



STUDIJŲ KOKYBĖS VERTINIMO CENTRAS

Vilniaus Gedimino technikos universiteto
***BIOMECHANIKOS PROGRAMOS (621H15001,
62409T110)***
VERTINIMO IŠVADOS

**EVALUATION REPORT
OF *BIOMECHANICS* (621H15001, 62409T110)
STUDY PROGRAMME**

At Vilnius Gediminas Technical University

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Išvados parengtos anglų kalba
Report language - English

DUOMENYS APIE ĮVERTINTĄ PROGRAMĄ

Studijų programos pavadinimas	<i>Biomechanika</i>
Valstybinis kodas	621H15001, 62409T110
Studijų sritis	technologijos mokslai
Studijų kryptis	bendroji inžinerija
Studijų programos rūšis	universitetinės studijos
Studijų pakopa	antroji pakopa
Studijų forma (trukmė metais)	dieninės studijos (2)
Studijų programos apimtis kreditais	120 ECTS
Suteikiamas laipsnis ir (ar) profesinė kvalifikacija	biomechanikos inžinerijos magistras
Studijų programos įregistravimo data	1997-05-19 Nr. 565

INFORMATION ON EVALUATED STUDY PROGRAMME

Title of the study programme	<i>Biomechanics</i>
State code	621H15001, 62409T110
Study area	Technological Sciences
Study field	General Engineering
Kind of the study programme	university studies
Cycle of studies	second
Study mode (length in years)	full time (2)
Scope of the study programme in credits	120 ECTS
Degree and (or) professional qualifications awarded	Master of Biomechanical Engineering
Date of registration of the study programme	19-05-1997 Nr. 565

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I. INTRODUCTION

Vilnius Gediminas Technical University (VGTU) offers a second level university study programme on Biomechanics since 2002. The curriculum has been redesigned in 2011 after a first external evaluation took part in 2008. The Master-programme lasts 2 years and is equivalent to 120 ECTS credits.

This evaluation has been performed in subsequent stages:

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 read and discussed by all members of the accreditation team before the audit at the university took place. This work started at from 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. The 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 expert 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, especially with regard to the structure of the master programs has been written. The reader is kindly referred on this annex in addition.

II. PROGRAMME ANALYSIS

1. Programme aims and learning outcomes

A future oriented master programme for the growing demand on well educated experts in the field of engineering tasks in health care and rehabilitation treatment with clear vision for fast growing industrial markets in aging European societies has been developed.

The aims and learning outcomes of the programme have been well described in the self report of VGTU. This information has been made visible to applicants as well as stakeholders at web pages etc.

Students, graduates and employees agreed that the aims of the programme meet at least local requirements for this second level university programme. They also agreed to the recommendation on renaming the programme into *medical engineering*, or something like that, since this would describe the content and the skills much more precisely for both, employees and applicants.

The audit team concluded that the scientific content as well as the environmental conditions for the programme does not match with European standards defined for research based second level university educations so far. Research based master programmes at European universities (and worldwide) are driven by scientific excellence. In contrast, to the reviewers' impressions, the programme at hand focuses much more on local industrial relationships. It is strictly recommended to switch into the direction of scientific excellence.

2. Curriculum design

The study programme MSc in Biomechanics is divided into a core study area, other related subjects and the thesis. The core study area consists of study modules with a total of 62 ECTS credits, other related subjects count 19 credits minimum and there are 39 credits foreseen for the final thesis. The preparation of the thesis work starts already in the first semester with introduction work which is continued during the next two semesters 3 credits each. The last semester is reserved for thesis work. The size of the study modules is equivalent to 3 to 7 ECTS credits.

There is a little space (equivalent to 3 ECTS credits) reserved in the first semester for free choice in order to the students' specific needs. In the third semester there are optional choices provided for two study modules (two options each with in total 8 credits) for the students' specialization.

A specially designed module on fundamentals of scientific research and innovation underlines the aimed scientific character of this study programme.

The subjects of studies provide a broad academic education in the field of medical and rehabilitation engineering, including advanced classes for example in dynamics of biomechanical systems, treatment of medical waste, maintenance of medical apparatus etc. There is no repetition observable from the SM-card catalogue.

Based on the provided SM-cards the expert group concluded that this programme provides a broad and high level education in medical engineering equivalent to level VII of the European Qualification Framework.

The proposed learning outcome is obtained by the implementation of a staggered scheme of students' performance evaluation in each study module. Methods of project- and problem based learning have been implemented.

The expected learning outcomes have been described in detail on the basis of four categories, namely knowledge, understanding, special skills and general abilities. Especially for scientific oriented master programmes a classification with regard to Blooms taxonomy is established, which requires the classification of learning outcomes into six categories.

The programme design appears to be oriented on the national labour market rather than on the scientific developments in this field measured on an international level.

3. Teaching staff

From the plan of studies it appears obvious that the programme is taught by 2 Professors, 4 Docents and 2 Lecturers or assistants. It is remarkable that study modules with an amount for 44 credits, which is about 54 percent of the regular study programme, are taught by two people with an academic degree Docent, which has been explained to the audit team to be equivalent with an associate professor. In addition, one of these teachers is responsible for the thesis work, which is spread over the total time as mentioned before. From the list of thesis it is observable that 5 or 6 academic teachers are involved in the final thesis work, from which it is concluded that the scientific broadness of the programme is satisfied. The amount of professors contributing to this 2nd level university appears quite low; however, Docents are formally qualified to ensure the scientific quality. Lectures and assistants train general skills, which appears appropriate.

The teaching staff is very well prepared for the pedagogic work. They enjoyed special training within a programme funded by the EU. Besides the pedagogic skills results of these measures are the development of modern course material. But it remains questionable if for a European oriented 2nd level university education programme if the effort for the development of specific course material in Lithuanian language is goal oriented?

If 53 percent of the teaching loads in this master programme is carried by two academic teachers the scientific broadness, diversity and speciality remains questionable. In addition, the

risk of vulnerability of the programme is high if one of these engaged academics steps out. And furthermore, this extremely high teaching load hinders these young scientist from own original research, which is an additional obstacle for the development of this programme to reach international standards.

None of the participating scientists has been recognized as an expert at the international scene, documented by original publications in leading international journals (International Journal of Biomechanics for example). Thus the scientific depth of the programme remains questionable.

4. Facilities and learning resources

The equipment of classrooms, libraries, computer labs etc. appears adequate for the theoretical part of the study programme.

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).

First improvements for the equipment of experimental labs in the field of biomechanics are visible. For example innovative motion tracking systems are provided to the students for state of the art scientific research in the related fields. Nevertheless, in addition many demonstrators collected from equipment outsourced from clinical application have been shown to the peers (ultrasound imaging etc.). This of course is not the right way to educate professionals for future scientific research as aimed in this master programme.

Students explicitly claimed for the establishment of a subsequent PhD-programme.

5. Study process and students' performance assessment

The requirements to enter this programme appear rather low, e.g. no more than 10 credits in mathematics, 5 credits in mechanics etc. are required. The programme is named *Biomechanics*, but not preliminaries in biology are required? Students and graduates who stepped into this programme from different prior studies, i.e. industrial engineering, electronic engineering etc., argued that these conditions are not an obstacle to graduate just in scheduled time.

The programme itself appears to be well organized and structured with regard to the learning outcomes. The main goal on scientific work is already founded in the first semester and also the work of the thesis starts from the beginning of the studies. Options for individual specialization and students own scientific development is not obvious at the first glance. Students and graduates mentioned to be satisfied on this issue.

The students are integrated into the local scientific community, for example the presentation of the final thesis at a special young scientist's conference is mandatory. In addition they participate in ongoing research projects.

Opportunities for students' abroad studies (for example in the framework of ERASMUS-program) are provided and well documented. In addition, a couple of the participating teachers have established contacts to foreign universities in order to assist students in there planning. Not clear is how students could integrate the academic skills earned abroad into their local study programme (e.g. based on ECTS credit points in agreement with Lisbon Agenda).

As this study programme is frequented by a few students only so far, the academic mentoring appears excellent. However, since most of the interviewed students enrolled in this MSc programme stated to be employed full time or at least part time to cover their living costs, clear doubts arise to the audit expert team if this programme could meet the Bologna criteria for 2nd level university education. The offered 30 ECTS credits per semester reflect a workload of 900 hours. If one assumes that this is the real workload required for this programme, students

have to perform an 80 h working week at least, to be performed over a period of two years. This might be one explanation for the rather low number of students. In contrast, one could imagine that study specific work is performed in collaboration with employees, which is in clear contradiction with the scientific demand claimed by an MSc programme.

Graduates as well as employees interviewed during the audit session declared that the study programme meets the local market requirements. Graduates suggested including additional professional management skills. They also agreed that more strong scientific competences would help to trade out new innovative industries.

6. Programme management

The MSc programme on biomechanics is managed by the head of the Department of Biomechanics, who appears as very engaged and talented young academics. His academic position is entitled as Docent (*associate professor*). This young professional attracted a few highly motivated junior researchers to promote and fill out this study programme. The audit experts appreciate this engagement of the young management team, which battles to drive this quite infant but future oriented study programme to international standards. In total, the internal management appears quite professional.

The integration of the programme into the university's strategy remains imprecise. No stretchable statements for the specific promotion of this innovative master programme have been stated by the authorities so far, which to the audit teams opinion has quite good pre-conditions for international visibility within the Bologna process.

III. RECOMMENDATIONS

3.1. Similar to the suggestions made for the related prior bachelor programme this master programme should be renamed, for example into *medical engineering*, because the contents is much broader than *biomechanics*, which is only a special field of research within it. This opinion of the expert team has been underlined by the response of the organizing team, contributing teachers, students and graduates as well as prospective employers during their interview sessions.

3.2. During the audit meeting at VGTU the referees obtained the impression, that this master programme is driven as a part time programme. Most of the enrolled students are employed in fulltime or part-time positions, while the classes will be held in evening lessons. This is in clear contradiction to the Bologna requirements as outlined above. It is recommended either to switch the traditional system into the direction of a fulltime programme taught at daytimes or to a part time programme, e.g. a 90 ECTS master programme spread over two or two and a half year. Even a workload of 90 credits appears extremely demanding in two years besides fulltime employment of the students. In this case even more distance learning material should be provided.

3.3. In order to approach European standards, teaching language should be switched to English. By that the programme would also be more attractive for students from abroad.

3.4. Since the scientific demand of the programme does not meet the Dublin descriptors so far, changes in the overall systems structure are recommended. This requires decisions at the levels of the faculty, university as well as the government, as explained below.

During their visit in Lithuania the audit team observed especially in this programme a great potential to establish a centre of excellence on medical engineering sciences. This programme is driven by highly engaged young scientists who also archived outstanding records for the

establishment of international standards in university education. We strictly recommend the support of this engaged group for developing scientific excellence too.

This requires decisions for concentrating human and material resources to support this promising young branch within the faculty and university. An adequate environment for the engaged young researchers driving this programme has to be provided, which enables them to go out for international conferences grasping up the latest trend of scientific research and doing own scientific work. The teaching load of these leading scientists has to be reduced at least to an average level of established professors at VGTU. The permission for PhD education has to be claimed back, which of course is in the responsibility of all members of the faculty with emphasis to match the legal requirements.

The university as well as the government should be motivated to identify this study programme as an example for strategic development to promote a Lithuanian centre of scientific excellence.

3.5. It is on hand that excellent (top-down) scientific education appears impossible without related PhD-programmes. It is recommended to install a specific PhD-programme with relationship to this specific field of research.

IV. SUMMARY

A 2nd level university study programme with high potential for research in a future oriented field has been analyzed.

The audit team realized that the programme is driven by a small group of highly motivated young professionals. Recent progress has been made for establishing small parts of state of the art laboratory equipment. The study programme on a first glance appears consistent and formally in agreement with Bologna and local legal rules.

The name of the programme does not precisely describe the contents, it is recommended to change the name in order to attract the students by the real contents of the studies and also provide potential employers and collaborators from industry with a recognizable brand.

The content of the master programme does not fully meet the requirements for a research oriented university second level programme so far. The content is driven rather more from local industrial demand than from international scientific trends.

As most of the students are employed for fulltime jobs in industry and the study programme is performed in evening classes, the programme appears not to conform with the Bologna rules. It appears unbelievable to the expert team that even highly motivated students can carry a workload of 80 to 90 hours per week continuously over a period of two years.

The weakest point is the equipment of the programme with human resources. The engaged team is overloaded with teaching and management duties, there remains only a very little time for research. But, international visible research activities of the teachers are the driving force for a scientific based master programme.

So far, the research activities of the participating scientists are not on an internationally visible level. As European university master programmes are research oriented, mentionable effort should be spent on this important aspect. Scientific research is driven by scientific excellence; it is a top-down process. Scientific teachers have to be recognized as experts in the international scene. This requires that they will go out for in participating leading international conferences for grasping up the latest developments and trends for identifying their own field of specific expertise. This expertise will lead in the establishment of scientific work groups, where a professor guides talented students for PhD-research. Once a critical scientific mass is obtained, related master programmes will run naturally on an international scientific level. Furthermore, scientific experts will attract experts from all over the world which, from whom impact of knowledge will increase, and simultaneously, talented students from abroad will be attracted.

Drastic changes in the overall structure are recommended in order to drive this *little green plant* to an international visible centre of excellence within Lithuania. With the highly motivated promoters of this programme a quite good basis is provided. However, decisions are needed to promote this branch with human resources, freedom to the leading scientists for their own scientific development to international recognized quality and academic independency within the quite old fashioned university system.

The programme at all is very vulnerable since the teaching load is carried by only a few people. This, in addition, is an obstacle for sound scientific activities which are needed to drive a 2nd level university master programme. The implementation of PhD-programmes is highly recommended in order to supplement the scientific weight of the master programme.

Since the audit team recognized similar deficiencies in all master programmes evaluated during their one week work at different universities all over Lithuania, especially this programme appears to be future oriented, on a good way to meet international standards and therefore, valuable to promote it. The needed measures described above require of course long lasting processes. Nevertheless, the experts concluded to suggest a limited accreditation for three years only in order to observe, if necessary decisions have been made and the process for change has been initiated.

As measures for a successful reaccreditation after three years for this scientific based master programme the following items are recommended:

- Structural changes in the university system should be made visible. The authority and autonomy of the responsible people has to be made visible.
- A related PhD-programme should be installed.
- The scientific activity should be made visible for the international scene. Increasing activity for publications in leading international journals and active participation on related international conferences should be documented.

V. GENERAL ASSESSMENT

The study programme *Biomechanics* (state code – 621H15001, 62409T110) 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	2
3.	Teaching staff	2
4.	Facilities and learning resources	3
5.	Study process and students' performance assessment	3
6.	Programme management	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.

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