STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

VYTAUTO DIDŽIOJO UNIVERSITETO PROGRAMOS *MATEMATIKA IR JOS TAIKYMAS* (612G10004) VERTINIMO IŠVADOS

EVALUATION REPORT OF *MATHEMATICS AND ITS APPLICATION* (612G10004) STUDY PROGRAMME AT VYTAUTAS MAGNUS UNIVERSITY

Team Leader:	Prof. dr. Winfried Müller
Team members:	Assoc. Prof. dr. Vytautas Būda
	Prof. dr. Jüri Kiho
	Prof. dr. Donald McQuillan
	Šarunas Venslavas

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DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	Matematika ir jos taikymas
Valstybinis kodas	612G10004
Studijų sritis	Fiziniai mokslai
Studijų kryptis	Matematika
Studijų programos rūšis	Universitetinės
Studijų pakopa	Pirmoji
Studijų forma (trukmė metais)	Nuolatinė (4)
Studijų programos apimtis kreditais	240 ECTS
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Matematikos bakalauras
Studijų programos įregistravimo data	1997-05-19

INFORMATION ON ASSESSED STUDY PROGRAMME

Name of the study programme	Mathematics and its Application
State code	612G10004
Study area	Physical sciences
Study field	Mathematics
Kind of the study programme	University studies
Level of studies	First
Study mode (length in years)	Full-time (4)
Scope of the study programme in credits	240 ECTS
Degree and (or) professional qualifications awarded	Bachelor of Mathematics
Date of registration of the study programme	1997-05-19

CONTENTS

I. INTRODUCTION

This report summarizes the observations of the expert team (Team) based on the analysis of documents prepared by the self-assessment group consisting of seven members of VYTAUTAS MAGNUS UNIVERSITY (VMU) and the information obtained from the interviews during the visit at the VMU on October 09, 2012.

Schedule for the visit:

The members of the Team acquainted themselves with and assessed the documentation and annexes provided by the Lithuanian Centre for Quality Assessment in Higher Education (CQAHE) in Vilnius.
On October 08, 2012, an introductory meeting at CQAHE was arranged and the following topics were presented:

1. Brief overview of CQAHE
2. Higher Education Evaluation System in Lithuania
3. Study Programmes Evaluation and Accreditation
4. Methodological Guidelines. Visits. Final Reports

The following schedule for the visit at VMU has been prepared and executed:

Tuesday, October 09, 2012	
09.00 – 09.30	Meeting with administration staff
09.30 – 10.30	Meeting with staff responsible for the preparation of the Self-Assessment Report (SAR)
10.30 – 10.45	*Coffee break*
10.45 – 11.30	Meeting teaching staff
11.30 – 12.15	Meeting with students
12.15 - 13.15	*Lunch*
13.15 – 14.00	Review of students‘ course and final papers (thesis), examination material
14.00 – 15.00	Visiting auditoriums, libraries, other facilities (studios, teaching spaces, computer services etc.)
15.00 – 15.30	Meeting with alumni
15.30 – 16.00	Meeting with employers and social partners
16.00 – 16.30	Experts private discussion and finalization of the visit
16.30 – 16.50	Introduction of general remarks of the visit to Vytautas Magnus University community

The Team would like to thank the authorities of VMU for their friendly welcome and hospitality. We also want to express our appreciation to the various representatives of VMU, who actively participated in the meetings and considerably contributed by their open discussions to a good overview of the institution.
Last but not least we want to thank Mrs. Agnė Tamošiūnaite from CQAHE for her friendly way of maintaining contact with us, for preparing the visit so well and assisting us during our stay in Lithuania.

II. PROGRAMME ANALYSIS

Vytautas Magnus University (VMU) is a public university in Kaunas, Lithuania. The university was founded in 1922 and it was known as the University of Lithuania, but in 1930 the university was renamed Vytautas Magnus University, commemorating the 500th anniversary of the death of Vytautas the Great. Today it is one of the leading universities of Lithuania. It consists of 10 faculties (Faculty of Humanities, Faculty of Economics and Management, Faculty of Informatics, Faculty of Natural Sciences, Faculty of Social Sciences, Faculty of Theology, Faculty of Arts, Faculty of Political Sciences and Diplomacy, Faculty of Law, VMU Music Academy), containing 41 departments, 1 institute, 22 study and research centres.

The Bachelor Study Programme „Mathematics and its Application“ is organized by the Department of Mathematics and Statistics in the Faculty of Informatics (IF). IF also includes the Departments of Applied Informatics and System Analysis, which are involved in the teaching of this Programme. Furthermore, a collaboration with the Faculties of Economics and Management as well as Social Sciences is established in order to supplement the Programme of Mathematics and its Application.

1. Programme aims and learning outcomes

The framework for qualifications for the European Higher Education Area (EHEA) defines learning outcomes as statements of what a learner is expected to know, understand and/or be able to do at the end of the period of learning.

According to several recent studies, well-educated mathematicians, statisticians, and engineers with a good education in mathematics will be the most sought after specialists in coming years in highly industrialised countries.

Strengths

- The programme Mathematics and its Application has clearly defined its mission in the Lithuanian economy and society. It is designed for the preparation of specialists who can successfully work in technology, business and social areas or systems.

- According to the formulated learning outcomes of the programme Mathematics and its Application the graduates are supposed to know and be able to interpret and explain the main theoretical concepts of applicable mathematical methods; have skills in the application of the main numerical methods and algorithms; know mathematical methods in system modelling and be able to apply them in interdisciplinary areas of studies and in practice; understand and interpret new forms of IT-supported collaboration and management.

- It is not clear how the ambitious aims of the Programme are reached by the current curriculum. Skills of applying mathematics for the analysis of problems related to economics, energetic, medicine and other sciences are not reflected adequately in the curriculum.

- The name of the Programme, its learning outcomes, content and qualifications offered are compatible with each other. The programme conforms to legal requirements.

- There is a strong focus on delivering liberal arts subjects, i.e. languages, arts, philosophy. This can be considered as a competitive advantage in the region (students' responses).

Weaknesses

- The learning outcomes are specified only in the self-assessment report. They are not publicly available anywhere else.
- No subject is taught in English (students' responses).

2. Curriculum design

The programme Mathematics and its Application is on the bachelor's level. The standard period of instruction for this programme is four years. The workload amounts to 240 ECTS credits. This is compliant with the Bologna declaration and Lithuanian legal requirements. The Programme is subdivided into the following educational components:

- General study subjects (52 ECTS)
- Mathematics core subjects (88 ECTS)
- Informatics (16 ECTS)
- Physics (6 ECTS)
- Special subjects (78 ECTS)

Each educational component attracts 3 to 6 ECTS, the internship in the fourth year 15 ECTS, and the Bachelor Thesis 12 ECTS.

Strengths

- The content of each educational component corresponds to the intended learning outcomes of that component. Size and content of all educational components are appropriate.

- The curriculum design meets the legal requirements.

- The level of instruction meets the requirements of a modern, internationally competitive education in mathematics and its application. The content of the programme reflects in a great area of mathematics the latest achievements in science and technology.

- The Team found that the educational components of the programme cover most of the learning outcomes and contents that would be needed to educate an applied mathematician.

- There is strong collaboration in the research area between the University and industrial and academic organizations in the region (Lithuanian Energy Institute, Lithuanian University of Health Sciences).

Weaknesses

- Graduates of mathematics often have to model processes and to apply methods of discrete mathematics. Knowledge of algebraic structures such as semigroups, groups and fields is essential for a broad field of applications. This part of mathematics is not represented adequately in the curriculum. There is an imbalance between applied analysis and applied algebra and a general lack of subjects devoted to applied mathematics.

- The methods of instruction in the undergraduate programme are rather traditional. The Team does not find evidence that activating forms of learning and teaching are practiced.

3. Staff

In total there are 15 teachers affiliated with the Programme. The high competence of VMU's academic staff, especially in the area of energy security, risk management and nuclear installation safety, provides for the strength of the programme. However, lack of experts in the field of finite algebraic structures and discrete mathematics as well as the lack of new didactic methods are obstacles to improving the programme. The age distribution of the academic teachers of the programme will see the replacement of several professors within a few years. This will provide an opportunity to attract young academics with new research competences and new ideas for teaching and learning to VMU.

Strengths

- The qualifications of the current academic staff are sufficient for achieving the aims and learning outcomes set for the Programme and meet the legal requirements.

- The majority of courses, but not all (e.g. Mathematical Logic), are taught by teachers doing research in the field.

- Several professors do research together with the industrial and academic organizations in the region (Lithuanian Energy Institute, Lithuanian University of Health Sciences).

Weaknesses

- The age distribution of the academic teachers of the programme will require the replacement of several professors in the near future. This will provide an opportunity to attract young academics with new ideas for teaching and learning and to cover deficiencies with respect to the teaching and research in Discrete Mathematics.

- Teaching loads, especially for young teachers, are quite heavy. This may lead to poor quality teaching, low attendance at lectures, and will certainly adversely affect the time available for research.

- Too many teachers do not work exclusively for VMU and work for several institutions at the same time what summarizes to enormous (maybe illegal) teaching duties.

- Mobility of the teachers is quite low.

4. Facilities and learning resources

The IF shares the building with the Faculty of Natural Sciences. The building contains 10 classrooms (497 places), 9 computer laboratories with 10 to 24 working places in each, and the Informatics and Natural Sciences Library with 67 working places. In addition, there is a Multimedia Laboratory, a Computer Controlled Systems Laboratory, a Laboratory of Internet and Mobile Solutions and an Energy security Research Centre. All lecture rooms are equipped with the necessary furniture and basic didactic material. Projectors and computers for multimedia-based instruction are available.

Strengths

- The university uses the public domain software bundle Moodle as a modern eLearning tool. Students reported having access to the university servers from their private computers.

- The university has bought online access to some of the journals, books and textbooks of leading publishers.

Weaknesses

- As mathematics lectures often require big blackboards in order to develop and demonstrate proofs, at least some lecture halls should be equipped with adequate boards.

- The Team visited the university library. The library is equipped with a limited number of computer work places with internet access. But there are not many books available in the library (especially text books in English).

5. Study process and student assessment

Students are admitted according to national regulations based on high school graduation results. Access to state financed places is competitive and has to meet minimum standards. Those not admitted to state funded places get access to the programme if they pay tuition on their own.

Strengths

- Enrollment in the Mathematics and its Application programme increased considerably in 2007–2011 as well as the total number of students. The total number of students in 2011 was 85 (36 first study year, 23 second study year, 14 third study year and 12 fourth study year). This is remarkable since enrolment in physical sciences programmes in Lithuania has been decreasing in recent years.

- Several students stated that they chose VMU because of the possibility to learn languages and attend other courses besides those in their chosen career (e.g. art and architecture).

- The academic year is organized in two semesters. Timetables are scheduled rationally. The study classes are well distributed during the week and semester. The sequence of the different courses follows a consistent and well elaborated scheme.

- The examination sessions are carefully planned and fit well into the study programme.

- There is a low drop-out rate and the majority of students graduate at the end of the fourth year.

- Most of the graduates are able to find a job corresponding to their qualifications. Some get employment with companies less focused on their respective specialisations.

- The graduates of the Programme and the employers of the graduates spoke very highly about the qualifications gained during the undergraduate course.

- Students make their internship and prepare their bachelor theses in the industrial organizations (Lithuanian Energy institute, Lithuanian University of Health Sciences).

Weaknesses

- Students are not very critical and not open to the study process. Students were not willing to participate openly with the Team in the discussion on the quality of the study process. Only one student gave us some critical remarks on this topic.

- Student assessment material (examination papers) focuses exclusively on easy theoretical material and nearly trivial examples and problems. There is need for improvement here. Some course descriptions are not realistic and some of the examinations we saw are too easy and do not correspond to the desired learning outcomes.

- The Team examined 27 student examination worksheets. Distribution of marks was far from the expected normal distribution: 1 negative mark of 24 exam papers; 9 and 10 make the greatest part of marks. For the other exam, there are 17 marks from 8 to 10, 6 marks from 5 to 7, and 4 negative marks.

- Sheets of paper for the examination are non-standard, rather brought by the students from home.

- Goals of practice (internship) are defined inadequately. The Team could not find any clear instructions which kind of practice was desired by the curriculum.

- Mobility of staff and students is documented. However, the numbers in and out are very small compared with other European and some Lithuanian universities. Incoming

Erasmus exchange students are taught individually, since there are no subjects delivered in English.

6. Programme management

Strenghts

- Quality management structure is defined clearly in the internal documentation of the University.

- Stakeholders stated that they have some influence on the content of courses and the design of the curriculum.

Weaknesses

- Only a small percentage of the students assess, through student questionnaires, the educational components at the end of a semester. The dean's office collects and evaluates the results. There is no clear information on the quality management process, responsibilities, consequences.

- There is a lack of supportive instruments (e.g., trainings on teaching skills) in order to improve teaching.

III. RECOMENDATIONS

(The first number refers always to the corresponding section.)

1.1 To increase availability of courses for exchange students some subjects should be taught in English.

1.2 Learning outcomes should be attached to the course descriptions and made available to students and lecturers.

2.1 The Team stresses that a knowledge of discrete mathematics, as well as basic knowledge of algoritms' time-complexity, are essential to several applications of mathematics. The Faculty should consider providing for those elements in appropriate educational components and incorporating such material into the undergraduate degree programme. The introduction of those elements may be accomplished by reducing the volume of other subjects.

2.2 More subjects devoted to applied mathematics should be included into the curriculum. On the other side too theoretical subjects in pure mathematics should be reconsidered and defined on a realistic level for becoming applied mathematicians.

2.3 One way of engaging students to participate actively in the process of learning is to introduce elements of project-based learning. Everywhere in the world each mathematics course has two components. The first concerns the theoretical aspects of the course content – the key concepts and theorems. In the second component the students learn to apply the theory by tackling exercises and problems assigned by the teacher. This is a crucial part of the training of young mathematicians because they learn the subject by doing mathematics themselves and not by watching others doing it. We therefore recommend the following refinement of the procedures at present in use in the practical component of courses. Each week the teacher should distribute a set of exercises to the students a week in advance of the practice lecture (tutorial); each student will work on finding solutions to the exercises, alone and possibly in collaboration with other students. A week later the students will discuss their solutions with the teacher during the practice lecture.

3.1 A change of culture so that academic teachers have the focus of their activities at one institution only, and do not work simultaneously at several institutions, should be enforced. Teaching loads especially of young staff inside and outside the institution should be decreased and incentives set to give more attention to research. More full-time teachers should be attracted. Visiting professors, both on a national and international basis, should be invited (e.g. Fulbright scholarship professors).

3.2 The possibility of study leaves and sabbaticals at universities abroad in order to exchange ideas on modern didactic methods as well as to perform research should be considered.

3.3 Within the next few years several professors will retire. This will provide an opportunity to attract young academics with new ideas for teaching and learning and to cover deficiencies with respect to the teaching and research in discrete mathematics and computer mathematics. As an option, this could be done by attracting young Lithuanian scientists currently working abroad.

4.1 Since mathematics lectures often require big blackboards in order to develop and demonstrate proofs, at least some lecture halls should be equipped with adequate boards.

5.1 Realistic and reasonable course descriptions should be elaborated, and examinations set at a level to guarantee the desired study outcomes. Students who do not know or understand the basic facts of a course must not be marked positively. The level of examinations should be increased to conform the learning outcomes of the subject and the programme.

5.2 Increase autonomous student work and self-learning components. (Students should not merely "repeat" in practical classes and exams what they have learned in lectures). Creativity and practical components should be strengthened. For this purpose full use of e-learning platforms such as Moodle is strongly recommended.

6.1. VMU should further enforce Quality Assessment and go ahead with the quality assurance procedures already started. Quality assessment should not be considered as a burden but as an instrument for improvement. Hence the Team suggests that clear procedures to improve teaching and research should be defined based on feedback from students, the extensive collection of information, and the results of different evaluations. The collected data should be used in order to provide advice. Students and teachers should be kept fully informed of the impact their responses and suggestions have on the quality improvement of teaching and course management. Mechanisms to support academic staff in their teaching (teacher training, teacher promotion) and research missions (study leaves, reduction of work load) should be developed.

6.2. Internationalisation is an essential element of higher education development. It is a multi-dimensional task taking into account mobility programmes, language policy, curricula, joint study and double degree programmes, collaborative research, conference attendance etc. Strengthen further your foreign languages policy by using more English text books and offering lectures in English. VMU and the Faculty of Informatics should look for equal partners for student and teacher exchange and increase the incoming and outgoing mobility of both students and academic staff (Erasmus, special agreements).

6.3 Contacts between the University and enterprises should be strengthened, diversified and formalized in order to integrate students into project work.

IV. SUMMARY

The bachelor degree programme “Mathematics and its Application” at VMU meets the needs of the society and the Lithuanian and European labour market. It prepares specialists in the field of mathematics to work in many different fields of economy and industry as well as in scientific positions. Well trained mathematicians are, and will become more and more, a key element in our IT-dominated world.

The high competence of VMU’s academic staff, especially in the area of energy security, risk management and nuclear installation safety, provides for the strength of the programme. However, lack of experts in the field of finite algebraic structures and discrete mathematics as well as the lack of new didactic methods are obstacles to improving the programme. The age distribution of the academic teachers of the programme will see the replacement of several professors within a few years. This will provide an opportunity to attract young academics with new research competences and new ideas for teaching and learning to VMU.

The modernisation of buildings and laboratory equipment is visible; however, some lecture rooms need to be adapted for better teaching of mathematics classes (larger blackboards).

The clear and well-designed curriculum of the programme enables students to complete the programme within the standard period of studies. The dropout rate is low, which seems to show high motivation of students. The incoming and outgoing mobility of both students and academic staff is too low and needs to be increased.

Course descriptions should be revisited and examinations adjusted to ensure their mutual compatibility. The level of difficulty of examinations should be increased.

Research and its international visibility should be strengthened. Students should be more integrated into project work, and self -learning components should be strengthened.
The results of the evaluation of the courses should be more thoroughly analysed and discussed with the students. Students are key stakeholders, thus open communication with them is a very important element.

V. GENERAL ASSESSMENT

The study programme *Mathematics and its application* (state code – 612G10004) at Vytautas Magnus University is given positive evaluation.

Study programme assessment in points by fields of assessment.

No.	Evaluation Area	Evaluation Area in Points*
1.	Programme aims and learning outcomes	**3**
2.	Curriculum design	**2**
3.	Staff	**2**
4.	Material resources	**3**
5.	Study process and assessment (student admission, study process student support, achievement assessment)	**3**
6.	Programme management (programme administration, internal quality assurance)	**3**
	Total:	**16**

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

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

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

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