



STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Vilniaus Gedimino technikos universiteto
***BIOMECHANIKOS PROGRAMOS (612H15002,
61209T102)***
VERTINIMO IŠVADOS

**EVALUATION REPORT
OF *BIOMECHANICS* (612H15002, 61209T102)
STUDY PROGRAMME**

At Vilnius Gediminas Technical University

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DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	<i>Biomechanika</i>
Valstybinis kodas	612H15002, 61209T102
Studijų sritis	technologijos mokslai
Studijų kryptis	bendroji inžinerija
Studijų programos rūšis	universitetinės studijos
Studijų pakopa	pirmoji pakopa
Studijų forma (trukmė metais)	dieninės studijos (4)
Studijų programos apimtis kreditais	240 ECTS
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	biomechanikos inžinerijos bakalauras
Studijų programos įregistravimo data	1997-05-19 Nr. 565

INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme	<i>Biomechanics</i>
State code	612H15002, 61209T102
Study area	Technological Sciences
Study field	General Engineering
Kind of the study programme	university studies
Cycle 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 Biomechanical Engineering
Date of registration of the study programme	19-05-1997 No. 565

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The Centre for Quality Assessment in Higher Education

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I. INTRODUCTION

Vilnius Gediminas Technical University (VGTU) offers a 4 year first level study programme on Biomechanics since 2002. It is organized by the Department of Biomechanics within the Faculty for Mechanics. A prior external evaluation in April 2008 motivated the organizers for drastic changes of the programme in order to meet European standards and national legal requirements. With this programme a specialized education is offered for professionals working in the growing field of engineering in health care and rehabilitation. A solid basis on theoretical knowledge, engineering applications as well as practical phases in industries is fixed in the curricular rules. Only a little freedom for individual specialization is provided.

This evaluation has been performed in subsequent staged:

1st Reviewing the supplied documents by two experts in the field of studies (Prof. Dr.-Ing. habil. Udo Nackenhorst, Prof. Dr. habil. Vincas Laurutis) and writing a draft evaluation report. These drafts have been analysed carefully and discussed by all members of the accreditation team before the audit at the university took place. This work started at end of April 2012.

2nd Interview with administrative staff, programme organizers, teaching staff, students, graduates and employers on March, 23rd at VGTU. The audit team enjoyed the very good preparation of this meeting as well as the open and informative atmosphere provided by VGTU. First conclusions have been reported to the stakeholders at the end of this day.

3rd Overall discussion on all evaluated study programmes on March 24th and writing the final report by the experts in the field of studies, which has been reviewed by all members of the audit team.

4th A summary report of the impressions of the audit team obtained for all study programs evaluated during their one week stay and their general recommendations. The reader is kindly referred on this annex too.

II. PROGRAMME ANALYSIS

1. Programme aims and learning outcomes

The aims of the programme are well described and made visible for applicants, students as well as employees on different web-sites.

An external evaluation of the program with regard to promised learning outcomes took place in 2008 and 2011. Continuous internal processes for the evaluation of studies quality as well as general strategies of the university to measures and improve academic education are not visible so far.

During the latest evaluation the programme has been revised in order to meet the latest rules of the Ministry for Education and Science. Additional improvements have been made to meet European requirements. Main goals of the Dublin descriptors are met.

The teaching program provides a solid basis of mathematical and natural science foundations and general engineering foundations.

Even so, the expected outcome of the learning programme is well described and categorized into four groups, i.e. knowledge, understanding, special skills, and general abilities. From the analysis of the study programme it is concluded that the goals described as Studijų kokybės vertinimo centras

Dublin descriptors are met. Nevertheless, the programme organizers should notice, that learning outcomes should be categorized into six classes after Blooms taxonomy.

The name of the programme appears too restricted, because its educational aims are much broader defined as simply biomechanics. This has also been underlined from the interviewed teachers, students, graduates and employees.

2. Curriculum design

The programme meets national requirements for undergraduate study programmes and the requirements for Technological studies.

15 ECTS points are mandatory for general educational disciplines, while 3 have to be chosen from Philosophy and technical history each, 3 are from specific language and 6 from foreign language. Each language classes a specifically designed for engineering profession. An open question arises with regard to the optional classes on English for Foreigners as most of the classes are taught in Lithuanian language.

The slight mismatch with regard to requirements for general education and the optional classes have been explained by the programme organisers that additional contents related to these subjects in integrated in other mandatory modules and has not been explicitly outlined. By this the legal requirements are met mainly. The examination board is built up according to the prescribed rules

The total volume of study area subjects is 187 ECTS.

36 ECTS point are mandatory in mathematics (21), physics and chemistry.

In total 44 ECTS points are given in the field of main academics subjects and 14 points in social science subjects. In the field of special education 29 points are offered and 8 weeks are foreseen for practical projects in collaborating in industries for which 12 ECTS points will be given. To meet the mandatory 15 ECTS for practical placement additional 3 ECTS are given for practice projects integrated into study modules. The final project is split into three parts distributed over the last two terms, for which 18 points will be booked. Optional subjects are offered in the fields of general education and specialization with a total amount of 24 ECTS points.

The study duration is 4 years which are equivalent to 6400 hours, from which 2500 hours are contact studies, divided into 55 percent lectures, 23 percent laboratory and 18 percent practical work.

The overall study scheme appears consistent; there are parallels to traditional mechanical engineering programmes. Doublings in the contents of classes are not obvious visible from the material applied. The study programme appears well structured and meets the European standards for the first university level.

It appears that a very strictly evaluation and continuous system for students learning progress combined with intensive guidance by the teaching staff has been installed. This is appreciated of course for the first part of studies in order to pick up young students at high school level. However, strong elements for support of self-motivated learning with the aim to form self-organized engineers and scientist are not observable at the first glance. The organizers should be motivated to install more self motivated learning elements, e.g. on basis of the promised project based learning concepts.

The name of the programme does not reflect the contents precisely. Biomechanics is a well defined discipline within the international scientific community. Here the mechanics of human motion, the mechanical behaviour of soft- and hard tissue as well as fluid flow in organism are studied, down to the length scale of the behaviour of cells or elementary constituents of bone, muscle, cells etc. These subjects are roughly observable in the

curriculum, i.e. with a percentage of zero cellular biology and less than 10 percent mechanics inside, the name of the programme appears not justified. For a better description of the programme one should discuss about programme titles like “Health care engineering” or something like this. This observation is shared by programme organizers, students, graduates and employees.

3. Teaching staff

21 percent of the classes are given by full or associate professors and about 59 percent are presented by university docents. More than three lecturers are active in research in the field of biomedical engineering. However, it is remarkable, that about 32 percent of the programme is covered by two docents from the Department for Biomechanics, especially for the programme specific classes. Most of the academic staff (more than 20 percent) is involved for more than three years.

The specific training programme is carried by 4 teachers mainly (compare final projects), i.e. Dr. Astraukas (69, automatic control and robotics, no mentionable scientific activity), Dr. Daunoraviciene (32, biomechanics and medical technologies, 5 publ. in national journal, several short term visits in Poland, Finland and Germany), Dr. Griskevicius (35, dynamics and biomechanics, several publ. in national media, visits in Poland, Italy, France, Ukraine) and Dr. Sesok (40, biomaterials and rehabilitation technologies, several publ. in national journals).

From the provided material it appears that most of the teaching staff is very engaged in university education. This has been boosted by the implementation of an EU funded project on academic education.

In comparison to international standards the scientific activity of the teaching staff for university level education appears not to match the top notch. Neither publications in world leading journals (like J. of Biomechanics) nor participations on related international conferences (e.g. World Congress on Biomechanics) are documented. In contrast one gets the impression that the actors appear as generalists in the broad field of medical engineering without a specific field of scientific specialization just for carrying the load of these specific studies and without any chance for scientific excellence.

In comparison to more western European countries university education systems the number of professors appears rather low. The status of a Docent has been explained to the peers to be comparable with associated professorships.

The relationship of 2 students per teacher, as outlined in the presented self report, promises an outstanding mentoring ratio even compared with US Ivy League Universities. However, these numbers appear wrong, because most of the teaching staff is involved in other study programmes too. However, this also underlines a weakness of the programme, namely the small number of students which could be attracted in the past years. If one concludes that four engaged university teachers are responsible for 30 students, the students to teacher ration is very good compared to more western European universities.

The programme is driven by obviously very engaged young professionals (unfortunately not full professors). Additional academic staff is working in this innovative field. Basic studies in engineering sciences have to be provided in additional study programmes.

A more detailed analysis shows that about 32 percent of the programme specific classes are carried by two upcoming academic professionals (25 percent Sesoc (40) and 7 percent Giskevicius (35)). There is a great risk of vulnerability for the programme if one of these peoples step out.

The demographic structure of the teaching staff should be discussed in detail, cp Tab. 2.6 on page 27 of the self-report. In total there are 8 professors, from which 6 are over the age of 60 (up to 75). The average age of the docents group is about 40 years.

Internships for the professional development of the teaching staff are required from each academic teacher at least once within a five year period. First moderate attempts on that issue are described in the provided material. However, so far it is not visible that identified high scientific potentials are provided with opportunities to participate to leading world conferences to grasp up the latest trends of research in order to reflect this back into study programs at all. The scientific expertise of the, e.g. documented by publications in international peer reviewed journals, staff is not visible at the international floor so far. Here it is referred to the overall opinion of the audit team provide in the annex again.

4. Facilities and learning resources

Quite small classes are attracted for this programme which for basic engineering study modules is collected with students from other programmes. Technical equipment for lecture halls, computer classrooms, libraries etc. are on a state of the art level.

The library is well equipped with related textbooks and a smaller amount of specific scientific journals. The opening times of the library and the online booking systems are adequate. Additional course specific material has been worked out from the academic in Lithuanian language.

Some practical training demonstrators, e.g. machine elements, gear boxes etc. appeared old fashioned to the peers such that one could get the impression that education is on a practical schools level. Study specific laboratory equipment is growing slowly, but recent acquirements in the biomechanics lab are suitable for state of the art university research and education.

5. Study process and students' performance assessment

The admission for the study programme is well described. Accepted will be applicants who are well prepared for engineering studies, evaluated from a score computed high school skills in mathematics, physics, Lithuanian and foreign languages. The admission is managed by a central institution in Lithuania.

Student's performance is measured continuously during exercises and exams. Since the structure of the study programme is borrowed from traditional mechanical engineering, well established rules on an international level are applied.

This first level university programme is designed to educate professionals for industrial practice. Practice work in industry is mandatory and final thesis topics are strongly connected to industrial problems. Thus the programme focuses rather on applied industrial research than on scientific research. This is a quite critical aspect from the peer's point of view in order to distinguish the scientific education performed in universities from that obtained in academies etc.

Students are encouraged to join mobility programs. ERASMUS contracts exist with several European universities. The audit team met several students, who successfully performed abroad studies.

A clear description of the students' performance assessment is provided with the so called study module cards. This first attempt for a detailed analysis of learning outcomes and the evaluation process of students performance has been very well appreciated by the peers. However, it remains questionable if this material can be understood by undergraduate students to.

The audit team had the opportunity to interview graduates from this programme and potential employers. Graduates from this programme are satisfied with their academic Studijų kokybės vertinimo centras

education and employers are satisfied with graduates. Thus, the programme has written a success story so far.

6. Programme management

The programme is managed by the director of the department of biomechanics, who appears as a highly motivated young scientist, but unfortunately holder of a university status “docent”. As outlined before, the teaching program is carried by two additional members of this department mainly. The status of the management team within the Faculty of Mechanics is not transparent to the audit team.

However, despite the fact that the attractiveness for this programme has decreased, as in all engineering study programme in Lithuania, the programme runs quite well and provides a solid education in engineering sciences.

A great progress to meet European standards has been made during the latest reform, which has been based of prior evaluations. The programme has been improved after the latest external evaluation with regard to optional branches in specialization. The audit team appreciates the efforts which have been made within the EU funded project on *study quality improvement, increasing internationalization and lifelong learning* activities.

Evaluation of students’ performance and students’ satisfaction are established for this programme. Students reported that their comments are reflected by the teachers. Also a quite good system for the feedback of employers and graduates appear installed. The final graduation committee for example is assembled with externals too.

In total the internal quality management appears well installed. However, till now it works on a national level. From this international evaluation the responsible organizers will get more hints for further continuous improvement of the study programme in order to guide it to an international level.

III. RECOMMENDATIONS

3.1. The audit team recognized a small plant of innovative engineering education at European standard university level, derived as a special branch from traditional mechanical engineering sciences. This innovative study programme is highly recommended, despite the fact that the attractiveness for these studies has been decreased during the last five years as in all branches in engineering sciences all over Lithuania. It is recommended emphatically to promote scientific study programmes in upcoming engineering disciplines, since this will provide a fundamental basis for the economical development of a small state like Lithuania. Well educated people are needed to develop local industry for international markets. Thus, we recommend to the government for decisions to provide more comfortable conditions for the education of talented young students.

Furthermore, one gets the impression that the goal of the programme is defined by needs/questions from national industry. University scientific work should be performed mainly independent from industrial interests. Politics in Lithuania should be motivated to spent more effort in this direction of scientific education (independent and global thinking people).

3.2. Vilnius Gediminas Technical University should be motivated for a clear statement on promoting this study programme. The structures of the university, faculties and departments have been well described within the self report, but it remains unclear to the audit team, how decisions are made. Furthermore, we got the impression, that the process for transition from the pre-Bologna system to the Bologna scheme has not been finished. This attaches the observation, that the number of full professors is rather low in comparison to more western European universities.

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Scientific staff should be given the chance to participate international conferences in order to grasp up the latest scientific trends. In addition, freedom of the academic staff should be enabled in order to specialize in a specific research field with international visibility.

3.3. The programme should be renamed because it is much broader than simply biomechanics. We suggest medical or health care engineering. Thus suggestion has also been supported by teachers, students and graduates from this programme during the audit sessions. An alternative is to integrate this study programme as a branch of specialization into traditional mechanical engineering programme.

3.4. The programme is very vulnerable with regard to the teaching staff involved. If one of the three engaged persons will step out, the programme will crash. The faculty should set clear signs that they avow themselves to this future oriented study programme, by supporting the group with PhD-students for example.

3.5. With regard to the teaching concept it is recommended, that the students should be guided for more self motivated studies during the second phase of the programme. The audit team got the impression, that they are guided by teachers on a very short leach even for the final project. In order to educate self contained and responsible thinking young academics the organizers should develop the curriculum in that direction.

In addition a broader space for free choices of modules in the specialization phase should be provided, which has also been requested by the students. In addition this simplifies the accounting of study modules performed at foreign universities and will motivate students much more for studies abroad.

3.6. Novel computer simulation techniques (computational mechanics) should be intensified in order to substitute experimental investigations (e.g. lab investigations). Furthermore it is recommended intensifying co-operations with medical faculties etc. in order to sharpen the specific contents of the study programme.

IV. SUMMARY

Vilnius Gediminas Technical University offers a modern 1st level university study programme on Biomechanics. The programme is compatible with European standards for Bachelor-level programmes (e.g. Dublin descriptors). The studies are organized by the Department of Biomechanics which is part of the Faculty of Mechanics. In the past the Faculty spent a lot effort into the modernization of their study programmes, here an EU funded project on study improvement and internationalization is emphasized. The organizers are very engaged to drive this programme to international visibility. Student exchange programs are installed and practiced. Organizers, students, graduates and employees are satisfied with this programme.

The study programme is strong related to local industrial need rather than it focuses on a scientific education teaching the latest scientific contests. Here a weak point of the programme in comparison with more western European universities gets visible. Despite the responsible teaching staff appears very engaged to drive this young programme to international standards, their scientific activity is not visible at the international scene. The teachings staffs appear as generalists in the field of biomedical education rather than as scientific experts.

Another aspect of weakness results from the fact, that the main programme specific teaching load is carried by three very engaged junior scientists. The teaching load of these three academics appears unacceptable high by which they are constrained in developing scientific work. Furthermore, the programme becomes very vulnerable, if one of them steps out, the programme will crash.

The faculties structure (8 Professors from which 6 are over the age of 60 and 21 Docents) appears not appropriate for a scientific based university level study programme. It is recommended to the university as well as to the faculty to develop a sustainable structure suitable for scientific based university education which is competitive on an international level.

The BSc study programme has made great improvements with regard to meet European standards since the last evaluation in 2008, the accreditation for the full period is suggested. The programme should be continuously developed further more considering the hints and recommendations given in this report.

V. GENERAL ASSESSMENT

The study programme *Biomechanics* (state code – 612H15002, 61209T102) of Vilnius Gediminas Technical University is given **positive** evaluation.

Study programme assessment in points by evaluation areas.

No.	Evaluation Area	Evaluation Area in Points*
1.	Programme aims and learning outcomes	3
2.	Curriculum design	4
3.	Teaching staff	3
4.	Facilities and learning resources	3
5.	Study process and students' performance assessment	3
6.	Programme management	4
	Total:	20

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

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

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

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

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