, by putting emphasis on broad theoretical knowledge based on the results of new fundamental and applied research; ability to study and work independently, selecting the methods for task completion, analysing and recording activity results, submitting reports to activity coordinators, ability to adapt to constant and normally unpredictable changes predetermined by the progress of knowledge and technologies in a specific professional field.

##### **The SP in the context of other study programmes implemented by VU and other universities**

The Bachelor programme in Financial and Actuarial Mathematics provides a solid foundation for the Master’s programme of the same name offered by Vilnius University. A similar programme in Financial Mathematics is offered by Šiauliai University, but it is shorter (3.5 years). There are many similar (both in contents and duration) bachelor programmes in Financial and/or Actuarial Mathematics offered in Europe, e.g. Financial and Actuarial Mathematics (Vienna Technical University), BSc (Hons) Actuarial/Financial Mathematics (Dublin City University), BSc Actuarial Science and Mathematics (The University of Manchester). Overall the taught subjects and developed competences are similar: all compared programmes provide a solid and broad mathematical background, contain introductory level Economics/Accounting courses. Our programme, for example, puts more emphasis on probabilistic modelling and somewhat less to numerical methods (we do not have a separate Numerical Analysis course, say), it also offers more opportunities to acquire useful IT skills (both through compulsory and optional courses). And we devote attention to fostering subject-specific communication skills through foreign language subjects – this is an absolute must for our graduates, as most subject-specific scientific literature is in English. For more on the rationale of our programme, see Section 2.2.

##### **Strengths and weaknesses of the area under evaluation and improvement measures to be taken**

Strengths:

* Compliance with the requirements of various legal documents
* Compliance with the requirements of the Lithuanian Society of Actuaries and International Actuarial Association
* Solid background in (pure) mathematics together with adequate attention to application areas.

Weaknesses:

* Some problems when implementing measures for achievement of learning outcomes may be met during initial years.
* Since originally our Programme derived from a programme in pure mathematics, some application-related subjects are less developed (e.g. numerical methods).

Improvement measures:

* Steps to strengthen cooperation with more partners from the financial sector will be taken.
* Course on numerical analysis will be added to the list of optional courses in the nearest future.

### Curriculum design

The curriculum design is in agreement with the *General Requirements for First-Cycle and Integrated Study Programmes* approved by the Minister of Education and Science of the Republic of Lithuania on 9 April 2010,[[9]](#footnote-9) the *Regulation of Study Programmes of Vilnius University* approved by Commission of Vilnius University Senate[[10]](#footnote-10) and the *Description of the study field of Mathematics* approved by the Minister of Education and Science of the Republic of Lithuania on 23 July 2015[[11]](#footnote-11) (see Table 2).

Table . C**onformity of the SP of Financial and Actuarial Mathematics to the general requirements of the first-cycle study programmes**

| **Requirements** | **In the study programme** |
| --- | --- |
| The scope of the first-cycle university study programmes, whose graduates are granted a bachelor’s degree in the study field (branch), shall be within the scope of 210 and 240 credits. | 240 |
| No fewer than 165 credits shall be allocated to course units within the study field. | 180 |
| No fewer than 15 credits shall be allocated to course units focusing on general university studies. | 15 |
| No more than 60 credits shall be allocated to course units offered by the university and chosen by the students; the course units (modules) are intended for more specialised studies in the same study field (branch) or for studies in another study field (branch), or for general university studies, internship/s, also to course units freely chosen by the student. | 30[[12]](#footnote-12) |
| The total scope of internships/s shall be at least 15 credits. | 15 |
| The total number of course units per semester shall be no more than 7. | max 6 |
| The study programme is completed by assessing the student’s competence during the viva voce defence of his/her bachelor thesis and final examinations (if they are stipulated in relevant legal acts) by allocating to the bachelor thesis and final examinations no fewer than 12 credits. | 15 |

Table 3. **STUDY PLAN (full-time studies)**

**(COMPETENCES AND LEARNING OUTCOMES ACROSS COURSE UNITS (MODULES))**

| **Code** | **Course units (modules) according to types** | **Volume in credits** | **Total student workload** | Contact hours | Individual work | **Competences of the study programme** |
| --- | --- | --- | --- | --- | --- | --- |
| **Generic competences** | **Subject-specific competences** |
| 1. | 2. | 3. | 4. | 5. | 6. | 7. |
| **Learning outcomes** |
| 1.1 | 1.2 | 2.1 | 2.2 | 3.1 | 3.2 | 3.3 | 4.1 | 4.2 | 5.1 | 5.2 | 5.3 | 5.4 | 6.1 | 6.2 | 6.3 | 7.1 | 7.2 | 7.3 | 7.4 | 7.5 |
| **Programme totals** | **240** | **6400** | **≥2655** | **≤3745** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **YEAR 1** | **60** | **1600** | **801** | **799** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **SEMESTER I** | **30** | **800** | **401** | **399** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Compulsory course units (modules)** | **30** | **800** | **401** | **399** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Mathematical Analysis I | 10 | 268 | 127 | 141 |  X |   | X | X | X | X |   | X |   | X | X |  X |   |   |   |   |   |   |   |   |   |
|   | Algebra and Geometry | 5 | 144 | 82 | 62 |  X |   | X |   | X |  X |   | X |   | X | X | X |   |   |   |   |   |   |   |   |   |
|   | Discrete Mathematics | 5 | 138 | 74 | 64 |  X |   | X | X | X | X |   | X |   | X | X | X |   |   |   |   |   |   |   |   |   |
|   | Introduction to Financial and Actuarial Mathematics | 5 | 125 | 52 | 73 |   |  X |   |   | X | X | X |   |   |   |   |   |   |   |   |   | X |   | X |   |   |
|   | Informatics I | 5 | 125 | 66 | 59 |  X |   |   |   | X | X |   |   | X |   |   |   |   | X | X | X |   |   |   |   |   |
| **SEMESTER II** | **30** | **800** | **400** | **400** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Compulsory course units (modules)** | **30** | **800** | **400** | **400** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Mathematical Analysis II | 10 | 268 | 128 | 140 |  X |   | X | X | X | X |   | X |   | X | X | X |   |   | X |   |   |   |   |   |   |
|   | Algebra | 5 | 142 | 76 | 66 |  X |   | X |   | X |  X |   | X |   |  X | X | X |   |   |   |   |   |   |   |   |   |
|   | Financial mathematics | 5 | 140 | 66 | 74 |  X | X |   | X |   |   |   | X | X |   |   |   |   |   |   |   | X | X | X | X |   |
|   | Informatics II | 5 | 125 | 66 | 59 |  X |   |  |  |  X | X |   |   | X | X | X | X |   |   |   |   |   |   |   |   |   |
|   | Foreign Language I | 5 | 125 | 64 | 61 |  X | X |   |   | X | X |   |   | X |   |   |   |   |   |   |   |   |   |   |   |   |
| **YEAR 2** | **60** | **1600** | **≥805** | **≤ 795** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **SEMESTER III** | **30** | **800** | **431** | **369** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Compulsory course units (modules)** | **30** | **800** | **431** | **369** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Mathematical Analysis III | 5 | 150 | 93 | 57 | X |   | X | X | X | X |   | X |   | X | X | X |   |   | X |   |   |   |   |   |   |
|   | Microeconomics | 5 | 137 | 72 | 65 |   | X |   |   | X |   | X |   | X |   |  X |   |   |   |   |   | X | X |   |   |   |
|   | Practical Informatics I | 5 | 130 | 68 | 62 | X |   |   |   | X |   |   |   |   |   |   |   |   | X | X | X |   |   |   |   |   |
|   | Probability Theory and Mathematical Statistics | 10 | 254 | 134 | 120 |   |   | X | X | X | X |   | X | X | X | X | X |   | X | X |   |   |   |   |   |   |
|   | Foreign Language II | 5 | 129 | 64 | 65 |  X | X |   |   | X | X |   |   | X |   |   |   |   |   |   |   |   |   |   |   |   |
| **SEMESTER IV** | **30** | **800** | **≥374** | **≤426** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Compulsory course units (modules)** | **20** | **550** | **278** | **272** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Statistics | 5 | 140 | 60 | 80 | X  |   |   |  X | X | X |   | X | X | X | X | X |   | X | X |   |   |   |   | X |   |
|   | Macroeconomics | 5 | 150 | 80 | 70 |   | X |   |   | X |   | X |   | X |   | X |   |   |   |   |   | X | X |   |   |   |
|   | Practical Informatics II | 5 | 126 | 64 | 62 |  X |   |   |   | X |   |   |   |   |   |   |   |   | X | X | X |   |   |   |   |   |
|   | Differential and Integral Equations | 5 | 134 | 74 | 60 |  X |   | X |   | X | X |   | X |   | X | X | X |   |   | X |   |   |   |   |   |   |
| **Optional course units (modules)** | **10** | **250** |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **One course unit from the following list:** | **5** | **125** |  |   |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Database Management Systems | 5 | 125 | 70 | 55 |  X |   | X | X | X | X |   | X | X |   |   |   |   | X |  | X |   |   |   |   |   |
|   | Modern Economic Thought | 5 | 125 | 69 | 56 |   | X  | X | X | X | X |   | X | X | X |   |   |   |   |   |   | X | X |   |   |   |
|   | Statistical Modelling | 5 | 125 | 64 | 61 |   |   | X  | X | X | X |   |   | X | X | X |   |   | X | X | X |   |   |   |   |   |
|   | Statistical Decision Theory | 5 | 125 | 64 | 61 |   |   | X | X |   | X |   | X | X | X | X | X | X | X | X |   |   |   |   |   |   |
|   | Financial Reports and their Analysis | 5 | 125 | 63 | 62 |   |   |  X | X |   | X |   | X | X |   |   |   |   | X |   |   | X | X | X | X | X |
|   | Game Theory | 5 | 125 | 48 | 77 |   |   | X  | X  | X  |   |   | X  |   |   |   | X  |   |   |   |   | X  | X  | X  | X  |   |
|   | Visual Programming | 5 | 125 | 52 | 73 |   |   |   | X  |   |  X |   |   | X  |   |   |   |   | X  |   | X  |   |   | X  |   |   |
|   | Scientific Seminar I | 5 | 125 | 32 | 93 |  X |   | X |   |   | X |   | X | X |   | X | X | X | X | X | X |   |   | X | X |   |
|   | Physics | 5 | 125 | 64 | 61 |   |  X |  X | X  |   |  X |   |  X | X  | X  | X  | X  |   |   |   |   |   |   |   |   |   |
| **GUS subject**[[13]](#footnote-13) | **5** | **125** | ≥48 | ≤77 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **YEAR 3** | **60** | **1600** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **SEMESTER V** | **30** | **800** | **≥744** | **≤856** |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Compulsory course units (modules)** | **30** | **800** | **388** | **412** |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Finite Population Statistics | 5 | 125 | 55 | 70 |  |   |   | X |   |   | X |   | X | X | X | X |   | X | X |   |   | X |   |   |   |
|   | Survival and Demographic Models | 5 | 140 | 77 | 63 | X |   |   |   | X |   |   | X | X |   |   |   |   |   |   |   | X | X | X | X |   |
|   | Functional Analysis | 5 | 143 | 77 | 66 |   |   | X  | X  |   |  X |  |  X | X | X | X | X | X |   |   |   |   |   |   |   |   |
|   | Regression Models | 5 | 133 | 63 | 70 |   |   |   |   |   |   |  | X  | X | X | X | X |   | X | X |   |   | X | X | X |   |
|   | Investment Theory | 5 | 133 | 66 | 67 |   |   |   |  X |   | X  |  X |   |  X |  X | X  |   |   | X  | X  | X | X  | X  | X |  X | X  |
|   | Basics of Investment | 5 | 126 | 50 | 76 |   |   |   |  X |   |  X | X |   |  X |   |   |   |   | X  | X  |   | X  |   | X  |  X | X  |
| **SEMESTER VI** | **30** | **800** | ≥**346** | ≤**454** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Compulsory subjects** | **20** | **550** | **250** | **300** |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Random Processes | 5 | 150 | 84 | 66 |  |   | X  | X |   | X  |   |  X | X  |  X | X  | X  |   |   |   |   |   |   |  X |   |   |
|   | Non-Life Insurance Models | 5 | 142 | 56 | 86 |   |   | X  | X |  X |   |   | X | X | X | X | X |   |   |   |   | X |   | X | X | X |
|   | Financial Risk Management | 5 | 128 | 50 | 78 |  X |   |   |  X |  X | X  | X  |   | X  | X  | X  |   |   |   |   |   |  X | X  | X  | X  | X  |
|   | Actuarial Mathematics | 5 | 130 | 60 | 70 |   |   |   | X  |   |   |   |  X | X  | X  | X  | X | X  |   | X  |   | X  | X  | X  |  X | X  |
| **Optional course units (modules)** | **10** | **250** |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **One course unit from the following list:** | **5** | **125** |  |   |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Database Management Systems | 5 | 125 | 70 | 55 |  X |   | X | X | X | X |   | X | X |   |   |   |   | X |  | X |   |   |   |   |   |
|   | Modern Economic Thought | 5 | 125 | 69 | 56 |   | X  | X | X | X | X |   | X | X | X |   |   |   |   |   |   | X | X |   |   |   |
|   | Statistical Modelling | 5 | 125 | 64 | 61 |   |   | X  | X | X | X |   |   | X | X | X |   |   | X | X | X |   |   |   |   |   |
|   | Statistical Decision Theory | 5 | 125 | 64 | 61 |   |   | X | X |   | X |   | X | X | X | X | X | X | X | X |   |   |   |   |   |   |
|   | Financial Reports and their Analysis | 5 | 125 | 63 | 62 |   |   |  X | X |   | X |   | X | X |   |   |   |   | X |   |   | X | X | X | X | X |
|   | Game Theory | 5 | 125 | 48 | 77 |   |   | X  | X  | X  |   |   | X  |   |   |   | X  |   |   |   |   | X  | X  | X  | X  |   |
|   | Visual Programming | 5 | 125 | 52 | 73 |   |   |   | X  |   |  X |   |   | X  |   |   |   |   | X  |   | X  |   |   | X  |   |   |
|   | Scientific Seminar I | 5 | 125 | 32 | 93 |  X |   | X |   |   | X |   | X | X |   | X | X | X | X | X | X |   |   | X | X |   |
|   | Physics | 5 | 125 | 64 | 61 |   |  X |  X | X  |   |  X |   |  X | X  | X  | X  | X  |   |   |   |   |   |   |   |   |   |
| **GUS subject** | 5 | 125 | ≥48 | ≤77 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **YEAR 4** | **60** | **1600** | **≥363** | **≤1237** |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|  **SEMESTER VII** | **30** | **800** | **≥348** | **≤452** |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Compulsory course units (modules)** | **20** | **550** | **252** | **298** |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Time Series | 5 | 138 | 52 | 86 |  |   |   | X  | X  |   |   | X  | X  |  X | X  |  X |   |   |  X |   |   |  X | X  | X  |   |
|   | Discrete-time Financial Models | 5 | 140 | 66 | 74 |   |   |   | X  |   |   |   | X  |   |  X | X  | X  |   |   |   |   |  X |   | X  | X  |  X |
|   | Health Insurance | 5 | 130 | 66 | 64 |  X |   |   |   | X |   | X |   | X |   |   |   |   |   |   |   | X | X | X | X  | X |
|   | Foundations of Scientific Research | 5 | 142 | 68 | 74 |  X |   |   |   | X  | X | X |   | X |   |   | X  |   | X  | X |   |   |   |   |   |   |
| **Optional course units (modules)** | **10** | **250** |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Queuing Theory | 5 | 125 | 53 | 72 |  | X  |   | X  |  X | X  |   | X  |   |  X |   |   |   | X  | X  | X  |   |   |  X | X  |   |
|   | Scientific Seminar II | 5 | 125 | 32 | 93 |   |   |  X | X |   | X  |   |  X | X |  X | X | X | X | X  | X  | X  |   |   |   |  X |   |
|   | Sources of Economic Data and Their Processing | 5 | 125 | 48 | 77 | X  |   |   |  X |   |   |   |   | X  |   |   |   |   | X  | X | X |   |  X |   |  |   |
|   | Mathematical Economics | 5 | 125 | 90 | 35 |  |   |   | X |   |   |   | X  | X |  X | X | X |   |   |   |   |  X | X |   | X |   |
|   | Public Sector Economics | 5 | 125 | 52 | 73 | X |   |   | X  | X  | X | X |   | X  |   |   |   |   |   |   |   | X |  X |   | X  |   |
|   | JAVA Technologies | 5 | 125 | 70 | 55 |  X |   |   | X  | X  | X  | X  | X  | X  |   |   |   |   | X  |   | X  |   |   |   |   |   |
| **GUS subject** | 5 | 125 | ≥48 | ≤77 |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **SEMESTER VIII** | **30** | **800** | **15** | **785** |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| **Compulsory course units (modules)** | **30** | **800** | **15** | **785** |  |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|   | Graduation Thesis | 15 | 399 | 10 | 389 |  X |  X |   |  X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X  |
|   | Internship | 15 | 401 | 5 | 396 |  X | X | X | X | X | X | X | X | X |   |   |   |   | X | X | X | X | X | X | X | X |

##### **2.2. Principles of curriculum design and rationale of the Study Programme**

The study programme of Financial and Actuarial Mathematics consists of 240 credits while its duration is four years (8 semesters). A major part of credits (180) are attributed to compulsory course units which develop general and/or main subject-specific competences. Among these one may find subjects addressing topics in pure mathematics (*Mathematical Analysis*, *Algebra and Geometry*; *Discrete Mathematics*; *Algebra*; *Probability Theory and Mathematical Statistics*; *Differential and Integral Equations*; *Functional Analysis*). Other subjects from this area develop “supporting” skills, e.g. *Foreign language*; IT related subjects (*Informatics*; *Practical Informatics*); *Micro / Macro Economics*; *Foundations of Scientific Research*. Finally, a large group of subjects address development of practical application skills, e.g. *Introduction to Financial and Actuarial Mathematics*; *Financial Mathematics*; *Finite Population Statistics*; *Survival and Demographic Models*; *Regression Models*; *Investment Theory*; *Basics of Investment*; *Random processes*; *Non-Life (General) Insurance Models*; *Financial Risk Management*; *Actuarial Mathematics*; *Time Series*; *Discrete Time Financial Models*; *Health Insurance*.

The remaining credits are split between subjects allocated to general university studies[[14]](#footnote-14) (15 credits), other optional courses (15 credits), preparation of final graduation (bachelor) theses (15 credits) and Internship (15 credits). The topics and scope of general university subjects vary significantly, as do the competences developed by these course units. Students may freely choose three courses which best suit their expected future career needs.

Other optional courses are part of the Programme and their descriptions are available through Vilnius University information system. These course units are mainly supposed to develop deeper subject-specific competences, e.g. competences that are important for the future careers but may be related to more detailed knowledge and therefore are not included in the list of compulsory courses. Some courses are solely from Economics/Accounting (e.g. *Modern Economic Thought*; *Financial Reports and their Analysis*; *Sources of Economic Data and Their Processing,* etc.), some are related to the IT area (e.g. *Database Management Systems*; *Visual Programming*; *JAVA Technologies,* etc., thus addressing a suggestion of the previous evaluation team) while others may be attributed to (applied) mathematics or scientific research (e.g. *Statistical Modelling*; *Statistical Decision Theory*; *Game Theory*; *Scientific Seminar I/II*; *Mathematical Economics,* etc.). The list of 9 optional courses offered for the 4th and 6th semester is the same, offering students a chance to select two units, one course during each semester (IV and VI). During the 7th semester, students need to choose one course out of six offered, so the possibilities for students to broaden their knowledge are quite extensive. For the full list of courses offered see Table 3. More information on the Internship and Final Graduation thesis may be found below.

As it was already mentioned, the first-cycle programme of Financial and Actuarial Mathematics fully conforms to the legal acts regulating study programmes but this is not enough for a modern study programme. As its name suggests, programme graduates are supposed to successfully operate in various environments where actuarial approach is needed and/or management of financial risks is expected. Therefore subjects developing actuarial / financial competences form an integral part of our programme syllabus. When considering what subject to include, the Study Programme Committee (SPC) had some consultations with one of our social partners – Lithuanian Society of Actuaries (Lietuvos aktuarų draugija - LAD) which has its own education requirements applicable for those who wish to become Fully Qualified Actuary (Full Member of LAD). Education requirements used by LAD are in agreement with the Education Syllabus adopted by the International Actuarial Association (IAA). One concern should be clarified there. It is quite likely that employers (many members of LAD are representatives of employers) sometimes have “just here, just now” attitude which may lead to a situation where course units developing very detailed and narrow skills are included into a university programme and start dominating or when priority is given to subjects developing competences which may easily be developed at the early stages of a career at the cost of more important “fundamental” subjects which may not bring clear benefits now but may give useful advantages in the future, e.g. analytical thinking. The SPC thinks that such pitfalls were successfully avoided when designing our programme syllabus.Priority was given to subjects, which develop broad and/or fundamental skills applicable in different professional environments. Subjects related to more detailed specialist knowledge were not included or left as optional.

The last major revision of the programme was made during the spring of 2015, right after the last international programme evaluation took place in the autumn of 2014. The Evaluation Review Team expressed some important concerns regarding curriculum design:(a) *the first two years of the existing course could be mistaken for the first two years of a study programme in pure mathematics*; (b) *in the third and fourth years there are no further classes in Informatics*; (c*) all students should be given experience of group work, and this should occur before the final semester*. SPC took these concerns very seriously and the Programme Syllabus Review Task Force (TF) was formed. Four members comprised the TF – Chair of SPC assoc. prof. M. Manstavičius; SPC members, Professor J. Šiaulys and student representative Ms R. Staniūtė (she has graduated and is not a member of SPC anymore) and lecturer A. Skučaitė (who is now a member of SPC, but was not during the review). When considering the new syllabus, SPC faced two major challenges. Firstly, according to the earlier syllabus, only pure mathematics subjects were taught during the first four semesters; moreover, they dominated the 5th semester, too. Only starting from the 5th and 6th semester, students had a possibility to get basic subject-specific (financial/actuarial) knowledge and start developing related competences. This caused dissatisfaction of students, as also noticed by the earlier review team, and in such case, probably, the programme could be developed as a branch of a programme in (pure or applied) mathematics with no separate enrolment possibilities. Indeed the programme needed substantial rebuilding. But the second challenge faced was that really sound mathematical background is needed to fully understand the nature of problems from financial/actuarial area and to develop appropriate competences. The need for solid mathematical background is also stressed in the new IAA Education Syllabus. So TF had to find a balance between pure mathematics and subject-specific courses in each semester, especially during the early study years.

Firstly, in the first semester a new introductory course – *Introduction to Financial and Actuarial Mathematics* – was implemented. So now from the very beginning students get very basic understanding of problems encountered in financial/actuarial area, main methods and models used, they also get acquainted with the activities of international professional bodies, the need for professional standards, etc. Other subjects taught during the 1st semester are from pure mathematics (needed to build an adequate foundation upon which subject-specific competences may be built) and one from IT. During the 2nd semester, there are two courses from pure mathematics (with the same intention as in the 1st semester), one from IT, classes in foreign language (addressing communication skills) and one subject-specific course – *Financial Mathematics*. So already during the first year students have a possibility to get deeper knowledge from subject-specific areas and develop very basic competences needed for their future career. Moreover, the TF thinks that, after seeing how (pure) mathematics skills are used when solving financial/actuarial problems, students will become more motivated when studying general mathematics subjects.

During the 2nd year (3rd and 4th semesters) there are further classes from pure mathematics; however, a foreign language course, as well as courses in IT and Economics, is also included. Moreover, during the 4th semester, students need to choose two elective subjects, which also contain courses from IT and Accounting.

The third and fourth study years (5th, 6th and 7th semesters) are mostly devoted to subject-specific courses and courses representing almost all major areas where actuarial/financial expertise is needed, e.g. Investment (*Investment Theory*, *Basics of Investment*), General insurance (*Non-life insurance models*), Life insurance (*Actuarial mathematics*), Health systems (*Health insurance*), Finance (*Discrete-time Financial Models*). Students also need to choose electives during the 6th and 7th semesters.

Though there are no compulsory classes from IT starting from the 5th semester, there are opportunities for students to choose such courses as electives; moreover, laboratory exercises are included into the curriculum of some courses; and various IT software is used when fulfilling assignments. Some courses (especially those taught during the 5th – 7th semesters) also contain some group projects. There were also attempts to include some IT elements during classes of pure mathematics, in particular, Mathematical Analysis. However, they were not successful, yet. On the one hand, the covered material is quite difficult for the first year students, so very little time, if any, may be devoted to explore software possibilities in Mathematical Analysis. On the other hand, the aim is not to show “what command to use” but rather to help students understand some concepts using software, e.g. visually illustrate what a limit is, acquaint how to numerically evaluate definite integrals (trapezoid and Simpson’s rules), etc. Moreover, there are some problems regarding the software. Students are not able yet to use quite specific software such as Matlab. In many cases, however, Excel may help. In fact, our social partners (employers) expressed concern that some of our programme graduates aren’t even capable of writing macros in Excel, but here we encountered the problem that some teachers simply do not want or are not able to use Excel. Nevertheless, the SPC will encourage inclusion of some IT elements into classes of pure mathematics hoping that such efforts will be successful in the future.

SPC thinks that study subjects are spread evenly and appropriately over the period of study and themes are not repetitive, but rather further developed. Students need to undergo an Internship period and prepare Graduation theses during the last semester.

SPC acknowledges that all implemented changes should be viewed more as a “pilot project” rather than “syllabus forever”. SPC plans to periodically review and adjust the programme, if needed. And feedback from students, graduates, employers and social partners will be taken into account when considering any updates.

##### **2.3. Study methods, proportion between contact hours and students’ individual work**

The study methods used vary from traditional (lectures, seminars) to more modern ones (laboratory works, discussions, individual/group assignments, oral presentations, etc.). They are chosen according to the nature of a subject and chosen so that aims of the course unit are achieved in a most efficient way. Theoretical foundations are usually provided during traditional lecturers which are held for bigger groups of students (at least for all our programme students, in some cases the same lecture may be delivered for students from other programmes, too). Great attention during classes in pure mathematics is paid to seminars / recitation classes when smaller groups of students have opportunities to learn how to apply theory when solving problems and / or get additional explanation about theoretical issues. In some cases, e.g. during studies of *Foreign language,* there are no theoretical lectures at all since all competences are best developed during seminars. For courses developing application skills (*Probability Theory and Mathematical Statistics*; *Statistics*; *Survival and Demographic Models*, *Health insurance,* etc.) at least part of time is devoted to laboratory works when students have possibilities to work on (usually) computer based project from subject area. The study and assessment methods used are closely related, so, for example, if a traditional lecture is chosen, then most probably closed or open book examination will be used for assessment; if a computer based project is suitable, it will be used as a study method and as an assessment method as well. The same is true for individual/group presentations. During laboratory works (e.g. for a *Health insurance* course) a computer-based project is usually used. Since students’ own work is very important for the achievement of course aims and for the development of competences, discussions, individual or group assignments are used during (even traditional) seminars/ practical classes.

As already mentioned, student’s own work is very important, so a significant amount of time is allocated to individual student’s work at home. Almost until the last semester, hours attributed to compulsory courses are split almost equally between contact and individual work hours (see Table 4), however, proportions may vary from subject to subject. In most cases, individual work hours are used for the fulfilment of homework assignments which may vary from traditional exercises to more complex ones, e.g. research on given topics, preparation of presentations, etc. Moreover, students need to read required and recommended course materials and prepare themselves for laboratory works and classwork during individual work hours. In the world of individual responsibility, there is little need to formally assess a major part of students’ homework. Assessment is done via formal assessment procedures (presentations, projects, exams, etc.) while during preparatory stages students are responsible for self-assessment of their progress. During the early years students are encouraged to use individual tutorials (e.g. during *Mathematical analysis* classes) to check whether competences are developed properly. In any case, students may discuss problems encountered with the teacher, e.g. via the virtual learning environment(Moodle) or directly in class.

During optional courses the proportion between contact and individual hours varies more significantly – from very little time attributed to contact hours if students’ individual work is more important for achieving aims of the traditional lectures / seminars, e.g. 32 hours out of 125 during classes of *Scientific seminar*, to a quite significant part of time during subjects that require more contact between teachers and students, e.g. 90 out of 125 during classes of *Mathematical Economics*.

Table 4**. Proportion between contact hours and students’ individual work hours**

|  |  |  |
| --- | --- | --- |
|  | **Compulsory course units** | **Optional course units** |
| **Semester** | **Contact hours** | **Individual work, hrs** | **Total** | **Contact hours** | **Individual work, hrs** | **Total** |
| 1 | 401 | 399 | **800** | - | - | **-** |
| 2 | 400 | 400 | **800** | -` | - | **-** |
| 3 | 431 | 369 | **800** | - | - | **-** |
| 4 | 278 | 272 | **550** | ≥80 | ≤170 | **250** |
| 5 | 388 | 412 | **800** | - | - | **-** |
| 6 | 250 | 300 | **550** | ≥80 | ≤170 | **250** |
| 7 | 252 | 298 | **550** | ≥80 | ≤170 | **250** |
| 8 | 15 | 785 | **800** |  |  |  |
| **Total** | **2415** | **3235** | **5650** | **≥240** | **≤510** | **750** |

##### **2.4. Requirements for graduation theses**

Procedures for preparation and defence of a Graduation Thesis are set out in the *Procedure for the Preparation, Defence and Safekeeping of Graduation Theses* approved by Decree No R-446 signed by Vilnius University Vice-Rector on 17th of November, 2015[[15]](#footnote-15) and also in the course description (available on VU IS, Vilnius University Information System). The decree sets out general requirements, such as various terms, principles of formation of the Defence Committee while more detailed standards and thesis evaluation criteria are given in the course description. The aim of bachelor theses is to (practically) demonstrate competences developed during the whole studies. Usually, topics for bachelor theses are provided by the teaching staff a couple of months before the last semester, when the thesis should be written, all topics are entered into VU IS. Students may then choose the topics which is the most interesting to them. After meeting with a potential supervisor, topics may be adjusted. Usually, students are processed on a “first-come-first-served” basis. Most talented students may choose a subject on their own, but in such a case they need to find a supervisor whose research interests are closest to the selected topic. A recommended size of the graduation thesis is 15–50 pages. During the last internal evaluation, the experts expressed concerns that bachelor theses were in most cases prepared by groups of up to four students and suggested that *Attempts should be made to move to a situation whereby all students undertake an individual thesis*. The Study Program Committee (SPC) took all recommendations very seriously, and since 2015 students are advised to prepare their thesis on individual basis. However, during transition period, students are allowed to work in pairs, in which case they must clearly separate their individual contributions, and achievements of each student are assessed individually in all cases, since each student must orally present his/her results during the thesis defence. The SPC is committed to shifting towards individual thesis in the near future, for example, we are currently exploring possibilities to attract social partners as possible supervisors.

After the previous programme evaluation, more detailed requirements for graduation theses were formulated. Each graduation thesis may be attributed to one of three major categories – a survey (review of several academic articles, technical documents, etc., on some real problem related to the programme aims); mostly theoretical research related (containing proofs of new propositions, etc.) and mostly practical applications related (typically related to investigations of some real data set or solving practical problem, nevertheless containing a substantial theoretical part). With a variety of possible topics almost all competences may be developed when preparing final theses, though specific developed/demonstrated competences depend heavily on the topic chosen by the student. In any case it is highly recommended that topics be related to financial/actuarial mathematics; for surveys and mostly practical theses this is a must, and for mostly theoretical theses this is highly desirable. More detailed requirements for each type of thesis are set out in the course description. Broad evaluation criteria are also set out in the course description, e.g. at the minimum all these must comprise an introduction, motivation (review of earlier results/works in the area), main part (proofs of new statements, description and explanation of methods / models used, etc.) and presentation of results (conclusions). The final grade is given after the presentation during the defence and it is based upon mutual agreement of the Defence Committee members. The Defence Committee evaluates the thesis itself (quality of work, importance of the subject, quality of research done, etc.), quality and clarity of presentation, opinion of the reviewer and additional comments of the thesis advisor. The final grade is the average of individual grades of Committee members only; however, if the thesis advisor or reviewer is a member of the Defence Committee, he/she must refrain from voting.

##### **Internship**

Students are required to undergo internship before formally graduating from the university and before their final graduation thesis is defended. There is a possibility to choose *Professional Internship* (chosen by absolute majority of students where general and subject-specific competences are developed in a professional context) or *Scientific Research Internship* (at least in theory, such internship form may be offered for the most talented students; during this internship a student is engaged in scientific research at the Faculty or some other research institution). Internship role in the study process is very important since for the majority of students this is the first time when they get a chance to apply theoretical knowledge and skills in real environments and not some classroom. It is not surprising that all competences, except maybe for those attributed to the fifth group (*Fundamental knowledge and skills in pure mathematics*), are (may be) developed during Internship. Students therefore are advised to treat internship very seriously and to start looking for an internship place several months before the Internship is to start.

The Internship is scheduled for the last semester, and no other formal internships are required from students, since it takes time to develop many applications related competences and gain knowledge needed for financial/actuarial world. Currently, the duration of the internship is 12 weeks, 40 hours per week, a total of 480 hours. However, from spring 2019 onward (e.g. starting with those who enrolled in the fall of 2015), the duration of internship will be reduced to 11 weeks, 36 hours per week, a total of 396 hours. This number is shown in Table 3 as hours for individual work. 5 hours are regarded as “contact” and used mainly for student’s consultations with his/her internship supervisor at the university (e.g. to agree what tasks should be achieved during internship, to clarify possible problems, to agree on the final report, etc.), so that the total hours attributed to internship amount to 401 (15 credits).

Information about the internship may be found on the Faculty’s webpage.[[16]](#footnote-16) Students may start to look for potential internship places (companies) during the 7th semester (typically in November and December, sometimes as early as October) and need to finish all formalities by the end of January of their final year. For example, this academic year, the internship placement process started in October, 2016 and should be finalized by January 31, 2017. Students may find an internship institution/company on their own or may register at VU internship database where contacts of potential internship providers are given. In the latter case, students may need to undergo a competition process (quite similar to a job search process). After a potential internship place is found, a student needs to agree on the tasks to be completed during the internship with his/her potential supervisor from the company and with the supervisor from the university. In all cases, tripartite agreement between the student, the company/organization and the university is signed. The supervisor from the university is almost always student’s graduation thesis advisor. A student is supervised directly in his/her internship place supervisor assigned by the company/organization while the university supervisor is responsible for ensuring that internship tasks are in agreement with the goals of the programme and all formalities are met. The company supervisor is the one who evaluates students’ performance during internship by completing a questionnaire and assigning a grade on a 10-point scale. After completion of the internship, students must provide a written report and make a presentation about his/her internship for the members of the Study Programme Committee and/or academic staff of our Department. The final grade given by the company supervisor may then be adjusted. Also the students have a possibility to evaluate his/her internship by completing an electronic questionnaire.

##### **Strengths and weaknesses of the area under evaluation and improvement measures to be taken**

Strengths:

* The programme curriculum is solid, comparable to similar programmes in Europe, and develops key competences needed in the financial/actuarial world.
* There is an acceptable mix between the basic competences developed which are based on pure mathematics and core competences from the area of actuarial practice.
* Development of subject-specific competences is started as early as possible. Thus our programme stands out from other programmes based on mathematics, and this allows students to decide whether their choice to enrol is in agreement with their career expectations.
* Serious steps are taken to develop team-working skills.
* Though Informatics subjects are not compulsory after the second study year, there are plenty of opportunities for students to develop such skills via optional courses.
* Almost all interested parties were involved when revising the curriculum.
* Latest changes in the curriculum were positively accepted by students and social partners.

Weaknesses:

* Some courses that develop needed but perhaps not indispensable skills may not be fully covered, e.g. some subjects on numerical methods/practical applications are desirable.
* Some subject-specific competences are developed via optional courses only, e.g. *Financial Reports and their Analysis*, so some students may graduate without acquiring all skills necessary to start a career in a particular area.
* As the programme is not fully tested yet, it may happen that the course sequence may need to be changed, e.g. if students do not yet have all the necessary skills.
* The Review Panel of the last evaluation suggested that the curriculum design could be based on streams. This was only partially achieved.
* The Review Panel also suggested that the curriculum should seek to address a range of issues that would be important in employment, e.g. information security, ethical conduct in the world of finance and insurance, steps to be taken to become a consultant, the role of professional bodies in the world of insurance and finance, etc. This again has only been partially achieved, mainly because development of such competences is usually beyond the scope of the first-cycle programmes.
* More IT / software usage during pure mathematics classes is desirable.

Improvement measures:

* Further evaluation of the curriculum among many interested parties (at least student representative and social partners) will be done in the future on a regular basis. Amendments to the curriculum will be made if needed.
* Adding more optional courses (offered to students from other programmes) that develop practical application skills is envisioned.
* SPC will put strong efforts to make IT / software usage ubiquitous in classes of pure mathematics.
* Review of the timing of topics in some of the courses is scheduled to be done at the end of the semester (there were instances of topics during the last semester, for example, that needed to be taught earlier than scheduled).
* Even though Introduction to Financial and Actuarial Mathematics course now provides a glimpse to the programme, discussions with students at least once a year about their progress and acquired competences is envisioned for the nearest future.

### Academic staff

##### **3.1. Composition of academic staff and its conformity to requirements**

25 academic staff members, including 8 full professors, 6 associate professors, 8 lecturers and 3 assistant lecturers (see Table 5 below) were/are involved in our Programme during the academic year of 2016-2017. Also a handful of assistants/lecturers helped with tutorial classes (will teach them) but there are no credits given separately to such classes so such instances were not counted in Table 5.

The average teaching experience of the all above mentioned 25 academic staff is 19,24 years; their work experience is 20,8 years on average.

Table 5. **Composition of academic staff according to academic titles and research degrees and scope of teaching in the SP of Financial and Actuarial Mathematics (see study plan of the academic year 2016-2017).**

|  |  |  |
| --- | --- | --- |
| Academic title, research degree | No of people employed  | Scope of teaching in the SP |
| Credits | Percentage |
| Professors (Dr. Habil. or Prof. Dr.) | 8 | 83.17[[17]](#footnote-17) | 39.60 |
| Associate Professors (Dr.) | 6 | 48.17 | 22.94 |
| Lecturers with a doctoral degree | 8 | 58.67 | 27.94 |
| Assistant lecturers, doctoral students | 3 | 20 | 9.52 |
| Total | 25 | 210 |  |

The composition of the academic staff is in conformity to the requirements stipulated in legal acts of the Republic of Lithuania,[[18]](#footnote-18) which is reflected in Table 6.

Table 6. **Conformity of the qualifications of academic and other staff in the first-cycle SP of Financial and Actuarial Mathematics to the General Requirements and to the Regulation of Study Programmes of VU**

|  |  |
| --- | --- |
| **Requirements** | **In the study programme** |
| No less than half of the course units (modules) in the study field shall be taught by researchers. | 36 out of 38(during academic year 2016-2017) |

The next table (see Table 7) presents changes in the composition of the academic staff teaching courses to Financial and Actuarial Mathematics programme students. As one can notice, changes in the period under review were essentially minor, a few people have changed but their positions remained approximately the same overall.

Table 7. **Composition of academic staff in the SP of Financial and Actuarial Mathematics according to position, academic years 2012-2016**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Academic yearPosition | **2012** | **2013** | **2014** | **2015** | **2016** |
| number | **%** | Number | **%** | number | **%** | number | **%** | number | **%** |
| Professors | 7 | 26.92 | 6 | 24 | 6 | 27.27 | 6 | 27.27 | 8 | 39.60 |
| Associate professors | 8 | 30.77 | 8 | 32 | 7 | 31.82 | 5 | 22.73 | 6 | 22.94 |
| Lecturers\doctors | 7 | 26.92 | 8 | 32 | 6 | 27.27 | 6 | 27.27 | 8 | 27.94 |
| Lecturers | 3 | 11.54 | 2 | 8 | 2 | 9.09 | 4 | 18.18 | 3 | 9.52 |
| Assistant lecturers | 1 | 3.85 | 1 | 4 | 1 | 4.55 | 1 | 4.55 | - | - |
| **Total** | **26** |  | **25** |  | **22** |  | **22** |  | **25** |  |

##### **3.2. Recruitment of teaching staff, evaluation, turnover**

On 17 December 2013 the Senate of Vilnius University (Decree No SK-2013-8-2) approved the *Regulations for Organising Open Competition for Teaching and Research Staff of Vilnius University*, which stipulate the procedure of evaluating the qualifications of the teaching and research staff of Vilnius University and the procedure of the competition as well as qualification requirements. At the University, teaching and research staff (except for invited professors and researchers) are recruited or promoted to higher positions on the basis of the results of open competition. The competition is started by the order of VU Rector. After the candidate wins the competition, he signs a contract for five years. If the person after five years of his/her work at the University, which is his/her main employer, wins the competition for the same position for the second time in succession, he/she signs a job contract for an unlimited period.

To determine if the qualifications of the teaching and research staff members are adequate for the position taken, teaching / research staff is evaluated every five years. During the evaluation, the following aspects are taken into consideration: the number of research papers, participation in conferences, supervising research projects, lecturing, preparing teaching materials, participation in the third-cycle (doctoral) studies, supervising students’ papers, expert, managerial and other research-related activities. Moreover, the students’ feedback on the lecturer’s teaching is taken into account. During the last years, the system of students’ feedback has been expanded paying more attention to student satisfaction and thus contributing to a more objective representation of the student’s opinion.

During the period of self-evaluation, the turnover of the academic staff has been hardly noticeable (see Table 8). For every person who ceased to teach to our programme students, we were fortunate to find a suitable replacement.

Besides regular teaching staff, some lectures are given by professionals, e.g. Laimė Naruševičienė from **ERGO Insurance SE**, Romualdas Zovė from Central Bank of the Republic of Lithuania.

Table 8. **Turnover of academic staff in the SP of Financial and Actuarial Mathematics**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Academic year** | **Full professors** | **Associate professors** | **Lecturers/doctors** | **Lecturers** | **Assistant lecturers** |
| **First-time agreement with VU** | **Left VU** | **First-time agreement with VU** | **Left VU** | **First-time agreement with VU** | **Left VU** | **First-time agreement with VU** | **Left VU** | **First-time agreement with VU** | **Left VU** |
| 2012-2013 |  | 1 |  |  |  | 1 | 1 |  | 1 |  |
| 2013-2014 |  |  |  | 1 |  | 1 |  | 1 |  |  |
| 2014-2015 |  |  |  |  |  |  |  |  |  | 1 |
| 2015-2016 |  | 1 |  | 1 |  |  | 1 |  |  | 1 |
| 2016-2017 |  |  |  |  |  | 2 | 2 |  |  |  |
| **Total** |  | **2** |  | **2** |  | **4** | **4** | **1** | **1** | **2** |

The age of the academic staff implementing the SP of Financial and Actuarial Mathematics is 49 years on average (see Table 9).

Table 9**. Distribution of academic staff by age**

|  |  |
| --- | --- |
| **Position** | **Age** |
| **25-34** | **35-44** | **45-54** | **55-64** | **65 and over** |
| Professors | 0 | 0 | 2 | 4 | 2 |
| Associate professors | 0 | 3 | 0 | 2 | 1 |
| Lecturers\doctors | 2 | 2 | 3 | 1 | 0 |
| Lecturers | 1 | 2 | 0 | 0 | 0 |
| Assistant lecturers |  |  |  |  |  |
| **Total** | **3** | **7** | **5** | **7** | **3** |

The age bands of 35–44, 45–54, and 55–64 are almost equally represented, so the programme may benefit from experience gained by “elder” teachers as well as from new ideas brought by “younger” colleagues. However, since currently 40% of the academic staff are 55 and older, we may soon encounter a problem as most of senior staff members teach fundamental courses to large audiences. Keeping younger faculty members is also a problem due to low salaries. With the new university-wide salary reform this problem is expected to be at least partially solved, but seeing first promising results will take a few more months or even years. As of now we still have a solid faculty basis from other departments of the Faculty of Mathematics and Informatics, people who are willing to help us teach programme students, and with the structural Faculty reform, expected to be completed by the end of 2017, it should become easier to fill potential staff shortage in the programme.

##### **3.3. Teaching workload of academic staff**

The University is in the process to reform the salary system for academic staff. The Faculty of Mathematics and Informatics in on the forefront of this reform and is working on the model to see what impact to the existing system changes in the required teaching load, research and other work hours would have to all involved. At this time, precise data on the teaching load, and especially other (out of class) work, of academic staff involved in our programme is not available. Contact hours, of course, are listed in course unit descriptions, but these numbers alone would not show a complete picture of staff involvement. We hope that the new faculty-wide (and later possibly university-wide) staff work monitoring system which is currently tried at our Faculty will yield more accessible data and clearer overall picture. As of now we can only provide *suggested* (or discussed; not yet approved) working hour distribution for each category of academic staff (see Table 10). From this table, the annual teaching load of an academic staff member working full-time is 300.8 hours on average (1584 work hours per year; 36 work hours per week). Actual data do varies depending on the academic staff member since some have higher teaching load, some teach in various programmes, balancing the teaching load to match the envisioned workload is yet to be accomplished.

Table 10. **Envisioned teaching workload for various academic staff members**

|  |  |  |  |
| --- | --- | --- | --- |
| **Position** | **Contact work with students (in class)** | **Other work (out of class)** | **Research and experimental development (RED)** |
| **hours** | **%** | **Hours** | **%** | **hours** | **%** |
| Professors | 224 | 14.14 | 836 | 52.78 | 524 | 33.08 |
| Associate professors | 256 | 16.16 | 804 | 50.76 | 524 | 33.08 |
| Lecturers\doctors | 384 | 24.24 | 1200 | 75.76 | NR | - |
| Lecturers | 384 | 24.24 | 1200 | 75.76 | NR | - |
| Assistant professors | 256 | 16.16 | 804 | 50.76 | 524 | 33.08 |

NR – not required

##### **3.4. Competence and professional development of the academic staff**

Academic staff of the Faculty of Mathematics and Informatics has the same opportunities as all other Vilnius University academia members to participate in various courses to increase pedagogical competence. Each year, for example, E-learning and Examination Centre at Vilnius University organises courses to help teachers grasp modern IT technologies useful in the learning process. Also the newly established Vilnius University Pedagogy Centre started organising qualification improvement courses with the aim to improve programmes throughout the university. We expect improvements in this direction, albeit information at the Faculty of Mathematics and Informatics about the teaching skills developing events is rather scarce. Unfortunately, one cannot say that it is in any way systematically encouraged. Raising pedagogical competence level, de facto, became the responsibility of each academic staff member individually. Each year, for example, we are asked if we plan to go for an ERASMUS teaching visit, but hardly any of us go. On the other hand, the Faculty has sufficient funds for conferences, so whenever researchers find interesting meetings, they are fully or at least partially financed. Priority is given for those who give talks at a conference. International conferences are also being organized at our Faculty. With the help of Lithuanian Mathematical Society, the Faculty organized the 11th International Vilnius Conference on Probability Theory and Mathematical Statistics in June–July of 2014,[[19]](#footnote-19) the 12th conference is being planned for 2018. For more details on conference participation, see Table 11.

Another opportunity to develop competences is the weekly seminar organized by the Department of Mathematical Analysis. It is mostly devoted to new scientific developments in finance and in actuarial science. However, some presentations are devoted to didactics and developments in actuarial education, e.g. lecturer Aldona Skučaitė gave a few talks on the changes in Education Syllabus adopted by International Actuarial Association. All teachers involved in the programme had an opportunity to get acquainted with the modern trends and adapt their courses accordingly. Department seminar is also a good time for everyone involved to talk about student feedback and needed programme changes. The latest such discussion was held after the spring semester of 2016. It is anticipated that such meetings will continue on a regular basis.

The scope of research undertaken by the SP academic staff is shown in Table 11 while Table 12 provides information about the scientific projects by the SP academic staff. The number of projects significantly decreased during the past couple of years due to fewer funding opportunities.

Table 11**. Research output of the academic staff of the study programme in 2012-2016**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **01** | **02** | **03** | **04** | **05** | **06** | **07** | **08** | **09** | **Total** |
| **2012** |  | 1 | 17 |  |  | **1** | **22** |  |  | **41** |
| **2013** | 6 | 2 | 17 |  |  | **1** | **14** |  |  | **40** |
| **2014** | 1 |  | 13 |  |  |  | **12** |  |  | **26** |
| **2015** |  | 1 | 15 |  |  | **3** | **9** |  |  | **28** |
| **2016** | 1 | 1 | 11 |  |  |  | **3** |  |  | **16[[20]](#footnote-20)** |
| **Total** | **8** | **5** | **73** |  |  | **5** | **60** |  |  | **151** |
|  |
| **01** | **BOOKS:** (1) Monographs (monograph, study); (2) Literature intended for studies (textbook, teaching aid, other study-related literature); 3) reference publications (dictionary, guidebook, manual, encyclopaedia, atlases, maps, others); 4) other books (publications on the sources of research and scientific heritage, comments of legal acts, reports of projects, and other works, compiled and/or edited work, chapters in books) |
| **02** | **SUMMARIES**((1) summary of a doctoral dissertation, (2) summary of a habilitation thesis, (3) an overview of research papers submitted for the habilitation procedure) |
| **03** | **ARTICLES IN SERIAL PUBLICATIONS (JOURNALS) AND SINGLE VOLUMES** ((1) article in DB Thomson Reuters *Web of Science*, (2) article in DB Thomson Reuters *Web of Science*, (3) article in the international DB and publishing houses, (4) article in other peer-reviewed publications, (5) popular science article, (6) article in a publication on research, arts or culture, (7) other articles (overviews, information, introductory) |
| **04** | **PUBLICATIONS OF RESEARCH SOURCES AND PUBLICATION OF SCIENTIFIC HERITAGE** |
| **05** | **REVIEWS** ((1) review in DB Thomson Reuters *Web of Science*, (2) review in DB Thomson Reuters *Web of Science*, (3) review refereed in the international databases and publishing houses, (4) review refereed in other databases, review in other peer-reviewed publications, (5) review in a science popular publication, (6) review in a publication on research, arts or culture) |
| **06** | **ARTICLES IN CONFERENCE PROCEEDINGS**: (1) Articles in peer-reviewed conference proceedings (article in DB Thomson Reuters *Web of Science*, article in conference proceedings in the international DB and (or) in the international publishing house, article in conference proceedings refereed in other databases, article in peer-reviewed international conference proceedings abroad, article in peer-reviewed international conference proceedings in Lithuania, article in peer-reviewed conference proceedings in Lithuania); (2) Articles in non-reviewed conference proceedings (article in non-reviewed international conference proceedings abroad, article in non-reviewed international conference |
| **07** | **CONFERENCE ABSTRACTS:** (1) Conference abstracts in peer-reviewed publications (abstracts in DB Thomson Reuters *Web of Science* and abstracts in Thomson Reuters Master Journal List, abstracts in other databases, peer-reviewed extended abstracts, abstracts in other peer-reviewed publications); (2) Conference abstracts in non-reviewed publications |
| **08** | **PATENTS** ((1) patents registered in the European Patent Office (EPO), (2) patents registered in the US Patent and Trademark Office (USPTO), (3) patents registered in the Japan Patent Office (JPO), (4) patents registered in other countries, (5) patents registered in Lithuania, (6) other patents) |
| **09** | **TRANSLATION** ((1) translated book, (2) chapter in a book, (3) article) |

Table 12**. Research projects implemented by the SP academic staff in 2012-2016**

|  |  |  |
| --- | --- | --- |
| **Title of project** | **Period** | **Source of funding/Partner(s)** |
| **International projects**  |
| Statistical Inferences and Limit Theorems of Random Processes and Fields | 2011-2012 | Bilateral Lithuania-France research programme Gilibert, Vilnius and Lille Universities |
| **National projects** |
| Random graphs | 2011-2012 | Research Council of Lithuania (RCL) |
| Concrete Functional Analysis and Probability Theory: new methods and their applications | 2012-2014 | Research Council of Lithuania, scientist group project Nr. MIP-53/2012/LSS-580000-456 |
| Long Memory and Heavy Tail Modelling in Finance and Insurance | 2011-2012 | Research Council of Lithuania, scientist group project Nr. MIP-11155 |
| Statistical Decisions and Limit Theorems for Random Processes and Fields | 2011-2012 | RCL grant |
| Mathematical Models of Real Networks and Their Analysis | 2013-2014 | Research Council of Lithuania, scientist group project Nr. MIP-067/2013 |
| Nonlinear Long Memory, Heavy Tails and Aggregation | 2013-2015 | Research Council of Lithuania, scientist group project Nr. MIP-063/2013/LSS-580000-043 |
| Estimation of Extreme Value Index | 2013-2014 | Research Council of Lithuania, scientist group project Nr. MIP-076/2013 |

##### **Exchange of academic staff**

Even though Vilnius University has opportunities for academic staff to go for teaching visits abroad, e.g. under ERASMUS programme or taking advantage of bilateral agreements, teachers involved in the SP are often attending shorter conferences, workshops, and not going for teaching visits. As an exception, we can mention assoc. Professor A. Maldeikienė, who left to Taiwan for a semester in 2013; and we were fortunate to have a sufficiently qualified replacement, I. Šimonytė (the former Minister of the Ministry of Finance), who later was elected Chairman of Vilnius University Council. In 2016, both A. Maldeikienė and I. Šimonytė were elected to the Seimas (the Parliament of Lithuania) so we had to find a new lecturer.

##### **Proportion of academic staff to students in the study programme**

Average students-to-teachers ratio during period of evaluation was 8.5. During the academic year of 2016/2017 twenty-five (25) teachers were involved in our programme. Average number of students is about 217, since we had 50-60 new admissions each year and 54 dropouts during all period under investigation. Study programme Committee thinks that the ratio is appropriate to maintain the quality of studies. A slight staff shortage is experienced with supervising graduation theses, but here also steps are taken to attract thesis advisors from other Faculty departments and social partners.

##### **Strengths and weaknesses of the area under evaluation and improvement measures to be taken**

Strengths:

* Experienced and highly qualified academic staff is available.
* Sufficient opportunities to raise scientific/pedagogical competences (via seminars, conferences, university courses, etc.).
* Colleagues from industry are actively participating in ad-hoc activities (e.g. giving lectures and seminar talks on specific topics to students and academic staff).

Weaknesses:

* Though currently the distribution of teacher ‘s age is appropriate, we may experience potential shortage of qualified academic staff in the nearest future since aging population is a threat also for us, e.g. younger colleagues do not always want/have sufficient financial and other motivation to work at the university;
* Since originally the programme was derived from studies in pure mathematics, the competence of teachers who deliver „fundamental “subjects (in pure mathematics) is in general appropriate, however, we still have a shortage of experienced teachers who teach applied courses.

Improvement measures:

* Holding regular meetings on teaching competence, discussing what and how in the course contents and/or delivery mode may be improved.
* Efforts will be made to attract more experienced teachers to deliver applied courses, e.g. via contacts with social partners, etc.

### Facilities and learning resources

##### **4.1**[**. Rooms available for studies and the number of workplaces**](#_Toc329713669)

The Faculty of Mathematics and Informatics (FMI) is situated in several locations in Vilnius: two buildings are next to each other at Naugarduko St. 24 (classrooms and teachers’ offices) and Šaltinių St. 1A (computer laboratories), and another building is located at Didlaukio St. 47. Both places of the Faculty are accessible by public transport. The lectures of Financial and Actuarial Mathematics study programme take place mainly in two buildings: Naugarduko St. 24 and Šaltinių St. 1A. In addition to that, students have optional courses at the Didlaukio St. Building, and general university courses (GUS) at the other university facilities, depending on their choice. The most frequently used rooms and laboratories for the study programme are presented in Table 13 and Table 14.

Table 13. **Rooms most frequently employed for studies**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Room No (or name)** | **Address** | **Area, m2** | **Number of workplaces** | **Equipment available in the room** |
| N101 | Naugarduko St. 24 | 204,10 | 224 | Projector, sound system, computer for presentations, blackboard |
| N102 | 135,10 | 140 | Projector, sound system, computer for presentations, blackboard |
| N103 | 133,80 | 124 | Projector, sound system, computer for presentations, blackboard |
| N105 | 32,40 | 25 | Projector, computer for presentations, blackboard |
| N113 | 32,54 | 25 | Projector, computer for presentations, blackboard |
| N203 | 53,36 | 40 | Blackboard |
| N300 | 48,87 | 45 | Projector, blackboard |
| N301 | 69,60 | 80 | Projector, blackboard |
| N303 | 67,07 | 80 | Projector, blackboard |
| N304 | 34,14 | 25 | Projector, blackboard |
| N306 | 32,90 | 25 | Blackboard |
| N309 | 32,90 | 25 | Blackboard |
| N311 | 34,80 | 25 | Blackboard |
| N312 | 34,80 | 25 | Projector, blackboard |
| N409 | 33,40 | 25 | Blackboard |
| N411 | 34,10 | 25 | Blackboard |
| N415 | 35,30 | 25 | Blackboard |

The average occupation of class rooms in autumn semester is 76%, in spring - 51%, since the fourth year students leave for Internship during the spring semester.

Table 14. **Teaching and learning laboratories most frequently employed for studies**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Room No (or name)** | **Address** | **Area, m2** | **Number of workplaces** | **Equipment available in the room** |
| S07 | Šaltinių St.  1A | 41,65 | 16 | 8 Windows computers, blackboard |
| S10 | 30,90 | 16 | 8 Terminal computers, blackboard |
| S11 | 35,40 | 16 | 8 Terminal computers, blackboard |
| S12 | 35,40 | 16 | 8 Terminal computers, blackboard |
| S13 | 82,60 | 40 | 20 Terminal computers, projector, blackboard |
| S14 | 29,98 | 13 | 13 Terminal computers, projector, computer for presentations,  blackboard |
| Video conference room | 172,52 | 40 | 8 Terminal computers, projector, sound system, computer for presentations, blackboard |

Students of our study programme spend at least 126 contact hours in computer laboratories. The number can be as high as 190 or more contact hours if all scheduled laboratory exercises for compulsory courses take place in computer laboratories or a student chooses an optional IT course. This amounts to at least 4.75% of all contact hours. Besides Informatics/Practical Informatics and other IT optional courses, students have to use various software in the following subjects: *Differential and Integral Equations*, *Financial Mathematics*, *Survival and Demographic Models*, *Health Insurance*, *Mathematical Analysis*.

The average occupation of laboratories in the autumn semester is 37%, in spring - 30%. The number of rooms and computer laboratories are sufficient for successful studies. Students often bring their own laptops and use network resources; on the other hand, there are enough computers in the laboratories, so a majority of students use laboratory computers. During the last 5 years, the building at Didlaukio St. was renovated, and 8 new computer classes were installed. Therefore, computer laboratories at Šaltinių St. 1A became less crowded. This step gives the possibility to create more effective and convenient academic timetable for the students of Financial and Insurance Mathematics.

There is a library reading room in Naugarduko St. with 90 seats (8 of them with computers). Opening hours of the library are 9:00-18:00. The occupation of the library varies during the study year: in July and August, it is approximately 5%, in September it reaches 70%, in December and May (before examination session) it rises up to 95%, and during the remaining time it ranges between 30-70%.

Students can also use the resources and self-study environment at the new modern Vilnius University library (MKIC) located at Saulėtekio St. 5, which was opened in 2013. Students prefer to use MKIC facilities since they are more modern, open on a 24/7 basis and are close to dormitories. Recently MKIC became very popular among students where they spend much time studying, preparing presentations or bachelor theses.

There are also lounge rooms in Naugarduko St. and Didlaukio St. buildings, where students may relax or use self-service cafeteria.

The Naugarduko str. 24 building is old, and even though it was renovated as much as possible, it is not totally/easily accessible to disabled people. Even though equipment to get to higher floors is available if needed, it requires assistance. On the other hand, getting to the ground floor auditoriums is much easier. Thus, when planning the timetable, all lectures for study programmes with disabled students are usually planned on the ground floor, so that students have an easy access to the rooms.

The three largest rooms in the Didlaukio St. building are equipped with remote control cameras for online broadcasting of lectures for disabled students.

The following Table 15 represents the renovation of rooms at Naugarduko St. 24 facilities in 2015-2016.

Table 15. **Renovation of rooms and laboratories for teaching and learning**

|  |  |  |
| --- | --- | --- |
| **No** | **Room for teaching and learning** | **The works completed and their cost during 2015-2016, EUR** |
| 1. | N107 | Renewal of the room, 1875 EUR |
| 2. | N113 | Renewal of the room, 2120 EUR |

There are no major investments planned for renovation of Naugarduko St. 24 and Šaltinių St. 1A facilities, because a new building for the Faculty will be constructed in the near future at Visoriai, since there is already a funding of 32 million Euro planned for this matter.

##### **4.2. Equipment for studies**

Usually rooms with blackboards and projectors are used for theoretical lectures. Some lecturers have their own laptops to connect to the projector, otherwise, they can use laptops kept at the security office. Bigger lecture rooms are all equipped with laptops. Lecturers use either rooms with blackboards and projectors at Naugarduko St. 24 or computer laboratories at Šaltinių St. 1A during practice classes. There are 156 workplaces with computers in this building. When laboratories are not used for practice classes, students can use them for self-study. The larger rooms are also equipped with microphones*.*

The laboratories enable students to work on different operating systems (Linux, Windows, iOS). Students can use various software, statistical-econometric packages like SAS, Eviews, R, SPSS.

High speed and wireless internet connection is available in all Faculty buildings. Students and staff of the university can use Eduroam or MIF open wireless connection. Every student of the Faculty of Mathematics and Informatics gets additional electronic resources: every student receives 500 MB of space on servers for study purposes and can create, and set up his or her own websites. Students and academic staff can also use the supercomputer[[21]](#footnote-21) 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 (e-mail, e-mail conferences, web page hosting, etc.). 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 available software and computer equipment meets teaching and learning needs. Each year the Faculty assigns budget for equipment and software renewal. Detailed information is provided in Table 16.

Table 16. **Budget for equipment renewal**

|  |  |  |
| --- | --- | --- |
| **Year** | **Hardware (Computers, multimedia, servers), Euro** | **Software (servers and workplaces), Euro** |
| 2012 | 87975 | 87558 |
| 2013 | 255499 | 268573 |
| 2014 | 342547 | 48118 |
| 2015 | 51119 | 5311 |
| 2016 | 38261 | 3594 |

In 2013 there was an increase of budget for computer classes’ renovation in Didlaukio St. 47, most of the money for this renovation was obtained from the project EINFRA. A new Apple computer laboratory “Innovation Space” was established in 2014, which was financed by one of Faculty’s social partners, Barclays. There was also a lot of new server equipment and software purchased in 2014.

##### **4.3. Teaching and learning resources**

The Faculty library owns around 70000 various resources and publications (books, journals, textbooks) on mathematics, statistics, probability theory, economics, informatics, information technologies, and other subjects in different languages (mostly in English and Lithuanian).

The mathematical and statistical literature constitutes the majority of the library holdings. The Faculty library cooperates with the Central Vilnius University library and the library of the Lithuanian Science Academy*.* Holdings are regularly renewed*.*

The resources of the Faculty library are constantly updated according to the plan of the Central library of the University and teachers’ requests. Usually, teachers send their requests to the library staff. Books or journals are ordered after the list of requested resources is approved by the vice-dean overseeing financial matters. Each year the amount spent on Faculty library resources renewal is about 14000 EUR. Detailed information about the budget for journals and books at the Faculty is provided in Table 17.

Table 17. **Budget for journals and books, EUR**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2012** | **2013** | **2014** | **2015** | **2016** |
| 16398,20 | 15667,34 | 16726,31 | 11295,01 | 10007,49 |

The budget for purchasing books and journals has decreased in 2015 because students started using electronic resources more often, for example, electronic books, publications in databases. Students can find relevant information in electronic databases (via Vilnius University library): Springer Link, Science Direct, JSTOR, Annual Reviews, etc. Vilnius University Library subscribes to more than 60 databases. Students can also find lecture notes and study material of the subjects on lecturers’ webpages and on Moodle based Vilnius University virtual learning environment. Students also use the modern resources and self-study environment at the new Vilnius University library centre (MKIC) located at Saulėtekio Str. 5, which is very convenient for those living in the dormitories. The new library centre was opened in 2013.

There are possibilities to use Vilnius University Virtual Learning Environment (based on Moodle) for learning and/or convenient communication. Many teachers, e.g. teaching *Actuarial Mathematics*, *Introduction to Financial and Actuarial Mathematics*, *Financial Mathematics*, *Management of Financial Risks*, *Mathematical analysis*, *Random Processes*, *Risk management,* etc., use Moodle as a supplement to face-to-face communication. Other teachers usually also use some platform for virtual communication. SPC acknowledges that it is more convenient for students when one platform is used during all courses, so will take necessary steps to encourage all teachers to use Moodle in the future.

##### **4.4 Strengths and weaknesses of the area under evaluation and improvement measures to be taken**

Strengths:

* Material resources are sufficient for the successful implementation of the study programme. Premises are sufficient, and their quality is appropriate.
* Learning resources (software, books in the library, etc.) are constantly updated according to the needs of lecturers and students.
* Many teachers use Virtual learning environment (Moodle) as a supplement to face-to-face communication.

Weaknesses:

* There is a need to increase budget for new versions of software, as well as to obtain some additional software needed for successful studies.
* In some cases there are only a few copies of a particular textbook available in the library, especially if this textbook is in English and/or is quite expensive. In such cases teachers usually provide additional learning material (e.g. lecture notes, slides, etc.) via Moodle or some other channel.
* Capabilities of the Virtual Learning Environment are not fully appreciated and universally used.

Improvement measures:

* A new building for the Faculty is being planned, so the quality of premises will be improved significantly in the near future.
* The Faculty is currently being renovated to make it even more accessible for people with disabilities; their needs are prioritized when conducting a timetable.
* The Faculty will consistently continue to invest in new books, better software and hardware.
* Steps will be taken to encourage all teachers employ Virtual Learning Environment (Moodle) for their classes.

### Study process and assessment

##### **5.1. Admission requirements, statistics and major tendencies**

Since the program under evaluation is attributed to the first-cycle studies, students are admitted through the System of General Admission administered by *LAMA BPO* (a Lithuanian acronym for the *Association of Lithuanian Institutions of Higher Education for General Admission*, see <http://www.lamabpo.lt/> for more information). *Rules of Admission to the First-cycle Studies at Vilnius University* (approved by the VU Senate; available on the VU website[[22]](#footnote-22)) are also applied for admission procedures. A prerequisite for admission to each programme is secondary education. Admission to a study programme is competitive and based on the entrance score. The score and the principles of its calculation are defined in the above mentioned *Rules,* specifically in 2016 the entrance score was computed as a weighted average of grades of:[[23]](#footnote-23)

1. School-leaving national exam in Mathematics (weight - 0,4);

School-leaving (but not necessarily national) exam in Lithuanian Language and Literature (0,2);

School-leaving (but not necessarily national) exam or final school grade in Information Technology or Physics(subject depends on applicants choice) (0,2);

One more subject taught in secondary school and different from those listed under (i)–(iii) (0,2).

The minimum requirement to enter studies at Vilnius University is applied – entrance score cannot be lower than 3. Moreover, in 2016 the minimum score to be admitted to our programme was set to 4, it amounts to 40% of the maximum possible score excluding possible extra points. This is, however, currently a redundant requirement, since the lowest score of admitted students is higher (see Table 20 below).

All information about admission requirements may be found in VU booklets and other publications, during study fairs, Open Days organized by VU, other promotional events, e.g., “Student for a day”, where secondary school students can attend lectures with other students of our Faculty. Prospective applicants can also consult the website “VU Kviečia“[[24]](#footnote-24) („Vilnius University is Calling“, website in Lithuanian). All the above mentioned sources are the same as for all other programs in Vilnius University, but probably they are not so good to attract mostly motivated students. A short survey among the 1st year students was carried out during September 2016 by Study Programme Committee (SPC), and one of questions asked was –*Why did You decide to choose this programme for Your bachelor studies?* Twenty (20) responses were received (about 1/3 of the 1st year students). No one indicated that their choice was based solely on information received via official channels. The majority answered that the main reason was studies based on exact sciences together with good career opportunities; some indicated that their choice was based on advice got from a former programme graduate. Though this survey cannot be regarded as representative, it is obvious that successful programme graduates may serve as programme ambassadors and help attracting new students, so maintaining and strengthening ties with our graduates is a priority for SPC, as an example graduates may be invited to give ad-hoc talks to our students.

Varying levels of competition for studies were observed during all years under analysis. Since applicants may apply for 9 study programmes – state financed and personally financed studies are regarded as separate options – at once, and until 2014 applicants had a possibility to apply for 12 study programs in total, it is quite difficult to define what exact competition there was. There is no justification to simply divide the number of all applicants by the number of admitted (planned to be admitted) students. The yield rate (percentage of students who decided to enrol after having been offered admission) is usually very high (>80%, at least during recent years), so due to a high number of all applicants to our programme, it is highly unlikely that someone who indicated our programme as, say, 5th–9th (5th–12th) in priority, were even offered a possibility of admission. In reality, real competition is observed among those who indicated our programme as 1st or 2nd priority. For the purposes of this analysis, we use two metrics of competition – Regular competition based on 1st priority and Weighted average competition. Regular competition based on 1st priority is simply the number of applicants who indicated Programme as 1st priority to the number of students planned to be admitted. Weighted average competition takes into account not only the number of all applicants but also the number of choices made by every applicant and Programme priority set by each applicant. See Table 18 for comprehensive statistics.

Table 18**. Results of candidate admission to the SP of Financial and Actuarial Mathematics during the period of self-evaluation.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Year of admission** | **Source of financing – state funded (sf) / not funded by the state (nsf)** | **Planned number of students / study places** | **Number of applications** | **Competition** |
| **1st priority** | **Total** | **Regular based on 1st priority** | **Weighted average** |
| 2012 | sf | 56 | 137 | 587 | 2,45 | 2 |
| nsf | 5 | 1 | 135 | 0,2 | 2,4 |
| **Total** | **61** | **138** | **722** | **-** | **-** |
| 2013 | sf | 56 | 114 | 438 | 2,04 | 1,39 |
| nsf | 5 | 10 | 103 | 2,00 | 2,62 |
| **Total** | **61** | **124** | **541** | **-** | **-** |
| 2014 | sf | 50 | 86 | 350 | 1,72 | 1,3 |
| nsf | 3 | 2 | 113 | 0,67 | 3,55 |
| **Total** | **53** | **95** | **463** | **-** | **-** |
| 2015 | sf | 48 | 96 | 347 | 2,06 | 1,62 |
| nsf | 3 | 91 |
| **Total** | **48** | **113** | **438** | **-** | **-** |
| 2016 | sf | 60 | 76 | 257 | 1,30 | 1,04 |
| nsf | 2 | 79 |
| **Total** | **60** | **86** | **336** | **-** | **-** |

From 2012to 2015, the competition for the state funded and self-funded study places was carried out separately, e.g. Faculty management set different benchmarks for studies with different financing mode, so competition rate was calculated separately. During the last two years, just one competition rate for study places with both types of financing was calculated. Since the majority of applicants choose state financed studies, we limit this analysis to this option only. Competition data shows no clear trend, there was a slight decline in competition rates during the period of 2012–2014, then we saw an increase during 2015, and again a decrease during last year. It is quite difficult to clearly state what tendencies are indicated by the numbers above. First of all, the number of offered study places was increased to 60 during 2016 compared to 48 in 2015. If not for this increase, the regular competition based on 1st priority would be 1,63, e.g. still lower than in 2015 but higher than based on 60 study places. Moreover, the competition rate may be influenced by a number of parameters from solely demographic (numbers of high school graduates) to more complex ones, e.g. competition between different Programmes, including those offered abroad, forecasted career possibilities or even fashionable choices among young people. Even the offered number of study places and scores of enrolled students during previous years may have positive or negative influence on competition rate, e.g. if a high school graduate estimates that his/her chances of enrolment are quite low, he/she may easily decide to choose another programme as 1st priority simply because he/she will then have higher chances of admission. Finally, competition rate should be investigated together with rates of enrolled students (how many of those offered a study place actually decide to enrol) and scores of enrolled students (all in all, it is quality not solely quantity that matters). So next we examine the two above-mentioned points.

The number of enrolled students was usually equal or even slightly exceeded the number of offered study places (see Table 19).

Table 19**. Numbers of admitted (enrolled) students during 2012 – 2016**

|  |  |  |  |
| --- | --- | --- | --- |
| **Year of admission** | **Source of financing – state funded (sf) / not funded by the state (nsf)** | **Planned number of students** | **Number of admitted students** |
| 2012 | sf | 56 | 59 |
| nsf | 5 | 4 |
| Total | **61** | **63** |
| 2013 | sf | 56 | 54 |
| nsf | 5 | 6 |
| Total | **61** | **60** |
| 2014 | sf | 50 | 50 |
| nsf | 3 | 3 |
| Total | **53** | **53** |
| 2015 | sf | 48 | 58 |
| nsf | 0 |
| Total | **48** | **58** |
| 2016 | sf | 60 | 61 |
| nsf | 0 |
| Total | **60** | **61** |

More important are not the sole numbers of enrolled students, but their scores, which are provided in Table 20.

Table 20**. Entrance scores of the students admitted (enrolled) to the Study Programme of Financial and Actuarial Mathematics during 2012 - 2016[[25]](#footnote-25)**

|  |  |  |  |
| --- | --- | --- | --- |
| **Year of admission** | **Source of financing – state funded (sf) / not funded by the state (nsf)** | **Entrance score of the students admitted to the Study Programme** | **Mean value of the entrance score of all Faculty programmes** |
| **Highest score** | **Lowest score** | **Mean value** |
| 2012 | sf  | 22,34 | 18,92 | 20,63 | 17,83 |
| nsf  | 18,98 | 15,44 | 17,21 | 13,71 |
| 2013 | sf  | 19,82 | 15,22  | 17,02 | 16,73 |
| nsf  | 15,30 | 11,62 | 13,69 | 14,11 |
| 2014 | sf  | 9,8  | 4,94 | 7,78 | 7,52[[26]](#footnote-26) |
| nsf  | 5,08  | 4,68 | 4,86 | 4,92 |
| 2015 | sf | 10,80  | 6,48 | 8,01 | 7,67 |
| nsf | **-** | **-** | **-** | 5,14 |
| 2016 | sf | 10,86  | 4,90  | 7,58 | 7,51 |
| nsf | **-** | **-** | **-** | 5,60 |

A simple analysis reveals that the entrance scores of admitted students are quite high. We will limit further analysis only to studies financed by the state since few students choose to pay for their studies themselves. The lowest score during 2016 was higher than the minimum score (4) set by VU authorities and exceeded the minimum admission score in Lithuania during 2016 for similar programmes, which was 4.34.[[27]](#footnote-27) The highest scores were either higher than the maximum possible score excluding possible extra points (years 2012, 2015, 2016) or slightly lower. The average applicant scores were usually slightly above Faculty averages, and usually students admitted to our programme maintain the highest average scores in the Faculty.

During the period under analysis, the number of enrolled students and their scores were within acceptable limits. The Study Programme Committee currently has no intention to suggest the Faculty management to significantly change the number of offered study places. Due to limited Lithuanian market, i.e. limited number of potential students and teachers, and taking into account faculty resources, there are no possibilities to increase the number of enrolled students.

##### **5.2. Changes in the number of students: dropout rate and its causes**

Though the programme has never experienced difficulties attracting new students and the scores of enrolled applicants have been quite high, this does not guarantee that all enrolled students will successfully finish their studies. There may be various reasons for dropout – from personal reasons, including but not limited to family matters, health issues or differences between reality and expectations to failure to achieve acceptable academic standards. We provide some graduation and dropout statistics in this section. We will start from graduation statistics for the period of 2012 – 2016 (by graduation year). It should be noted that every year some students decide to take advantage of academic leave (mostly due to health related and / or maternity issues) or simply take study break holidays. Moreover, those students who have academic debts are not allowed to defend bachelor theses until all required courses are successfully completed. So naturally, the study period for all above mentioned reasons becomes longer than expected (longer than 4 years). Therefore, some caution should be taken when interpreting graduation rate for any single graduation year (see Table 21) and / or short term tendencies (e.g. sudden increase / decrease of rate during some years); however, 5 years on average may be taken as a quite reliable measure. The average graduation rate was 73% which is quite acceptable keeping in mind quite difficult nature of studies and dropouts due to „personal“ reasons, e.g. changes in students preferences / expectations (see paragraph on dropouts below). The lowest graduation rate (60%) was observed for those entering studies in 2008 (scheduled graduation year 2012), but we had an increase in the number of enrolled students during 2008 compared to the average of 50 during the period of 2005-2007. The highest graduation rate (83%) was observed for those entering studies in 2012 (scheduled graduation year 2016).

Table 21. **Graduation statistics during the period of 2012 – 2016**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Admission year** | **Number of enrolled students** | **Graduation year** | **Number of graduates** | **Graduation rate** |
|
| 2008 | 60 | 2012 | 36 | **60%** |
| 2009 | 56 | 2013 | 41 | **73%** |
| 2010 | 55 | 2014 | 42 | **76%** |
| 2011 | 59 | 2015 | 43 | **73%** |
| 2012 | 63 | 2016 | 52 | **83%** |
| **Average during 2012 – 2016** | **293** | **-** | **214** | **73%** |

Directly related to graduation statistics is the dropout rate. As mentioned above, dropouts may occur for many different reasons. Therefore, we will now analyse observed dropouts in more detail than simply providing a single dropout rate. Firstly, we provide dropout data by year of admission and study year (see Table 22).

Table 22**. Dropouts during 2012 - 2016**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Admission year** | **Source of financing – state funded (sf) / not funded by the state (nsf)** | **Number of enrolled students** | **Number of dropouts** | **Dropout rate** |
| **1st year of study** | **2nd year of study** | **3rd year of study** | **4th year of study** | **Scheduled graduation year** | **Total** |
| 2012 | Sf | 59 | 4 | 2 | 2 | 3 | 2016 | 11 | 18,64% |
| Nsf | 4 |   |   | 1 |   | 1 | 25,00% |
| **Total** | **63** | **4** | **2** | **3** | **3** | **12** | **19,05%** |
| 2013 | Sf | 54 | 5 | 6 | 1 |   | 2017 | 12 | 22,22% |
| Nsf | 6 | 5 | 1 |   |   | 6 | 100,00% |
| **Total** | **60** | **10** | **7** | **1** | **0** | **18** | **30,00%** |
| 2014 | Sf | 50 | 4 | 7 | 1 | - | 2018 | 12 | 24,00% |
| Nsf | 3 |   |   |   | - | 0 | 0,00% |
| **Total** | **53** | **4** | **7** | **1** | **-** | **12** | **22,64%** |
| 2015 | Sf | 58 | 8 | 1 | - | - | 2019 | **9** | **15,52%** |
| 2016 | Sf | 61 | 3 | - | - | - | 2020 | **3** | **4,92%** |
| **Total / average during 2012 – 2016** | Sf | **282** | **24** | **16** | **4** | **3** | **-** | **47** | 16,67% |
|
| Nsf | **13** | **5** | **1** | **1** | **0** | **-** | **7** | 53,85% |
| **Total** | **295** | **29** | **17** | **5** | **3** | **-** | **54** | **18,31%** |

No clear trend can be distinguished when analysing dropouts by study year – slightly more dropouts occur during the 1st and 2nd year than during 3rd and 4th year. The 5-year average is about 18%, but one should keep in mind that only those students enrolled in 2012 should graduate by 2016 (at least theoretically), all others are still studying so statistics may change. The average dropout rate for admission years 2012–2013 is about 24%, so it is reasonable to assume that average dropout rate is about 20%. This figure may be within acceptable limits keeping in mind quite difficult curriculum (based on pure mathematics); mix between pure mathematics and its applications (conversations with several dropped out students revealed that some expected more mathematics while others – more applications); specific area of future career, quite high number of enrolments and even that the programme is in fashion among high school graduates (at least 3 students when asked why they decided to dropout mentioned that decision to enrol into this programme was based on fashion and not on more rational arguments). To get a clearer picture, we will analyse dropouts by causes. For the purpose of this analysis all dropouts are attributed into one of four major categories (see Table 23).

No dropouts occurred due to financial burden, such a result may be expected since only a few students pay for their studies. Actually, those paying for their studies themselves dropped out during the period of investigation, but even if this happened due to a financial situation they declared a different dropout reason.

We had no dropouts due to academic dishonesty, e.g. cheating during exams. The programme management and Student Council do not tolerate academic cheating, so various measures are taken to prevent this problem rather than punish students when cheating happens. For example, project „Sąžiningai“ (“Do not cheat“, „Do not crib“) implemented in 2007 is used to increase student awareness (cheating is not a solution) and / or technically minimise possibilities to cheat. As part of this project, student volunteer-observers offer help to teachers to ensure that all measures to avoid cheating are taken during an exam. For more on the prevention of academic dishonesty, see Section 5.8.

Eleven students were unable to maintain adequate academic standards and decided to cancel studies, this amounts to about 20% of all dropouts and almost 4% of all enrolled students. The Program Committee thinks that it is possible to manage such cases and, at least partially, to keep this figure as low as possible. Since the programme attracts students with sufficiently high scores, adequate academic support to students may help minimize dropouts due to unsatisfactory academic results (see Section 5.3 below).

A major part of dropouts is due to students own will and reasons for such a decision may be very different. Some students find studies quite difficult and / or claim that studies do not meet their initial expectations; for example, we had 3 first-year dropouts during the fall 2016 semester. Some students decided to change their study programme, e.g. they also found that their initial expectations were not met (but some came to our programme from other programmes of the Faculty). Some students decided to drop out due to family reasons (marriage, decision to emigrate, etc.), some decided to study similar subjects abroad, etc. The teaching staff discusses dropout instances on an individual basis, but the ultimate decision is left to the student. In some instances, the Programme Committee can offer a possibility of individual studies: we had such a case in 2016 for a student with disability, another student expressed interest in more informatics courses and was allowed to take a few subjects offered by other Departments, yet another student was allowed to switch to the Econometrics programme but later returned; several students from other programmes also joined our programme.

Table 23**. Causes of dropouts during the period of 2012-2016**

|  |  |  |
| --- | --- | --- |
|  **Reason** | **Admission year** | **Total** |
| **2012** | **2013** | **2014** | **2015** | **2016** |
| Failure to meet financial obligations | 0 | 0 | 0 | 0 | 0 | **0** |
| Unsatisfactory academic results | 5 | 1 | 4 | 1 | 0  | **11** |
| Dishonesty / cheating during exams |  0 |  0 | 0  |  0 |  0 | **0** |
| On the students own will (family reasons, change of study programme, etc.) | 7 | 17 | 8 | 8 | 3 | **43** |
| **Total** | **12** | **18** | **12** | **9** | **3** | **54** |

Taking into account that the average graduation rate is 73% and the average dropout rate is about 20%, we have about 7% „missing“ students. Most likely those students are on academic leave or had to prolong their studies due to academic debts. Some of those students will finish their studies later than expected while some will drop out. Assuming that about half of them will finish their studies, it is reasonable to consider that the average (ultimate) graduation rate would be 75%, while the dropout rate – 25%. Currently dropouts are within acceptable limits and do not threaten the viability of the programme. Slightly higher number of admissions (50–60) may also be justified keeping in mind the dropout rate. Under current conditions, 50–60 enrolled students mean 38–45 graduates each year, and this is an acceptable number to keep the programme viable.

##### **5.3. Organization of studies and academic support to the students**

The study process is organised in agreement with legal acts, in particular (including but not limited to) the *Regulations for Studies of Vilnius University.[[28]](#footnote-28)*Two semesters (fall and spring), 16 weeks each, make up one study year. Each semester is followed by the exam period and (possibly) a vacation. All lectures, tutorials, seminars, laboratory works are organized according to the Faculty timetable, individual / group consultations (if applicable) are organized upon mutual agreement between students and a teacher. The timetables for the upcoming / current semester usually become available online on May 31st (for the fall semester) and on December 31st (for the spring semester). Upon the completion of the first semester, as allowed by the *Regulations for Studies of Vilnius University*, all students have an opportunity to study according to their individual study plans. For that purpose, their applications, including sound motivation, shall be submitted to the Dean’s office and approved by the Dean. Exam timetables are also available online and are published about a month before the start of the exam period.

As stated in the *Regulations for Studies of Vilnius University*, students who failed during an exam are eligible for a second attempt during the first two weeks of the following semester. If they fail the second time, they may repeat the whole course (module) unit, by attending it together with other students who take it for the first time, and retake the exam one year later or they may prepare for the exam individually without formally repeating the whole course (module) unit. Those who have accumulated 15 credits of failed courses (modules) shall be expelled from the University and may renew their studies only after having passed all relevant examinations.

If a student disagrees with the evaluation of an exam, he/she may present an appeal to the Appeal Commission of the Faculty no later than five days after the results become available. A decision reached by the Appeal Commission on the results shall be final and not subject to further appeal. However, if a student is unsatisfied with the examination procedure (not simply evaluation) it may be subject to a further appeal at the VU Dispute Tribunal.

Students having health problems may take academic leave upon submitting a medical certificate; the leave shall be no longer than two years. Academic leave due to maternity is also possible; it shall be no longer than three years. Upon the Dean’s approval, a student, having a sound reason, may suspend his/her studies for one year.

Adequate and timely information about the studies is very important for the successful study process. Students may obtain information from various resources, e.g. from the Administration of Studies at the Faculty, the Dean’s Office and / or academic staff involved in the programme. Tutors are appointed by the Student Representation Agency (SA). This is a very useful project since the first year students may obtain information from their peers; which means that students are more likely to address senior students than academic staff if they have problems.

The website set up by the Studies Department at Vilnius University ([www.klausk.vu.lt](http://www.klausk.vu.lt)) provides access to the Q&A system, where answers to questions are provided by representatives of the Studies Department or the Faculties. This is a very fast and convenient system, which may save time and serve as an effective alternative to more time-consuming face-to-face communication in the office. The Study Programme Committee is currently exploring possibilities to create / maintain a website (probably using Facebook or a similar platform) dedicated specifically for programme students. Important updates on various projects will be published on this website and so students may stay up to date.

All necessary information about the study process (study calendar, timetables, partial studies abroad, tuition fees, grants, funding of studies, etc.) is provided online[[29]](#footnote-29) by the Faculty administrative staff responsible for studies. Most important information (timetables, access to virtual library, virtual learning environment, etc.) is provided also in English. From the main Faculty webpage ([www.mif.vu.lt](http://www.mif.vu.lt)) students may access Vilnius University Information System (VU IS) – a virtual environment where main information about studies is located, e.g. student’s personal data, copies of relevant orders, study plan, examination timetable, results, etc.

A very important part of academic support includes individual / group tutorials and additional lectures. During recent years an extra-curriculum course on *Mathematical Analysis* (one of most difficult subjects for students) is being offered. This course is optional and it is not possible to choose it instead of some other course (optional or not). Students are not evaluated after completion of this course. The main reason to implement such a course was to provide additional opportunities for students to get acquainted with major terms, concepts and theorems of mathematics, to hear how the same topics are presented by different lecturers, etc. Informal feedback from students is very positive. Since 2015 as a pilot project, the programme management decided to offer individual consultations (tutorials) for the course of *Mathematical analysis*. Tutorials are delivered by teachers responsible for practical seminars / activities. The duration of a single tutorial is about 15–20 minutes. Students need to register in advance via Virtual Learning Environment (Moodle). The number of individual tutorials during a semester for a single student is unlimited. Thus students have an opportunity to get help regarding the problems which are challenging for them. Moreover, students may feel more relaxed because they avoid asking questions in front of an audience of peers. Tutorials are quite popular among students – the total time used for consultations is about 10–15 academic hours per semester, and some students come 3–4 times per semester. Informal feedback about such consultations obtained from students is also very positive. Moreover, teachers provide students with detailed requirements of assessments, especially tests, mid-term exams, and final exams, in the form of examples from earlier years. This also gives another opportunity of self-evaluation.

Questions related to the learning outcomes, the content of a course unit or module, career opportunities are among the responsibilities of the Chair of the Study Programme Committee and the academic staff of the programme. They are all available for consultations at the time specified in advance or between/after the classes, or can be reached by email. Starting in 2015 the learning outcomes of the whole programme are presented to the first year students during the introductory course (*Introduction to Financial and Actuarial Mathematics*).

Career opportunities are also first presented during the introductory course and are further discussed during the classes, at the meetings with the Faculty alumni and potential employers. During recent years informal meetings with Programme graduates were organized by Student Representation; Programme management, together with the Department of Mathematical Analysis, organizes weekly seminars, some of which are devoted to education, lifelong learning and / or careers of actuaries. All interested students were invited to join, and some of them attended and actively participated in seminars.

Finally, the Student Representation of Vilnius University deals with various problems of the students, defends their interests, takes care of their academic and social welfare, organizes events of culture, fosters University traditions of student life, and helps first-year students with their integration into the University community. Besides activities mentioned above, summer camps (usually in August, before the start of an academic year) are organized for the first year students, and this is one of the really beneficial projects of SA since useful information about various aspects of studies and student life (e.g. traditional events, activities of the Student Representation, etc.) is provided. First year students may join activities of the Student Representation as soon as they wish.

##### **Social support to the students: grants, loans, tuition fees, hostels**

The main form of social support to the students is bursaries. During the period of 2012–2016 students in our Programme received the following types of bursaries: granted for excellent academic achievements (84 cases, on average 8,4 per semester since this type of bursary is awarded for one semester), social grants (9), social allowances (8, paid as a lump sum in case of a death of the family bread-winner or due to other misfortune), extraordinary grants (37, paid as a lump sum for students who achieved excellent results in sports, arts or scientific activities). Especially talented students who achieve really excellent academic results and/or actively take part in research may be eligible for memorial scholarships/awards, for more information see.[[30]](#footnote-30)

Another form of social support is loans provided to the students by the government of Lithuania (administered by the State Studies Foundation) and allowances for students with disabilities. The latter are also granted not by university but by the Department for the Affairs of the Disabled under the Ministry of Social Security and Labour of the Republic of Lithuania. More information about financial support may be obtained from VU website.[[31]](#footnote-31)Students who are not native to Vilnius may apply for accommodation in the dormitories of Vilnius University. Students in need of social support or with disabilities are eligible for a reduction when paying for living expenses. Vilnius University offers professional psychological assistance to students and staff through the Psychological Training and Research Centre. Single consultations or cycles of consultations (some of them have reduced fees) might be helpful to those facing difficulties in private or family life, social integration or studies. Psychological consultations may also help choose the most appropriate career path, to improve personality and general skills.

##### **Students’ participation in research, sports and arts**

Since our programme is first-cycle, the majority of students start their individual research only when preparing bachelor theses. Surely mostly talented students may start research earlier, and the academic staff is ready for help. A new optional course – *Scientific seminar* – is available (recommended) for the brightest students who want to acquire additional research skills. This optional course is available during the 4th, 6th and 7th semesters; however, at the time of writing, we do not know whether any or how many students decided to enrol into this course in the spring of 2017. There is also a possibility for students to publish articles (usually based on bachelor theses) in scientific journals. Some examples of such practice are: E. Ignatavičiūtė ir R. Mikalauskaitė-Arminienė (2012, advisor professor J. Šiaulys) *Lee Carter Mortality Forecasting* (in *Lietuvos statistikos darbai*, 51(1), p.p. 22–35); I. M. Andrulytė, D. Kievinaitė, J. Šiaulys (advisor), E. Bernackaitė (PhD student at the time; she has just recently defended her thesis) (2015) *A Lundberg-type inequality for an inhomogeneous renewal risk model* (in *Modern Stochastics: Theory and Applications*, 2(2), p. 173–184). A couple of graduates during 2016 were also preparing articles for publication.

Our students, like any other VU students or staff, have multiple opportunities of self-expression outside their classes, usually in sports, arts and music. There are numerous possibilities to join choirs, drama troupes, orchestras and ensembles (see, for example,[[32]](#footnote-32)). They can be frequently seen performing in many national and international festivals in Lithuania and abroad.

One if subsidiaries of Vilnius University –The Health and Sports Centre – offers various possibilities for the students and academic staff. The Centre has three gyms and/or stadiums. Students may use the facilities and equipment of the Centre, join general training classes, or enrol in individual training programmes. Most talented may join particular sports team and participate in various competitions. Academic and other staff also has a possibility to join training classes and/or engage in a number of sporting activities such as basketball, football, table tennis, volleyball, etc.

Each spring Student Representation at the Faculty of Mathematics and Informatics organizes Students Days (MIDI). During these days, which last almost a week, students may engage in various sports activities, meet with Faculty’s graduates and take part in gala performance – Rock Opera, fabula of which is based on realities of academic life.

##### **Student exchange programmes**

Studies abroad and international cooperation, in general, at Vilnius University are administered by the International Programmes and Relations Office. At the Faculty of Mathematics and Informatics, such responsibility is assigned to Vice-Dean Dr. Mindaugas Skujus. Opportunities to go for partial studies abroad (usually for one semester) are really broad since the Faculty has Erasmus (Erasmus +) agreements with about 90 European universities, about 30 of them offer studies in Mathematics, Statistics and Informatics.[[33]](#footnote-33)

Many Programme students successfully took advantage of exchange possibilities (see Table 24). Indeed, assuming that we have on average 220 students every year (assuming 55 new enrolees each year times 4 study years), the ratio of those going to partially studies abroad is 3–5%. Keeping in mind that usually only students who have successfully completed the first four semesters are encouraged to go abroad and usually it is not advisable to go abroad during the final semester, the ratio may easily be doubled. So the Study Programme Committee (SPC) thinks that exchange experience is within acceptable limits.

Though there are quite a few students from abroad (in the range from 30 to 74 each year) coming to our Faculty, no students came directly to our Programme. However, students coming to other programmes may choose courses offered by our teachers, for example, some students chose to attend *Life and Health Insurance Models* (lect. A. Skučaitė; 1-2 students during spring semesters of 2012-2013 and 2013-2014 academic years) and *Life Insurance* (prof. J. Šiaulys, 2 students during fall semester of 2011-2012 academic year).

Table 24. **Student mobility in the SP**

|  |  |  |
| --- | --- | --- |
| **Year of study** | **Number of outgoing students** | **Institution (country)** |
| 2012 | 7 | Københavns Universitet (**Denmark**);Tartu Ülikool (**Estonia**);Ivane Javakhishvili Tbilisi State University (**Georgia**); Athens University of Economics and Business (**Greece**); Libera Università di Bolzano; Università degli studi di Ferrara; Università degli Studi di Padova ; Università per Stranieri di Perugia; Universita Cattolica del Sacro Cuore (**Italy**)Universiteit Utrecht; University of Tilburg; Vrije Universiteit Amsterdam (**Netherlands**)Universidade Nova de Lisboa; Universidade Tecnica de Lisboa (**Portugal**)University of Economics in Bratislava (**Slovakia**)Universidad de Castilla-La Mancha (**Spain**)Mälardalen University (**Sweden**)Universität Basel; Universität Zürich (**Switzerland**)Anadolu University, Pamukkale University (**Turkey**); Texas State University (**USA**) |
| 2013 | 12 |
| 2014 | 8 |
| 2015 | 8 |
| 2016 | 12 |

##### **Assessment of academic progress**

Procedures for assessment of academic progress are set out in the internal documents of Vilnius university, e.g. *Regulations for Studies[[34]](#footnote-34)* and the *Procedure of Assessing Academic Progress.[[35]](#footnote-35)* In case of appeal, procedures are set in the *Regulations of the Appeal Commission for Assessing Academic Progress in a Core Academic Unit of Vilnius University.*[[36]](#footnote-36)

The assessment strategy is set out in the course unit (module) description. During the first class, the teacher responsible for the delivery of the course must introduce the syllabus of the course (module), its aim, forecasted learning outcomes and – most importantly –the assessment strategy, criteria and deadlines (if applicable). Usually the assessment strategy, criteria and other details are also published in Moodle (if the teacher uses the Moodle environment). Academic progress may be assessed in different ways, most often mid-term and final assessments are used. In some cases, academic progress is assessed continuously, e.g. via quizzes, laboratory works, oral / written presentations, etc. In the latter case, the final grade for the course unit is cumulative, calculated on the basis of the proportions specified in the course unit description. The final assessment is mandatory (see *Regulations for Studies*). The form of the final assessment is an examination. If the course unit extends over several semesters, all but the final semester of the course unit may end in a pass/fail assessment. Recommended scale for assessment is a 10-point assessment scale[[37]](#footnote-37) (see Table 25).

Assessment methods are chosen so that they ensure that students demonstrate competences set out in the course description. Several grades are usually used for assessment, e.g. at the minimum students should take a mid-term exam and the final exam. In most cases, the structure of grading is more complex, e.g. students need to successfully submit completed laboratory works, make presentations, prepare (written) surveys, etc. Traditional closed-book examination is one of major forms of assessment especially during the early years of study. However, in a few cases, if any, multiple choice questions are used for assessment. Some mixture of exercises, short and long questions is used in most cases. During later years (3rd or 4th) some teachers use “open book” examination. During all years classwork may include at least some form of assessment and so ongoing learning is encouraged. Classwork assessment in all cases is based on students own work. In some cases closed or open book examination is not appropriate for assessment. So, for example, during foreign language courses, oral presentations form a significant part of assessment. In other cases, computer based project is used, e.g. during IT related courses, *Health insurance,* etc. Group projects (usually in groups of 2-4 students) are used for assessment if they allow students to show competences needed, e.g. during classes of *Health insurance*, *Financial risk management*, *Finite population statistics*, *Informatics,* etc.

Table 25 **Recommended scale of assessment in Vilnius University**

|  |  |  |
| --- | --- | --- |
| **Pass, fail** | **System of assessment** | **Description** |
| PASS | 10 (excellent) | Excellent, exceptional knowledge and skills |
| 9 (very good) | Very good knowledge and skills |
| 8 (good) | Knowledge and skills are above average |
| 7(average) | Average knowledge and skills, some inessential mistakes |
| 6 (satisfactory) | Knowledge and skills are below average, there are errors |
| 5 (weak) | Knowledge and skills meet the minimum requirements  |
| FAIL | 4, 3, 2, 1(unsatisfactory) | Below minimum requirements |

Usually after each semester every student has a possibility to anonymously provide feedback about content, assessment methods and teaching quality of the course. Standard questionnaire is used for such surveys. Survey results are provided to the teacher, responsible for the course, Chair of the Study Programme Committee and the Faculty Dean. After receiving feedback, the teacher may adjust course content and/or delivery methods if he/she thinks that suggestions made by students are reasonable. Our programme has additional feedback collecting practices; for more see Section 6.4.

Procedures for the preparation and defence of a bachelor thesis are set out in the *Procedure for the Preparation, Defence and Safekeeping of Graduation Theses* approved by Decree No R-446 signed by Vilnius University Vice-Rector on 17th of November, 2015[[38]](#footnote-38) and in the corresponding course description. As it was already mentioned (see Section 2.4), final theses may be attributed to one of three major categories: survey; theoretical or practical. Of course, all contain typical parts: introduction, literature review, theoretical part and possibly an applications part. What differs is the size of each part and its contents. Recommended size of graduation thesis is 15–50 pages. During the last evaluation, the Programme Evaluation Team was dissatisfied that bachelor theses were being written in groups of at most four students and advised that *Attempts should be made to move to a situation whereby all students undertake an individual thesis*. Program Committee took all recommendations very seriously, so starting from 2015, students are advised to prepare graduation thesis on individual basis. To have a smooth “transition” period (2-3 years), students are for now allowed to prepare their thesis in pairs (but no longer in groups of 3-4) and in such cases, they must clearly describe individual contributions and talk about them during the defence. In 2016 two members of the thesis defence Committee, appointed by a decree of Rector, were representatives of social partners (one from Ergo Insurance SE, the other from Vilnius Gediminas Technical University). After the defence, the scientific advisors and reviewers give opinions about theses, pointing out positive and negative aspects; each member of the defence Committee evaluates every thesis, taking into account the subject of thesis, results and – mainly – presentation during the defence. If the advisor or the reviewer is a member of the Committee, his/her grade is not counted when computing the final grade. Usually the final grade is the average of all individual grades; all Committee members need to agree on the final grade. Grades from one year to the next are not necessarily easily comparable; one can also notice a broader grading scale during 2016, indicating stricter standards being enforced.

To ensure academic honesty during the studies, Vilnius University has taken various measures. The academic staff and the students shall adhere to the principles of ethics laid down in the *Code of Academic Ethics of Vilnius University,*[[39]](#footnote-39) which defines general norms of academic, teaching, studies and research ethics. The Code also defines the notion of violation involving cheating, plagiarism, bribery, unsolicited dishonest assistance to the peers, etc. The programme management and Student Council do not tolerate academic cheating, so various measures are taken to prevent this problem rather than punish students when cheating happens. We have already mentioned project „Sąžiningai“ (“Do not cheat“, „Do not crib“). Other actions employed include minimising possible cheating by almost eliminating such situations, for example, some teachers use „open book“ or „semi-open book“ examination method. Exam exercises in such cases are designed so that students need to demonstrate understanding and other skills and not simply to rewrite facts from a textbook. Even during a „closed book“ exam, the majority of teachers demand from students to demonstrate problem solving skills and, again, it is more difficult to cheat when solving a problem than when answering theoretical questions, answers to which may be found in the textbook. Last but not least, many teachers use so-called „accumulative grade“, e.g. the final grade is formed not only from assessment of the final exam and mid-term exams but also taking into account grades of laboratory works, presentations during seminars, etc.

##### **Professional activities of SP graduates**

Program graduates have many possibilities of a future career. Since a bachelor degree is usually not enough for a high-level professional position, a big part of graduates decide to continue their studies at the Master’s level. Some choose a Master’s programme at our Faculty, in particular, a companion programme in Financial and Actuarial Mathematics, and may benefit from continuation of subjects taught, others decide to enrol other universities in Lithuania (e.g. Vilnius Gediminas Technical university) or abroad. In some quite specific cases, program graduates choose totally different master studies, for example, in 2016 one graduate decided to study political sciences in VU (at Master’s level). Surely in such cases after completion of Master’s studies, the graduate will not only have technical skills but will be able to effectively combine skills form different professional fields – a competency which highly desirable nowadays. Usually program graduates have no serious problems finding suitable work position, a big majority of those who continue their studies are employed. Probably in most cases the first employment opportunity is got during, or shortly after, the internship, which is a quite rational and efficient way for graduates to try different career possibilities. Professional environments of our graduates vary quite significantly – actuaries, statisticians, business analysts, auditors, IT consultants are only some examples of „success stories“. Ability to operate in various and usually quite different professional environments is very desirable now and, probably, will become an absolute must in the nearest future, so currently the Programme successfully achieves its goal. To illustrate our claims we present several charts and tables. The first chart (Figure 1, left) shows percentages of employed graduates (graduated in2011-2015) 6, 12, 36 and 60 months after graduation. The numbers include those who already had a job before graduation. As one can observe, employment rates are indeed high and usually increase as time passes. The chart on the right (Figure 1) shows the percentages of graduates who found a job after 6, 12, 36 and 60 months from graduation. Here for graduation years of 2014 and 2015 we do not have full sets of observations, hence lower levels on the right of the chart. On the other hand, data shows attractiveness of graduates to employers.



Figure 1

To illustrate the occupations of graduates we have analysed data of graduation years 2011 through 2013 only, since data for later graduation years is scarce. Table 26, Table 27 and Table 28 indicate the same professions for comparison, but one can clearly observe that the most popular professions are changing from year to year, with a clear shift towards IT related professions for the graduation year of 2013 (this category combined several subcategories, from software creators to system administrators, IT consultants, etc.). Earlier graduates chose to be financial analysts, actuaries, mathematicians more often.

Table 26. Positions of programme graduates (graduation year 2011)

|  |  |
| --- | --- |
|  | **Months after graduation** |
| **Occupation of graduates** | **6** | **12** | **36** | **60** |
| Financial Analyst | 1 | 2 | 5 | 7 |
| Mathematician, Actuary or Statistician | 2 | 2 | 4 | 4 |
| Accountant | 2 | 3 | 3 | 3 |
| Financial and/or Investment Consultant | 1 | 1 | 2 | 3 |
| Junior statistician, mathematician or related | 1 | 1 | 2 | 3 |
| Management and organization analyst | 1 | 1 | 3 | 3 |
| IT specialist | 2 | 1 | 2 | 2 |
| Junior accounting specialist | 1 | 0 | 0 | 2 |

Table 27. Positions of programme graduates (graduation year 2012)

|  |  |
| --- | --- |
|  | **Months after graduation** |
| **Occupation of graduates** | **6** | **12** | **36** |
| Financial Analyst | 3 | 3 | 4 |
| Mathematician, Actuary or Statistician | 3 | 4 | 4 |
| Accountant | 0 | 0 | 1 |
| Financial and/or Investment Consultant | 3 | 2 | 1 |
| Junior statistician, mathematician or related | 1 | 1 | 0 |
| Management and organization analyst | 1 | 1 | 2 |
| IT specialist | 2 | 1 | 8 |
| Junior accounting specialist | 0 | 0 | 1 |

Table 28. Positions of programme graduates (graduation year 2013)

|  |  |
| --- | --- |
|  | **Months after graduation** |
| **Occupation of graduates** | **6** | **12** | **36** |
| Financial Analyst | 2 | 3 | 2 |
| Mathematician, Actuary or Statistician | 1 | 2 | 1 |
| Accountant | 3 | 1 | 3 |
| Financial and/or Investment Consultant | 0 | 0 | 0 |
| Junior statistician, mathematician or related | 0 | 0 | 0 |
| Management and organization analyst | 4 | 4 | 2 |
| IT specialist | 10 | 6 | 17 |
| Junior accounting specialist | 7 | 6 | 4 |

On the other hand, it is crucial to know how abilities of program graduates are treated by their employers. Therefore, in spring 2016, the Programme management (Study Programme Committee) together with the Lithuanian Association of Actuaries (LAD – Lietuvos aktuarų draugija) conducted a survey about professional competences of our graduates. Twenty major employers in Lithuania participated in the survey; among them were major insurance companies (including subsidiaries of companies operating abroad) and representatives of 2 banks with a significant market share. 15 filled out questionnaires were received (75% response ratio!) and, since the respondents were mainly chairs of actuarial (or similar) departments, the results received may be regarded as highly reliable. Eight respondents admitted that during the last five years they employed 3–5 of our graduates; two respondents employed 1–2 graduates, while one respondent employed more than 5. Respondents were asked to evaluate theoretical skills (pure mathematics/statistics; financial mathematics; actuarial models; economics; accounting), abilities to apply theoretical knowledge in practice (practical skills), computer literacy and some transferable skills (research/analytical skills, ability to work individually or in a team; communication skills, including foreign language). Though evaluations of theoretical and transferable skills as well as computer literacy were usually quite positive and mainly ranged from “average” to “very good”, evaluations of practical abilities were not so good and in every area attracted at least some “very poor” or “poor” evaluations. Moreover, more than one half of respondents were dissatisfied with even theoretical background in accounting/financial analysis, which they found quite important in a professional environment. After the survey was processed, the Study Programme Committee (SPC) invited representatives of responding institutions to join an open meeting of SPC during which we discussed how to best improve the competences of our graduates. Six employer representatives and four members of SPC participated. During the meeting it was agreed that at an initial stage, an optional course on Financial analysis will be enough for students to acquire basic knowledge. This course (*Financial reports and analysis*) is already offered and will be taught by dr. A. Linartas, who has sufficient practical experience and also theoretical background in this area. Regarding practical skills, the SPC promised to draw attention of teachers to this problem and to encourage them to supplement courses with some practical applications. During this survey we also got contacts of professionals who would like to share their knowledge with students and to deliver 1–2 lectures. “Ergo” representative Mrs Laimė Naruševičienė (Chair of Pricing and Reinsurance Department in the Baltic States) was the first to deliver a lecture on the Actuarial function for first year students in the fall of 2016. SPC hopes that effective cooperation with employers will continue in the future.

##### **Strengths and weaknesses of the area under evaluation and improvement measures to be taken**

Strengths:

* Programme does not experience problems attracting new students and scores of those enrolled are quite high.
* Graduation rate is acceptable for studies based on mathematics.
* Serious steps are taken to provide academic support to students (e.g. extra-curriculum course on Mathematical Analysis, individual tutorials, etc.)
* Attempts are made to make assessment procedures more transparent, the list of requirements and in particular weights of all themes covered are provided for students before each assignment (at least by some teachers).
* Good opportunities for social support are available, so, for example, no dropouts due to inability to meet financial obligations.
* Good opportunities to participate in research, sports and arts. Best students have possibilities to publish their results in scientific journals.
* Good international exchange possibilities; the programme enjoys quite high numbers of students using such opportunities to get more diverse experience.
* Adequately many and diverse assessment methods are used.
* Theoretical knowledge, computer literacy and transferable skills of our graduates are evaluated as mostly „good“ and „very good“ by major employers.
* Professional activities of a majority of graduates are usually related to studies and may be regarded as successful.
* A big majority of graduates are easily employed and find jobs in many different fields.

Weaknesses:

* There is still a substantial proportion of dropouts due to inability to achieve good academic results, more detailed investigation on why students fail is desirable.
* More steps on how to improve transparency in assessment and achievement of sufficient academic standards are needed, e.g. double marking, etc.
* Not all students prepare bachelor theses individually, even though they must clearly demonstrate their contribution during the defence.

Improvement measures:

* Some initials steps to minimize dropouts due to poor academic results are already taken, this will be further developed.
* SPC will take all necessary steps to increase transparency in assessments, e.g. will encourage teachers to prepare Requirements lists, use double marking, etc.
* Further steps will be taken to assure that all students prepare bachelor thesis individually.

### 6. Study Programme management

##### **6.1. Regulation of study quality assurance**

Fostering quality culture is a strategic aim of Vilnius University. It is made feasible by adhering to the values specified in the VU mission and in the *Standards and Guidelines for Quality Assurance in the European Higher Education Area.*[[40]](#footnote-40) In Vilnius University, all study programmes and their implementation are administered by the Department for Studies, which is also responsible for ensuring the quality of functioning of the units of different levels in VU.[[41]](#footnote-41)

The main document concerned with the internal quality insurance of studies is: *Vilnius University Quality Manual.*[[42]](#footnote-42) When implementing and improving the processes and procedures of internal quality assurance, Vilnius University takes responsibility for approving, monitoring and evaluating its study programmes and qualifications awarded, the evaluation criteria applicable to the new study programmes, the programme intended for newly recruited academic staff (see the publication *Manual of Vilnius University Lecturer*[[43]](#footnote-43)). The University also organises courses intended for the professional development of the academic staff, etc.[[44]](#footnote-44) In particular, **E-Learning and Examination Centre at Vilnius University regularly organizes training courses to promote broader use of virtual learning environment (Moodle), antiplagiarism tools and other modern learning technologies.**[[45]](#footnote-45)

As stipulated by the *Regulation of Study Programmes of Vilnius University,[[46]](#footnote-46)*a study programme shall be updated and its quality monitored on a regular basis. The quality is assured and improved through its internal evaluation and external assessment, by making the results of such evaluation and assessment accessible to the community, by accumulating and analysing the data about the programme and the process of study, by monitoring the feedback, ensuring the availability of facilities and learning resources, improving the qualifications of the academic staff, promoting the application of innovative methods of teaching, learning and assessment, improving the management of the programme and disseminating good practice.[[47]](#footnote-47)

All modifications of the study programme shall be subject to discussion and approval by the Study Programme Committee and the Faculty Council. When modifications involve changes in the title, field (branch) of studies of the SP, qualification degree, awarded as a result of its completion, professional qualification or scope of the SP, they shall be approved by the SP Committee, the Faculty Council and finally, by the Senate. The process of SP updating is supervised by the Administration of Studies of Vilnius University.

In accordance with the *Regulation of Study Programmes of Vilnius University*, assuring and improving the SP quality is the responsibility of the SP Committee, which operates in accordance with the Regulations of the Study Programme Committee.[[48]](#footnote-48) The Committee is in charge of the SP and the assurance of the quality of its implementation. It is accountable to the Faculty Council for the SP implementation and shall report to it at least once a year. The Committee is composed of academic staff, student and employer (social partner) representatives. The student representative is delegated by the VU SA (Lithuanian acronym for Vilnius University Student Representation), the composition is approved by the Faculty Council, and finally the SP Committee chairman is approved by the Senate upon the recommendation of the Faculty Council. The aims, functions, composition and responsibilities of the Committee are listed in the *Regulation of an SP Committee,[[49]](#footnote-49)* in agreement with other VU documents such as *Regulations for Studies of Vilnius University*, the *Procedure of Approving Academic Results,* etc.

##### **6.2. Aims and responsibilities of the Study Programme Committee**

Members of the Study Programme Committee (hereinafter also SPC) currently are: assoc. prof. Martynas Manstavičius (chairman), prof. Jonas Šiaulys, prof. Remigijus Leipus, partnership professor G. Bakštys (ERGO Life Insurance SE, social partner representative), assoc. prof. S. Dapkūnas, lect. A. Skučaitė and A. Dargvilaitė (3rd year student representative). The latest changes to the composition of SPC were approved on 14 April, 2015 by the Faculty Council (protocol No 4); chairman was approved upon the Decision of the Senate (22 September 2015, No S-2015-7-4). One of the key goals of the SPC is to strive for the high quality of the programme so that its purpose is attained, declared learning competences are developed, its content is compatible with the teaching, learning and assessment methods, and the programme is competitive and relevant to the society. The SPC analyses feedback about the programme and its implementation received from different units of the Faculty, students, graduates, academic staff and social partners. In addition to standardised questionnaires launched by the Department for Studies, the SPC may, on its own initiative, launch its own questionnaire focusing on the improvement measures to be taken as well as any other issue relevant to the students. In search of viable solutions, the problems are usually discussed by the SPC members with the Faculty administration, student representatives and the academic staff of the SP. The SPC shall ensure the update of the SP purpose and content; moreover, it shall participate in preparing and approving all documents related thereof (e.g. new course units’ descriptions prepared by the academic staff or changes to the existing ones – revision is typically done before each semester). All decisions of the SPC are taken by the simple majority of votes of its members. Another function of the SPC, usually performed by the chair, is concerned with evaluating the competences acquired by the students in other SPs (typically after ERASMUS visits) and deciding about the approval or disapproval of the academic results attained by those students in those SPs.

The Study Programme Committee works in close cooperation with all Faculty departments and administration when selecting lecturers for various courses, choosing advisors and referees of Graduation Theses, defence committee members, helping students choose internship positions and prepare official agreements, guiding with the choice of subjects for ERASMUS programme studies abroad.

##### **6.3. SP management database: Vilnius University information system of studies**

The Faculty administration and the academic staff make use of the Vilnius University information system of studies (VUSIS), which consists of several sub-systems. One of them is used for managing study programmes, offering access to people responsible for studies (Vice-dean for Studies, administrative staff, etc.). The administrative sub-system is an instrument for making, reviewing and editing study plans. Another subsystem is meant for managing the students and thus helps deal with the students’ personal data, their marks for course units (modules), registration for optional course units (modules), titles of graduation theses; it helps issue certificates, approve the course units (modules) attended and assessed in another higher education institution. The sub-system also gives access to the results of considering the students’ applications, marks for the course units (modules), etc. All orders related to the student affairs issued by the Dean or Rector (e.g. on the titles of term papers or graduation theses, on business trips when going for partial studies in foreign universities, etc.) are prepared by VUSIS. The system also assists in issuing diploma supplements. VUSIS also stores admission data (competition, the number of admitted candidates by priority), various statistics related to students and studies. The academic staff members have online workplaces, where they can enter examination results, descriptions of course units (modules); they have access to the list of students enrolled in their course. VUSIS makes information management and the implementation of studies much easier. On the other hand, as any system it is not perfect and must be constantly improved, e.g. to suit modular studies.

##### **6.4. Students’ and graduates’ feedback about the programme and its implementation**

Ways of getting feedback and handling it in Vilnius University are defined in the *Procedure of Ensuring Feedback to all Involved in the Study Process.*[[50]](#footnote-50)Twice a year, at the end of each semester, the University launches questionnaires to be filled in by first and second cycle students through an electronic database. The questionnaires focus on:

1. Specific course units (modules) attended during the semester.

For that purpose, the same standardised course questionnaire is used in all the Faculties of the University. Upon registration into the VU information system, a special slot on questionnaires opens up. There

* the students may anonymously evaluate their studies, including specific course units (modules);
* the academic staff members have direct access to the students’ evaluation and feedback about their course units (modules);
* SPC chairman has direct access to the students’ evaluation and feedback on all course units (modules) of the SP;
* Faculty administration has direct access to the students’ evaluation and feedback on all course units (modules) of the study programmes implemented by the Faculty.
1. General satisfaction with the studies during the last semester.

Detailed results of the questionnaires according to units and study programmes are available on the Administration of Studies website on the VU intranet by selecting “Feedback” section. Vilnius University makes use of the results of the standardised questionnaires for:

* improving the SP and a particular course unit (module);
* ensuring the quality assurance and improvement by the SPC and the Faculty administration;
* preparing for external assessment when drafting the self-evaluation report;
* analysing new study programmes;
* evaluating the qualifications of the academic staff;
* improving other activities of the Faculty and the University.

After the results of questionaries’ become available, SPC organises formal and informal discussions with Faculty members, teaching various programme course units, summarises the good and the bad comments from students and implements necessary changes, which sometimes even amount to changing the lecturer (as, e.g. happened with an Informatics lecturer). Typically though, problems are often the result of miscommunication between students and lecturers, different views on competences already acquired, prejudices. SPC is constantly striving to improve student and academic staff relations so that all achieve set goals.

One more way to get feedback from students is via recommendations made by the Feedback Group. This is an initiative of the Student Representation (SA) and is currently performed on voluntary basis. At the beginning of each semester, SA representative may address a teacher and offer him/her to be observed by members of the Feedback Group during lectures and/or other academic activities. The teacher knows that his/her work is observed, but does not know who exactly belong to the Feedback Group. Such practice resembles that of a Mystery Shopper. Before the last month of semester, the teacher receives recommendations made by the Feedback Group. This form of feedback is more flexible (written in free form instead of standard questionnaire) and is – probably – more objective since it incorporates opinions of different students merged together. Since the final assessment is not done before feedback is provided, students opinions are not biased based on final grades. For example, lecturer A. Skučaitė participated in such form of assessment during the spring semester of 2016 (during *Financial Mathematics* course; recommendations made by the Feedback Group are in Lithuanian but are available upon request).

More informal feedback from students is received during a particular semester via surveys (they maybe be anonymous or not, depending on the questions asked) published in the Virtual Learning Environment (Moodle). While the aim of anonymous surveys filled after each semester and Feedback Groups is to give opinions about the course as such (a quite high level evaluation), Moodle surveys allow a teacher to quickly get opinions of students regarding more „down-to-earth“ level matters. Some examples of questions asked during recent semesters - *which day is more suitable for a midterm exam (choose one from 2-3 dates)*; *rate each teaching method by effectiveness (short quizzes, oral answers, homework)*; *do you think the extent of homework’s is adequate,* etc. Such short surveys allow a teacher to get feedback almost instantaneously and choose the most rational and effective teaching method. Though not too many teachers use Moodle capabilities currently, we hope that substantially more of them will become familiar (usage courses are offered each year) and start using Moodle in the nearest future.

As a different example, after the survey of employers was carried out in June 2016, the list of competences was modified to better suit the current needs of the professional environment. In particular, the course unit *Financial Reports and their Analysis* content was substantially expanded to address the need for accounting skills of graduates.

Below we present charts illustrating answers to just four (in our opinion, most important) questions and the changes to the overall satisfaction of students with studies, course content, and teaching quality at Vilnius University (VU) in general, at Faculty of Mathematics and Informatics (MIF) and opinions about our programme (FAM). The final pair of charts illustrates student opinion on whether to recommend or not to recommend studies at VU. Data shows Autumn and Spring semesters separately. Since the Spring semester of 2016, questionnaire summaries contain percentages of non-responses to each question; they are listed below the graphs. The average numbers (from 2012 to 2016) of FAM programme students who completed questionnaires are ~76% and ~79% for the Autumn and Spring semesters, respectively. As one can observe from these charts, the rate of satisfied students in our programme is slowly increasing, this is better observed during the spring semester, while after the fall semester data shows more fluctuation which can be attributed to the first year students and their realised/unrealised expectations. Also we have fewer responses from the fourth year students in the spring, when they graduate. Course content and teaching quality evaluations also show noticeable improvement. Finally, what is most pleasing is the fact that the proportion of those who would recommend enrolling our programme has also increased, albeit not so significantly, over the last couple of years. On the other hand, we still need to wait for more data to be sure that this positive tendency is sustained.



\* (5.3% FAM; 4.8%MIF; 3%VU) - non-responses



\* (6.9% FAM; 5.5%MIF; 3.3%VU) - non-responses



\* (6.9% FAM; 5.7%MIF; 3.4%VU) - non-responses



\* (3.8% FAM; 5.6% MIF) - non-responses

##### **6.5. Cooperation with social partners**

Cooperation with social partners has significantly strengthened since 2014. More representatives (e.g. from Bank of Lithuania, Ergo, Danske Bank, etc., some are high ranking officials, department heads) are now coming to our Faculty to give lectures to Financial and Actuarial Mathematics students and/or present opportunities for Internships. Many former graduates are nowadays employing our new graduates and are frequent guests at the Department weekly seminar. We have already thoroughly discussed a questionnaire filled out by representatives of social partners about our graduate skills and needed changes in Section 5.8.

Apart from what was already mentioned, employers also expressed interest in attending graduation thesis defences, refereeing student works, giving occasional lectures on the role of actuary and/or specialist in finance, practical aspects of daily work.

##### **6.6. Strengths and weaknesses of the area under evaluation and improvement measures to be take**

Strengths:

* Significantly improved relations with employers since last programme evaluation
* Strong commitment of the SPC, students, academic staff and employers to make the programme better, more enjoyable for all, and yielding highly skilled graduates
* Improved programme management since last evaluation
* Good opportunities for student feedback (anonymous surveys, Feedback groups, Moodle platform).

Weaknesses:

* Quite complicated and bureaucratic management system sometimes prevents SPC from timely actions needed, e.g. there may be quite difficult to change a teacher in the middle of a semester even if dissatisfaction of students is very high (>90%).
* All SPC members (except for the Chair) participate in activities of SPC on a voluntary basis, so this prevents SPC from adequately using skills and competences of all members involved.

Improvement measures:

* Shortening the time from problem identification to solution implementation;
* Improving salary system at the university – reform is underway; SPC has already made suggestions to the working group regarding reimbursement to all SPC members.
1. <https://www.e-tar.lt/portal/lt/legalAct/96ceca70311f11e5b1be8e104a145478> (in Lithuanian) [↑](#footnote-ref-1)
2. <http://www.vu.lt/kviecia/> [↑](#footnote-ref-2)
3. <http://mif.vu.lt/lt3/studijos/studiju-programos/ba-studiju-programos> (in Lithuanian) [↑](#footnote-ref-3)
4. <https://www.aikos.smm.lt/paieska/_layouts/15/Asw.Aikos.RegisterSearch/ObjectFormResult.aspx?o=PROG&f=Prog&key=4405&pt=of&ctx_sbfr=sbfr> [↑](#footnote-ref-4)
5. http://www.vu.lt/kviecia/rinkis-studijas/leidiniai [↑](#footnote-ref-5)
6. <http://www.vu.lt/kviecia/naujienos/visos-naujienos/aplankyk/item/512-tapk-studentu-vienai-dienai> [↑](#footnote-ref-6)
7. See <https://www.soa.org/professional-development/competency-framework/> [↑](#footnote-ref-7)
8. http://www.kpmpc.lt/LTKS\_EKS/LTQF\_official\_translation.pdf [↑](#footnote-ref-8)
9. See <https://www.e-tar.lt/portal/lt/legalAct/TAR.38D8B16062C2/BZLEAzedIa> (in Lithuanian) [↑](#footnote-ref-9)
10. See <http://www.vu.lt/studijos/studentams/studijas-reglamentuojantys-dokumentai/45-studijos/studijos/2557-studiju-nuostatai> (in Lithuanian) [↑](#footnote-ref-10)
11. See <https://www.e-tar.lt/portal/lt/legalAct/96ceca70311f11e5b1be8e104a145478> (in Lithuanian) [↑](#footnote-ref-11)
12. Includes 15 credits for General University Studies. [↑](#footnote-ref-12)
13. General University Studies. Developed competences depend on the subject chosen by a student. [↑](#footnote-ref-13)
14. See <http://www.vu.lt/studijos/studentams/bus-dalykai#kokie-dalykai-vilniaus-universitete-yra-bus-dalykai> (in Lithuanian) [↑](#footnote-ref-14)
15. See <http://www.vu.lt/site_files/SD/Studentams/st._reglamentuojantys_dok/Rasto_darbu_rengimo_gynimo_kaupimo_tvarka_11_27.pdf> (in Lithuanian) [↑](#footnote-ref-15)
16. <https://kedras.mif.vu.lt/prakt-vld/studentai.php> (in Lithuanian, general information) and <https://kedras.mif.vu.lt/prakt-vld/studentai.php?p=9> (in Lithuanian, specific information for students from our Programme) [↑](#footnote-ref-16)
17. Due to an unexpected illness of one of lecturers, extra 12 credits were taken by full professors during this academic year. Hence, the atypically high percentage of courses taught by full professors. [↑](#footnote-ref-17)
18. *General Requirements for First-Cycle and Integrated Study Programmes* approved by Order No V-501 of the Minister of Education and Science of the Republic of Lithuania 9 April 2010.

*Regulation of Study Programmes of Vilnius University* approved by Decree No SK-2012-12-4 of Vilnius University Senate Commission 21 June 2012. Available in Lithuanian at: <http://www.vu.lt/lt/studijos/studiju-procesas/studijas-reglamentuojantys-dokumentai#vu_nutarimai> [↑](#footnote-ref-18)
19. <http://www.vilniusconference2014.mif.vu.lt/> [↑](#footnote-ref-19)
20. Data from the Department of Mathematical Analysis only. Some faculty members who teach in the SP belong to different departments. Data will become available later in 2017. [↑](#footnote-ref-20)
21. It is a powerful computer designed to handle large amounts of information and to conduct scientific calculations more rapidly. [↑](#footnote-ref-21)
22. See<http://www.vu.lt/kviecia/rinkis-studijas/kaip-istoti/1-pakopos-studijos>. [↑](#footnote-ref-22)
23. Composition of entrance score varies a bit from year to year. [↑](#footnote-ref-23)
24. [http://www.vu.lt/kviecia/rinkis-studijas/studiju-programos/1-pakopos-studiju-programos/item/103#2016-m-pri%C4%97mimo-s%C4%85lygos](http://www.vu.lt/kviecia/rinkis-studijas/studiju-programos/1-pakopos-studiju-programos/item/103%232016-m-pri%C4%97mimo-s%C4%85lygos) [↑](#footnote-ref-24)
25. Statistics is based on data from internal VU documents (*Admission statistics*), originals may be available upon request [↑](#footnote-ref-25)
26. Since 2014 maximum score was changed from 20+ to 10+, where “+” indicated extra points for exceptional activities, e.g. participation in Science Olympiads, etc. [↑](#footnote-ref-26)
27. See: <http://www.lamabpo.lt/bendrojo-priemimo-rezultatai/2016#1131> (in Lithuanian) [↑](#footnote-ref-27)
28. <http://www.vu.lt/studijos/studentams/studijas-reglamentuojantys-dokumentai/45-studijos/studijos/2557-studiju-nuostatai> (in Lithuanian) [↑](#footnote-ref-28)
29. <http://mif.vu.lt/> [↑](#footnote-ref-29)
30. See <http://www.vu.lt/studijos/studentams/finansine-parama#vardines_stipendijos> (in Lithuanian). [↑](#footnote-ref-30)
31. See <http://www.vu.lt/studijos/studentams/finansine-parama> (in Lithuanian). [↑](#footnote-ref-31)
32. <http://www.vu.lt/gyvenimas-universitete/studentams/meno-ir-sporto-kolektyvai> (in Lithuanian) [↑](#footnote-ref-32)
33. See <http://www.erasmus.tprs.vu.lt/partneriai/> (in Lithuanian) [↑](#footnote-ref-33)
34. <http://www.vu.lt/studijos/studentams/studijas-reglamentuojantys-dokumentai/45-studijos/studijos/2557-studiju-nuostatai> (in Lithuanian) [↑](#footnote-ref-34)
35. <http://www.vu.lt/site_files/SD/Studentams/Studiju_pasiekimu_vertinimo_Tvarka_12.21.pdf> (in Lithuanian) [↑](#footnote-ref-35)
36. <http://www.vu.lt/site_files/SD/Studentams/Padalinio_gincu_nagrinejimo_komisijos_nuostatai.pdf> (in Lithuanian). [↑](#footnote-ref-36)
37. <http://www.vu.lt/lt/studijos/studiju-procesas/egzaminu-sesija/45-studijos/studijos/2591-vertinimo-sistema>(in Lithuanian) [↑](#footnote-ref-37)
38. <http://www.vu.lt/site_files/SD/Studentams/st._reglamentuojantys_dok/Rasto_darbu_rengimo_gynimo_kaupimo_tvarka_11_27.pdf> (in Lithuanian) [↑](#footnote-ref-38)
39. <http://www.vu.lt/lt/studijos/studiju-procesas/studijas-reglamentuojantys-dokumentai/45-studijos/studijos/2564-akademines-etikos-kodeksas> (in Lithuanian) [↑](#footnote-ref-39)
40. ####  *Standards and Guidelines for Quality Assurance in the European Higher Education Area*. Seehttp://www.enqa.eu/index.php/home/esg/

 [↑](#footnote-ref-40)
41. See http://www.kvc.cr.vu.lt/site. [↑](#footnote-ref-41)
42. #### *Vilnius University. Quality Manual*. Vilnius, 2013. available in Lithuanian at<http://skvis.vu.lt/pub/book/qm/topic/10298430>.

 [↑](#footnote-ref-42)
43. #### *Manual of Vilnius University Lecturer.* Vilnius, 2013. available in Lithuanian at<http://www.kvc.cr.vu.lt/site/sites/default/files/VU_destytojo_vadovas_4_16.pdf>.

 [↑](#footnote-ref-43)
44. See <http://www.kvc.cr.vu.lt/site/?q=node/90>. [↑](#footnote-ref-44)
45. https://www.esec.vu.lt/en/ [↑](#footnote-ref-45)
46. Approved 21 June 2012. See <http://www.vu.lt/site_files/SD/Studiju_programu_reglamentas_2014_01_27.pdf>. The document also specifies requirements for new study programmes (their preparation and registration) and the accreditation, evaluation and improvement of the existing study programmes. [↑](#footnote-ref-46)
47. For more information about the processes of study quality improvement see <http://www.kvc.cr.vu.lt/site/> [↑](#footnote-ref-47)
48. Approved 6 March 2014. <http://www.vu.lt/site_files/SD/Studentams/SP/SRD/SPK_nuostatai_03.06.pdf> [↑](#footnote-ref-48)
49. <http://www.vu.lt/site_files/SD/Studentams/SP/SRD/SPK_nuostatai_03.06.pdf> (In Lithuanian) [↑](#footnote-ref-49)
50. Approved 29 May 2009. See <http://www.vu.lt/site_files/SD/SK/SP_dalyviu_GR_tvarka.pdf> [↑](#footnote-ref-50)