STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETO
STUDIJŲ PROGRAMOS *TECHNOMATEMATIKA (612G16001)*
VERTINIMO IŠVADOS

EVALUATION REPORT
OF *TECHNOMATHEMATICS* (*612G16001*)
STUDY PROGRAMME
at VILNIUS GEDIMINAS TECHNICAL UNIVERSITY

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Išvados parengtos anglų kalba
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DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	***Technomatematika***
Valstybinis kodas	612G16001
Studijų sritis	Fiziniai mokslai
Studijų kryptis	Matematika
Studijų programos rūšis	Universitetinės studijos
Studijų pakopa	Pirmoji
Studijų forma (trukmė metais)	Nuolatinė (4 metai)
Studijų programos apimtis kreditais	240
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	Matematikos bakalauras
Studijų programos įregistravimo data	2004-06-07

INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme	***Technomathematics***
State code	612G16001
Study area	Physical Sciences
Study field	Mathematics
Kind of the study programme	University studies
Study cycle	First
Study mode (length in years)	Full-time (4 years)
Volume of the study programme in credits	240
Degree and (or) professional qualifications awarded	Bachelor of Mathematics
Date of registration of the study programme	2004-06-07

CONTENTS

I. INTRODUCTION

1.1. Background of the evaluation process

The evaluation of on-going study programme is based on **Methodology for evaluation of Higher Education study programmes,** approved by Order No 1-01-162 of 20 December 2010 of the Director of the Centre for Quality Assessment in Higher Education (further – SKVC).

The evaluation is intended to help higher education institutions to improve constantly their study programmes and to inform the public about the quality of studies.

The evaluation process consists of the main following stages: *1) self-evaluation and self-evaluation report prepared by Higher Education Institution (further - HEI); 2) visit of the expert team at the higher education institution; 3) production of the evaluation report by the expert team and its publication; 4) follow-up activities.*

On the basis of external evaluation report of the study programme SKVC takes decision to accredit study programme either for 6 years or for 3 years. If the programme evaluation is negative such a programme is not being accredited.

The programme is **accredited for 6 years** if all evaluation areas are evaluated as “very good” (4 points) or “good” (3 points).

The programme is **accredited for 3 years** if none of the area was evaluated as “unsatisfactory” (1 point) and at least one evaluation area was evaluated as “satisfactory” (2 points).

The programme **is not accredited** if at least one of evaluation areas was evaluated as "unsatisfactory" (1 point).

1.2. General

The Application documentation submitted by the HEI follows the outline recommended by the SKVC. Along with the self-evaluation report and annexes, the following additional documents provided by HEI before, during and/or after the site-visit:

No.	Name of the document
1	Examples of examinational materials (tests, examination-papers, etc.)

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

The Departments of Mathematical Modelling, Strength of Materials and Theoretical Mechanics located in the Faculty of Fundamental Sciences of the Vilnius Gediminas Technical University (VGTU) are directly responsible for the programme, overseeing its delivery and monitoring. VGTU is an institution of higher education whose start is deemed to be September 1, 1956, when Vilnius Evening Division of the Evening of Kaunas Polytechnic Institute (KPI) was established. Now VGTU belongs to the top four percent of the best universities of the world according to the data of the international university rating '2013-2014 QS World University Rankings'. It consists of 9 faculties and 1 institute of studies: "A. Gustaitis" Aviation Instititute, the Faculty of Environmental Engineering, Architecture, Electronics, Fundamental Sciences, Creative Industries, Mechanics, Civil Engineering, Transport Engineering and Business Management. The structure includes 60 departments. Research is conducted in 6 University research subdivisions, 22 faculty research centres and 9 accredited laboratories. Other departments, such as Department of Philosophy and Political Theory, Foreign Languages, etc. are also involved in the Study programme development and implementation. VGTU also consists of library, publishing house, administration and other subdivisions (see Figure 1.1 in SER for more details).

VGTU applies Technomathematics study programme for the assessment in the Centre for Quality Assessment in Higher Education for the first time as this study programme has been registered in 2004.

Technomathematics study programme of Bachelor level with 240 credits belongs to the Technomathematics Studies branch (G160) and is attributed to the Physical Sciences' Mathematics field (G100) of studies.

1.4. The Review Team

The review team was completed according to *Description of experts' recruitment*, approved by order No 1-55 of 19 March 2007 of the Director of the Centre for Quality Assessment in Higher Education, as amended on 11 November 2011. The Review Visit to HEI was conducted by the team on *16th October, 2014.*

1. **Prof. Dr. Neda Bokan (team leader),** *full Professor at State University of Novi Pazar, Serbia.*
2. **Prof. Dr. Carl Winslow,** *full Professor of didactics of mathematics, Deputy Head of research at Dept. of Science Education, University of Copenhagen, Denmark.*
3. **Prof. Dr. Tomaz Pisanski,** *Professor of Discrete and Computational Mathematics, University of Ljubljana, Slovenia.*
4. **Prof. Habil. Dr. Alfredas Račkauskas,** *Professor in Faculty of Mathematics and Informatics, Head of the Department of Econometric Analysis, Vilnius University, Lithuania.*
5. **Mr. Žilvinas Kalvanas,** *student at Kaunas University of Technology, Faculty of Economics and Business, Lithuania.*

II. PROGRAMME ANALYSIS

2.1. Programme aims and learning outcomes

The programme aims are well defined. Technomathematics study programme's learning outcomes are harmonized with the outcomes enumerated in the Mathematics Subject Benchmark Statement, which are to be reached by the graduates of first cycle mathematics field. Learning outcomes involve: knowledge and its application, abilities to conduct scientific research, special abilities, social and personal abilities. But when the review group analyzed separately the aims of all courses it was pointed out that they are not defined in a compatible way with the specific topic of this one. For example, the aims of Discrete Mathematics are formally written: '...Students must be able solve typical problems, apply modern mathematical methods to solve real life problems, to modify and generalize formulation of problem' (see p. 49-53 of Annex 3). It is not clear: what are modern mathematical methods, etc. Such aims may be used for the whole study programme and all courses. There are no aims of Object-Oriented Programming (p.78-81 of Annex 3), Advanced Calculus (p. 78-81 of Annex 3), Finite Element Methods (p. 147-150 of Annex 3). The aim for General Algebra is 'to give information on basic concepts and statements of general algebra'. This one might be clear from the title (p. 82-85 of Annex 3) but it would be well to describe the aim more precisely as General Algebra involves a lot of areas.

There are many courses with defined aims in a correct way; for example: Cognitive practice (p. 108-109 of Annex 3), Management (p. 115-119 of Annex 3), Dynamical Systems and Chaos (p. 138-142 of Annex 3), Applied Statistics (p. 151-154 of Annex 3), Analysis of Mathematical Models of Real World Applications (p. 163-166 of Annex 3), etc.

When the review team considers learning outcomes the situation is very heterogeneous. It is evident that students acquire good theoretical knowledge of mathematics (differential calculus, integral calculus, mathematical logic and set theory, analytic geometry, etc.) and informatics (object-oriented programming, etc.) and less of technical sciences (engineering mechanics, etc.). It is reasonable as students achieve the diploma from the study field of mathematics. The knowledge and the cognition are mainly well defined except in some courses (for example Advanced Calculus, p.78-81 of Annex 3). General and special skills are mainly well defined except in some courses: Integral Calculus (the special and general skills consist of in some part the same statement: '...Students receive theoretical and practical knowledge about several types of integrals and practical application of them...' (p. 39-43 of Annex 3), Linear Algebra (they are written in a very broad sense: '...Ability to work in a team and individually, make decisions…')

(p. 44-48 of Annex 3), Discrete Mathematics (it is written almost the same as for Linear Algebra; lots of team work, decision making, etc.) (P.49-53 of Annex 3), etc.

In many courses abilities have been chosen from the general list without clear motivation. For example, for courses of foreign languages of the 1st and 2nd level it is written: 'this course develops the ability to think abstractly' (see Annex 3, p.27-36 and p. 62-73). How do the students succeed? Moreover, the evaluation of all outcomes is obtained by the total mark of homework assignments and average mark of tests. Tests are usually in a written form. What about the evaluation of oral abilities? Generally, the outcomes are recognized but it is not clear how one can assess the students' achievement in the frame of learning outcomes.

Students achieve skills although they are not mentioned in SER (for example: time management through presentations of their results, etc.). Social abilities through courses Philosophy, Specific Purpose Language Culture, etc. might be achieved.

The programme aims and learning outcomes are based on the academic and professional requirements. The development of society really needs experts who may build a bridge between pure theoreticians and engineers. Graduates with the diploma of Technomathematics may be members of interdisciplinary teams. Graduates may find a job which is closely related to their achieved competencies in computer centre, governmental administration, etc. Graduates' abilities may be recognized in the best way in technology companies, which is the nearest future of Lithuania having in mind the strategy of industrial development.

It is pointed out in the content of almost all courses that students achieve the interaction of theory and practical applications, although the topic names of lectures are very standard. Moreover, some courses are only devoted to achieve this goal of the interaction of theory and practical applications (for example: Analysis of Mathematical Models of Real World Applications, Mathematical Models in Industry, Optimization in Economics, etc.). Anyhow, it is necessary to point out that the social partners recognize a good adoption of graduates because of their key mathematical knowledge.

The content of the programme is established to achieve applications of mathematics and informatics in modelling of some problems of a real life and solve these ones in the frame of team work. Hence, the name of the programme is compatible with its learning outcomes, content and the qualifications.

2.2. Curriculum design

The study programme was developed according to Lithuania's legal acts regulating the structure of study programmes and VGTU programme framing rules. One credit in this programme corresponds to 26.67 hours. It keeps within bounds as in other countries within EHEA. The methodology of distribution of credits among courses is modified from time to time after the analysis of students results as showed in the evaluation of their knowledge and other abilities. The number of admitted students in the period from 2008 to 2012 is respectively: 31, 32, 34, 17, 11. Decreasing interest for this programme during these 5 last years is evident. It is an indicator of necessary changes. In each semester not more than 7 courses are realized. The assessment of average results per each course checks the regularity of credits distribution and students' workload. The review team concludes that the ratio of admitted and graduated students (0,9 and 0,56) is very good.

Table 6.2, p. 26 in SER shows the data about specific courses as an indicator of a proper distribution of students' workload during semesters. Some themes in the list of the Subject Modules (SM) lecture topics appear in two courses. For example:

> -linear operators (2 hours); eigenvectors and eigenvalues of linear operator (2 hours) appear in Linear Algebra and General Algebra (see Annex 3,p. 47, topic names: 16., 17., 18., and p. 85, topic names: 12., 13.); moreover, among study subject modules to be completed before General algebra studies appears Linear Algebra;
> -graph theory in Discrete Mathematics (13 hours) and in Theory of Algorithms (6 hours) (see Annex 3, p. 52, topic names 8.-12. and 17., and p. 107, topic name 7., Annex 3); moreover, Discrete Mathematics appears among study subject modules to be completed before Theory of Algorithms studies;
> - kinematics (2 hours) in General Physics and kinematics of a particle, motions in Engineering Mechanics (8 hours) (see Annex 3, p. 77, topic name 2. and topic names 9,-12., p. 94); moreover, General Physics does not appear among study subject modules to be completed before Engineering Mechanics.

Discussing these details from Annex 3 with representatives of academic staff the review team concludes that it would be necessary to make an overview of topic names of SM to have more precise distributions of topics considered in the courses and the corresponding list of study subject modules to be completed before SM studies and its consequences in the choice of themes in subsequent course. For this purpose better coordination among teachers is welcome.

The content of the subjects and modules is consistent with the type and level of the studies. Students achieve wide key mathematical knowledge to adopt themselves easily in companies by the opinion of social partners. The courses Analysis of Mathematical Models of Real World Applications, Financial Engineering and Modelling, etc. help students to be prepare for the research. Of course, solid classical mathematical courses of Algebra, Analysis, and Geometry allow students in the previously mentioned courses succeed to collect and analyze data necessary for solving important scientific and professional problems. The academic staff encourages students to participate in the seminars of the Mathematical Modelling Department and communicates their results.

It is not clear if the methods and content of the subjects and modules are appropriate for the achievement of intended learning outcomes. The review panel has mentioned before the example of foreign language courses and abstract way of thinking (see Annex 3, p.31-33, for German language, etc.). Another example concerns general skills such as "to be able to understand mathematical symbols, language and formulas in the course of Advanced Numerical Methods", etc. This course needs to be recognizable with a more specific general skill as a consequence of the content of this course.

Generally, the modelling and measurement of learning outcomes is a difficult and new problem in the concept of student-centred learning approach in higher education. Hence, the academic staff needs to cooperate mutually to improve the content and methods for the achievement of the intended learning outcomes.

Generally speaking, the scope of the programme might be sufficient to ensure learning outcomes but it depends on the realization and measurement of achieved goals. It is not clear how the students achieve learning outcomes among cognition. For example, 'understanding general laws of mathematics' within the course Integral Equations (see p. 171-174, Annex 3), 'to work as a

team and individually' within the course of Ordinary Differential Equations (see p. 99-103, Annex 3), etc.

The latest achievements in science and technology are of interdisciplinary character. Hence, the review team can conclude that the programme offers opportunities to students to be members of working team in various companies of high level development. Social partners also agree with the opinion of the review team, having in mind their experience with graduates of this study programme.

2.3. Teaching staff

There were 31 lecturers in the Technomathematics programme in the 2012/2013 academic year: 24 lecturers taught major field courses, including optional subjects, practice sessions and specializations, 7 lecturers taught general university study courses. These distributions differ slightly every year. The lecturers qualifications meet the requirements set for Bachelor's study programmes (Lithuania's Education and Science Minister's decree No. V-501 of 2010-04-09 'Confirmation of the general requirements' description list for the first cycle and integrated study programme) (see SER p. 19). The programme is implemented by 95% lecturers whose primary workplace is in one of the departments of VGTU.

If one sees Table 4.3 Lecturers' distribution according to their age and position for 2012/2013 in SER, p.22, the problem of academic staff is recognizable. To be more precisely, among 31 lecturers there exist only 5 junior lecturers younger than 31 years old and 4 associate professors and 1 lecturer of age 31-40. The staff involves mainly Professors and Associate Professors older than 50 years.

The programme is implemented by mathematicians, experts in computer science, engineers from corresponding departments, etc. who fulfil legal requirements, which is a guarantee ensuring a proper achievement of learning outcomes.

Total lecture/student ratio between 0.31 and 0.44 in the period of 2008/2009-2012/2013 academic years with decreasing number of students from 108 to 71 is adequate to ensure learning outcomes (see Table 4.2 in SER, p.21). Anyhow, it is necessary to point out that Technomathematics study programme's lecturers teach some courses in other study programmes at VGTU. But seeing all of their results in research, the corresponding publications, the international cooperation, etc. the expectations might be promising in the future too. To be more precisely, 11 lecturers of the programme participated in 16 scientific research projects, prepared 189 publications that are included in international databases or are meant for studies: 3 textbooks, 17 educational books, 167 scientific articles, 96 of which are included in the ISI Web of Science list, made more than 90 presentations in international scientific conferences (see SER, p.20).

Teaching staff turnover is able to ensure an adequate provision of the programme if the administrative staff would take care about the involvement of younger lecturers in the future. This is also important because of specific concept of this study programme which needs quick changes in the curriculum according to the development of high technology and corresponding sciences. 10 lecturers younger than 40 years, being active now, are for the future.

Reading the part of SER p. 20-22 and Annex 6 one may confirm that the professional development of the teaching staff is necessary for the provision of the programme and the improvement of lecturers' qualifications. Anyhow, the feedback of student assessment of

teachers' pedagogical abilities, the study programme, etc. should be better and more recognizable by the opinion of students' representatives. There are few lecturers without scientific activities, or they publish only in Lithuanian journals (see p. 45, 46, 63 in Annex 6). The workload of academic staff in teaching is very high. On average, lecturing lasts 12-18 academic hours per week. Some of full-time assistants professors give 2-3 courses per semester, which amounts to 4-5 courses per year (see SER p.23). The administrative staff does not motivate and encourage all members of the academic staff to be interested in the research. Mathematicians need to have the sabbatical year in a certain period to improve research and knowledge due to better adoption of the Technomathematics study programme to the needs of labour market and their corresponding teaching abilities. This has to be regulated by the corresponding bylaw at the University level.

Mostly members of academic staff participate in the international scientific research projects which include:

- European research, development and co-operation programme 'Eureka'. Project E!3691 OPTCABLES 'Optimisation of the Cable Harness', 1.52 ME;
- High technology development programme B-03/2007-2009 GRIDGLOBOPT 'Global Optimisation of Complex Systems Using High-Performance Computing and GRID Technologies';
- A multichannel cyclone of a new generation design DAKACIKAS, etc.

Some of teachers are projects leaders. The complete list of the activities is presented in the frame of Annex 7. Moreover, the cooperation with ITWN Institute in Kaiserslautern, Germany, and others is developed as well as exchange programs (lectures and scientific research) in the frame of Erasmus is in place. The examples include: Paris 11 University and Paris 12 University (France), Zaragoza University (Spain), etc. (more details one can see in Annex 7 and Annex 8). These facts confirm that the teaching staff is involved in research directly related to the Technomathematics study programme.

2.4. Facilities and learning resources

Reading SER p. 23-25 it is easy to check that VGTU is equipped with classrooms, laboratories, computer rooms, libraries, reading rooms, etc. which are adequate both in their size and quality for studies. These facts have been checked during the visit.

VGTU is equipped with equipment important for experiments in the engineering frame, various legal software (Maple, AutoCad, Matlab, Mathcad, etc.). Students of Technomathematics programme can also use the technology installed in Parallel computing lab. The lab has a PC cluster VILKAS with nodes of two types. Let us mention among, libraries (software) of programme design and visualization available in the cluster, only few of them: Fortran, C++/C, BOOST, CUDA, FFTW, GSL, HDF5, ICTCE, etc. The lab also has several EGEE certified GRID clusters, fully integrated into the European GRID infrastructure (EGI). Modern technologies 'Clouds' are investigated and tested in the lab too. Two graduates of Technomathematics study programme are employed in this lab. Students carry out their engineering experiments using the mechanical materials testing equipment. Students use Oracle SQL and Oracle Designer software programmes. The University has 1Gps optical backbone computer network which reaches the computer rooms in the Faculty of Fundamental Science and the dormitories. All of the university buildings are equipped with wireless computer network EDUROM. All classrooms are equipped with video projectors and are adequate both in size and quality. An exhaustive list of the equipment installed in the computer rooms is provided in

Annex 9. So, Inkscape, Lotus Notes, Magic Draw, PS Project 2010 pro, TeX, etc. are installed in all five computer rooms; Fedora, Maple, Matlab, etc. in 1-3 computer rooms. The teaching and learning equipment allows concluding that students have the approach to modern technologies and consequently good conditions for high quality studies.

The majority of the students conduct their introductory internship in the Lithuania's Parliament Office. Others choose various IT and business enterprises. Industry internship is conducted in various companies and institutions: insurance firms, logistics, software development companies, Lithuania's ministries, at social partners' establishments – at the Europe B.V. branch of Bentley Systems, Synergium Ltd. Some students have their internships abroad, for example in HSG-IMIT (Institut fur Mikro – und Informationstechnik), Germany.
During the meeting with the representatives of social partners the review team learned the students adopt themselves in companies very easily due to the solid key mathematical knowledge. The internship has been shown as a good approach of graduates as well as of students to look for a job in the companies of social partners. It is necessary to point out that the formalization of social partnership would be welcome in the future.

In the Annex 3 the list of main bibliography (no more than 3 sources) and additional bibliography (no more than 10 sources) for each study subject module is presented. It is well prepared and concentrates on reading only the most important data for all issues (title, name of the author, publishing company, etc). Textbooks and other teaching materials written by the VGTU academic staff are also available for other users (either in the electronic form or classical one). Some of these books are written in English.

The library of VGTU at this moment subscribes 28 databases such as: Springer LINK, Science Direct, Oxford University Press Journals Collection, etc. Library has 3 journal archives: Cambridge Journals Online (2003-2006) archive, IOP Publishing Archive collection 1874-1999, Springer Link Archive.

The study programme Technomathematics has 993 e-journals and 1588 e-books. The review team refers to the site www.ebooks.vgtu.lt for more details.

2.5. Study process and students' performance assessment

The general admission to Lithuanian Higher Education Institutions is organized and carried out by the Association of the Lithuanian Higher Education Institutions for Organizing General Admission (LAMABPO). Applicants can apply to state-funded places or places that are not state-funded. Applicants must have completed secondary education. The entrance to Technomathematics Bachelor degree programme does not require any additional examinations. The competition score is calculated by recounting the results of maturity examinations, the required annual grade and adding their products to the weighted coefficients in a proper way.

The number of admitted students to state-funded places/non state-funded places in the period from 2008 to 2012 is, respectively: 31/0, 29/3, 34/0, 15/2, 10/1. The number of applicants to state-funded places/not state-funded places in the same period is respectively: 216/28, 211/67, 211/39, 143/10, 122/19. Consequently, the review team concludes that the number of applicants and entrants to this programme decreases every year. The decreasing number of students is affected by the decreasing number of pupils, insufficient attention to the studies of mathematics at school, insufficient number of scholarships, etc. Therefore an Alumni organization needs to be established to promote this study programme and also to keep closer cooperation with the

University due to the benefit from both sides. The Mathematical association might also promote the programme.

The weighted average of the graduates in 2012 and 2013 is respectively 7,3 and 7,01. The ratio of the number of admitted students to the number of students who finished their studies is respectively 0,9 and 0,56 for the years of admission 2008, 2009 and the years of graduation 2012, 2013 respectively. Technomathematics study programme is conducted in accordance with the undergraduate study organization procedures regulated by the VGTU Rector's order.

Observations of the representatives of social partners according to the good adoption of graduates in their companies and previously mentioned facts allow concluding that the organization of the study process ensures an adequate provision of the programme and the achievement of the learning outcomes.

Good contacts among students and teachers encourage them to attend seminars organized by the Department of the Mathematical Modelling and to participate in the conference 'Science is the Future of Lithuania', annually held in VGTU. The skills and abilities developed by making the presentations of the results of their own work in seminars and conferences which help them to prepare their final theses. Anyhow, one cannot expect an intensive research and recognizable results as this is a study programme of Bachelor level where students first of all need to achieve a wide and respectable knowledge as well as generic and specific skills and abilities, precisely given in curriculum design.

The students get wide possibilities to leave according to exchange programs. The Faculty of Fundamental Sciences has concluded student and teacher exchange agreements under the ERASMUS exchange program with 56 European and 6 Turkish universities. This opportunity was used by 14 students in the academic years 2008/2009-2012/2013. To be more precisely, 2 students were at Technische Universitat Kaiserslautern, Germany; 2 students - at Southampton Solent University, Great Britain, 3 students - at Free University of Bozen – Bolzano, Italy; 1 student - at Rostock University, Germany; 4 students - in HSG-IMIT (The Institute of Microtechniques and Information technologies), Germany; 1 student - in Systems GmbH, Germany and 1 student - at Hanyang University, South Korea. One can very easily see that students have used opportunities to participate in student mobility program in high developed countries. This is important to have in mind as it is compatible with the scope of their study programme. To use these possibilities in a better way it would be well to introduce more courses in foreign languages and improve students' knowledge of foreign languages. In that case students would overcome differences in study programmes of both universities in an easier way.

On the initiative of the study programme executors, meetings with students are performed and various academic issues are discussed. According to SER, students have different consultations, but it is also mentioned that weak students interrupt their studies. So it is doubtful whether these consultations are sufficient for the students with learning difficulties in order to fill their gaps. The study quality questionnaires are the same in the whole university and are not adapted to the study programme. Students do not notice any changes after filling out those questionnaires. Students wishing to participate in sports and cultural activities can attend the choir 'Gabija', the theatre studio 'Palepe', the folk dance ensemble 'Vingis', etc.

In accordance with the size of scholarship and the number of students getting those scholarships it is very low, so the scholarships and their quantity should be increased in order to increase the students' motivation. VGTU provides three sorts of grants: social grants, named grants and one-

time grants (for more details see SER, p.29 and the corresponding website). The students can be provided with the students' house.

The cumulative score system is applied in the programme. The assessment formula is only indicated in the module card; the information on the assessment criteria of the students' results is announced in the website of the University and is accessible in public in the website for the students.

According to SER, most students find jobs while studying. After completing the speciality, the students start working in public institutions, business companies or educational institutions.

2.6. Programme management

The programme management, decision-making and control are implemented at various levels: from the state level, through the University level, the Faculty level to the Department level. All procedures are clearly defined in details. The interests of students are represented by their delegated representatives in the Programme Study Committee in the Faculty Study Committee and the Council. All details are presented in the corresponding website.

Information and data on the implementation of the programme are regularly collected. External evaluation of this programme has not been realized so far. The process of the VGTU study programme and quality assurance, as well as programme executors' responsibilities are described in the documents of various level: Statute, Strategy, resolutions, etc. VGTU is constantly conducting three types of surveys:

1. The survey aimed at all students of the University on the study subjects they had been taught and the teachers who taught those subjects;
2. First-year undergraduate student opinion survey on the choice of the studies in the University;
3. First-year postgraduate student survey on the quality of Bachelor's study programme.

In 2012 the University also launched a survey on the study conditions. Anyhow, by the opinion of student representatives, a feedback of students assessment is not enough recognizable. A coordination of teaching staff in this frame is more or less non-formal.

The representatives of social partners are involved in the design of Technomathematics study programme. Observing the specificity of this programme with these representatives the review team can conclude that the representatives are chosen in a proper way. They understand the world with rapid increase of information, quick development of technologies and possible adoption of the programme to these circumstances. The Alumni organization due to these purposes needs to be established in a formal way as well as the partnership with other stakeholders developed.

The internal quality assurance measures are effective and efficient in various aspects. The most delicate process of modelling and measurement of students' competencies might be improved to achieve the character of student-centred learning approach in the implementation of this programme in a proper way.

III. RECOMMENDATIONS

1. The Description on the assessment of the knowledge of Vilnius Gediminus Technical University approved by the VGTU Senate on 30 June 2009 might be simplified. It would be well to observe an assessment of other achievements: cognition, special skills, general skills, etc.
2. Formalize the partnership with social partners to have better and well defined cooperation.
3. An Alumni organization needs to be established to promote this study programme and also closer cooperation with the University (joint seminars, projects, etc.) due to the benefit from both sides developed.
4. Intensify the promotion of the study programme through the Mathematicians associations to increase the number of admitted students in the future.

5. Improve learning outcomes of the courses (see part „learning outcomes“ for details).
6. Introduce the sabbatical for the whole academic staff in order to intensify the research activities due to better adoption of teachers to quick development of technologies and science as well as possible adoption of this programme and their lecturing to these circumstances.
7. Introduce study quality questionnaires adopted to the Technomathematics study programme.

V. EXAMPLES OF EXCELLENCE (GOOD PRACTICE)*

V. SUMMARY

The programme aims are consistent with the learning outcomes which are harmonized with the outcomes enumerated in the Mathematics Subject Benchmark Statement, which are to be reached by the first cycle graduates mathematics field of studies. Learning outcomes are divided into 5 groups: knowledge and its application, abilities to conduct research, special abilities, social and personal abilities. The achievement of the learning outcomes allows graduates to adopt themselves in the job, especially due to the solid key mathematical knowledge. Moreover, the employability of graduates is very good and some of them find jobs during their studies. The industrial internship also helps students very much in seeking a job and achieving learning outcomes (team work, problem solving, critical way of thinking, etc.)

Anyhow, considering the aims and the learning outcomes of some courses the review team concludes that the situation is very heterogeneous. For some courses the aims and the learning outcomes are well written but in some courses the aims do not exist (Object-Oriented Programming, Advanced Calculus, Finite Element Methods, etc). In some courses the aims and learning outcomes are written in a very broad and insufficient precise way (Integral Equations, Foreign Languages, general Algebra, etc).

The influence of well developed international cooperation and research activities of the main part of academic staff, especially publishing of results in the international journals, is very recognizable in the quality of Technomathematics study programme. The academic staff also

pays the attention on publishing quality textbooks that are used in other universities. The workload in teaching does not allow all academic staff members to be active enough in research and international cooperation. The sabbatical does not exist for all academic staff members. The administrative staff is not active to motivate and encourage all academic staff members to be active in research and international cooperation.

Facilities and learning resources are of a good quality. Students can use the technology installed in Parallel computing laboratory and many others.

Students can assess pedagogical abilities of teachers, their workload, study quality, etc. The review team has learned that students expect better feedback of their assessments.

Social partners are well chosen and help students to realize their internship and to find a job. Their representatives are active in a proper way in the design of the programme as they understand the world with rapid increase of information, quick development of technologies and possible adoption of this programme to these circumstances. Unfortunately, the formalization of social partnership does not exist.

** if there are any to be shared as a good practice*

VI. GENERAL ASSESSMENT

The study programme *Technomathematics* (state code – 612G16001) at Vilnius Gediminas Technical University is given **positive** evaluation.

Study programme assessment in points by evaluation areas.

No.	Evaluation Area	Evaluation of an area in points*
1.	Programme aims and learning outcomes	3
2.	Curriculum design	3
3.	Teaching staff	3
4.	Facilities and learning resources	4
5.	Study process and students' performance assessment	3
6.	Programme management	3
	Total:	**19**

*1 (unsatisfactory) - there are essential shortcomings that must be eliminated;
2 (satisfactory) - meets the established minimum requirements, needs improvement;
3 (good) - the field develops systematically, has distinctive features;
4 (very good) - the field is exceptionally good.

Grupės vadovas: Team leader:	Prof. Dr. Neda Bokan
Grupės nariai: Team members:	Prof. Dr. Carl Winslow
	Prof. Dr. Tomaz Pisanski
	Prof. Habil. Dr. Alfredas Račkauskas
	Žilvinas Kalvanas

Vertimas iš anglų kalbos

VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETO PIRMOSIOS PAKOPOS STUDIJŲ PROGRAMOS *TECHNOMATEMATIKA* (VALSTYBINIS KODAS – 612G16001) 2014-11-24 EKSPERTINIO VERTINIMO IŠVADŲ NR. SV4-566 IŠRAŠAS

<...>

VI. APIBENDRINAMASIS ĮVERTINIMAS

Vilniaus Gedimino technikos universiteto studijų programa *Technomatematika* (valstybinis kodas – 612G16001) vertinama **teigiamai**.

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

* 1 - Nepatenkinamai (yra esminių trūkumų, kuriuos būtina pašalinti)
2 - Patenkinamai (tenkina minimalius reikalavimus, reikia tobulinti)
3 - Gerai (sistemiškai plėtojama sritis, turi savitų bruožų)
4 - Labai gerai (sritis yra išskirtinė)

<...>

V. SANTRAUKA

Programos tikslai susiję su studijų rezultatais, suderintais su Matematikos studijų krypties apraše išvardytais rezultatais, kuriuos turi pademonstruoti matematikos studijų krypties pirmosios pakopos studijas baigę studentai. Studijų rezultatai yra suskirstyti į 5 grupes: žinios ir jų taikymas, gebėjimai vykdyti tyrimus, specialieji gebėjimai, socialiniai gebėjimai ir asmeniniai gebėjimai. Pasiekę studijų rezultatus absolventai geba juos pritaikyti darbe, ypač dėl turimų svarių pagrindinių matematikos žinių. Be to, absolventų įsidarbinimo rodiklis yra labai geras, kai kurie jų randa darbą dar studijuodami. Ieškoti darbo ir pasiekti studijų rezultatų (komandinio darbo, problemų sprendimo, kritinio mąstymo ir pan.) studentams taip pat labai padeda gamybinė praktika.
Vis dėlto, apsvarsčiusi kai kurių studijų dalykų tikslus ir studijų rezultatus, ekspertų grupė daro išvadą, kad padėtis yra labai įvairialypė. Kai kurių studijų dalykų tikslai ir studijų rezultatai yra

gerai aprašyti, bet kai kurių studijų dalykų atveju tikslų iš viso nėra (Objektinis programavimas, Specialieji skaitiniai metodai, Baigtinių elementų metodai ir kt.). Kai kurių studijų dalykų tikslai ir studijų rezultatai aprašyti labai plačiai ir nepakankamai tiksliai (Integralinės lygtys, Užsienio kalbos, Bendroji algebra ir kt.).
Technomatematikos studijų programos kokybei akivaizdžiai turi įtakos gerai išplėtotas tarptautinis bendradarbiavimas ir pagrindinės akademinio personalo dalies mokslinė veikla, ypač rezultatų publikavimas tarptautiniuose žurnaluose. Akademinis personalas taip pat stengiasi spausdinti kokybiškus vadovėlius, kuriais naudojasi ir kiti universitetai. Didelis dėstymo krūvis neleidžia visiems personalo nariams pakankamai aktyviai dalyvauti mokslinėje ir tarptautinio bendradarbiavimo veikloje. Ne visas akademinis personalas gali išeiti mokslininko atostogų. Administracijos personalas nesiima iniciatyvos motyvuoti ir skatinti visą akademinį personalą aktyviai dalyvauti mokslinėje ir tarptautinio bendradarbiavimo veikloje.
Materialieji ištekliai yra geros kokybės. Studentai gali naudotis Lygiagrečiųjų skaičiavimų laboratorijos ir daugelio kitų laboratorijų įranga.
Studentai gali įvertinti dėstytojų pedagoginius gebėjimus, darbo krūvį, studijų kokybę ir pan. Vertinimo grupė sužinojo, kad studentai tikisi geresnio grįžtamojo ryšio dėl jų pasiekimų vertinimo.
Socialiniai partneriai yra gerai parinkti ir padeda studentams atlikti praktiką bei susirasti darbą. Socialinių partnerių atstovai aktyviai ir tinkamai dalyvauja rengiant programą, nes jie supranta pasaulį, kuriame greitai didėja informacijos kiekis, sparčiai vystosi technologijos, ir tai, kaip būtų galima pritaikyti šią programą prie šių aplinkybių. Deja, ši socialinė partnerystė nėra oficialiai įforminta.

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III. REKOMENDACIJOS

1. VGTU Senato 2009 m. birželio 30 d. patvirtintas Vilniaus Gedimino technikos universiteto studentų žinių vertinimo tvarkos aprašas galėtų būti supaprastintas. Būtų gerai numatyti kitų pasiekimų vertinimą, pavyzdžiui, kognityvinių, specialiųjų, bendrųjų įgūdžių ir pan.
2. Oficialiai įforminti patrnerystę su socialiniais partneriais siekiant geresnio ir geriau apibrėžto bendradarbiavimo.
3. Siekiant populiarinti šią studijų programą ir užmegzti glaudesnį bendradarbiavimą su universitetu (bendri seminarai, projektai ir pan.), būtina įsteigti alumnų klubą.
4. Labiau populiarinti šią studijų programą per matematikų asasosiacijas, siekiant didesnio stojančiųjų skaičiaus ateityje.
5. Patobulinti modulių studijų dalykų studijų rezultatus (išsamiau apie tai skiltyje „Studijų rezultatai“).
6. Siekiant, kad personalas intensyviau vykdytų mokslinę veiklą ir geriau prisitaikytų prie sparčios technologijų ir mokslo pažangos, reikia visam personalui įsteigti mokslininko atostogas. Taip pat, atsižvelgiant į šią kaitą, reikėtų nuolat atnaujinti programą ir dėstymą.
7. Sukurti ir taikyti Technomatematikos studijų programai pritaikytus studijų kokybės klausimynus.

<…>

Paslaugos teikėjas patvirtina, jog yra susipažinęs su Lietuvos Respublikos baudžiamojo kodekso 235 straipsnio, numatančio atsakomybę už melagingą ar žinomai neteisingai atliktą vertimą, reikalavimais.

Vertėjos rekvizitai (vardas, pavardė, parašas)