CENTER FOR QUALITY ASSESSMENT IN HIGHER EDUCATION

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STUDY FIELD OVERVIEW REPORT

PHYSICS

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Prepared by the chairperson of the expert panel:

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Report language – English

I. INTRODUCTION

This report is based on the external quality evaluation of the *Physics* study field in Lithuanian Higher Education Institutions: *Kaunas University of Technology* and *Vilnius University,* organised by the Lithuanian Centre for Quality Assessment in Higher Education (SKVC). Comprehensive external evaluation reports including strengths and weaknesses and concluding with some recommendations were prepared for Physics study field in each evaluated Higher Education Institution (separately for first and second cycle) and included evaluation marks. This overview focuses on the main findings of the external evaluation of the Physics study field from a general point of view. Based on these findings, the panel gave **a positive** evaluation to: *Kaunas University of Technology* and *Vilnius University.*

II. STUDY FIELD OVERVIEW BY EVALUATION AREAS

These observations regard the most positive aspects of the study field Physics at *Kaunas University of Technology* and *Vilnius University,* as well as identifying areas requiring consideration and probable investment. Except where explicitly stated otherwise, comments apply to both institutions.

II.1 Background

Physics is one of the core subjects in any portfolio of study fields in a major university, serving not only the need to maintain physics capability in schools and universities but also serving a much wider community, for example, in physics-based technologies and industries, and providing specialized knowledge in many other academic and industrial disciplines from Physical and Life Sciences to Medicine. Physics based industries (PBI) form a significant part of a modern economy[1], accounting for 5-10% of employment and a significantly higher percentage of contribution to GDP (Gross Domestic Product) and GVA (Gross Value Added). Physicists are also in demand in other commercial fields, from finance to information technology.

Given this broad range of potential destinations for physics graduates, the degree program must offer a broadly-based curriculum that provides graduates with the basic knowledge that "all physicists should know" as well as preparing them for the local jobs market, taking account of Lithuania's strengths, for example, in optics. It should prepare students at Bachelors and Masters level for careers in PBI with a solid foundation in physics combined with practical experience and transferable skills, as well as providing internationally competitive graduates at all three levels – Bachelors, Masters and Ph.D. An essential feature of a modern physics degree at first and second cycle level is the early involvement with current research, allowing the student to experience the thrill of research while acquiring through coursework the necessary background knowledge required to become a professional physicist.

[1] [see for example "The role of physics in supporting economic growth and national productivity", Institute of Physics (2017), and "Influence of physics-based sectors on the economy", IM Magomedov, HA Murzaev, and AM Bagov, International Conference on Economic and Social Trends for Sustainability of Modern Society (2020)]

Both universities offer degrees in applied physics or combined with other subjects, but only Vilnius University offers degrees in Physics, and Kaunas University of Technology Physics Department also offers a second-cycle degree in Medical Physics that is reviewed separately.

In summary, both Kaunas University of Technology and Vilnius University offer first and second cycle degrees in the physics field of study to international standards, with no significant weaknesses.

II.2 <u>Comments</u>

The curricula are both comprehensive and clear, and in the applied field well-matched to the local economic requirements. There is a good balance between providing a general education in physics, together with a focus, especially in the applied courses, on the needs of the local economy. There is a strong connection between the teaching and research programs, and students have good access to leading-edge equipment and advanced computing resources for their laboratory work, and appropriate library resources, including electronic and physical books and journals. The graduates produce high-quality theses at both first and second cycle level. There is appropriate engagement with local stakeholders (social partners), some of whom participate in the teaching programs and provide internships, projects and sometimes equipment. As a result, most of the graduates at first level who do not proceed to the second cycle find employment, and almost all second cycle graduates find employment. Some alumni maintain a close relationship with their university.

Student recruitment is well organized and well publicized, with clear criteria conscientiously applied. After the first semester, there is a low dropout rate. The universities provide central support services for students but in general the class sizes are small and there is good contact between students and teachers. Mentoring is available at various levels (university, department, group and peers) and, although not heavily used, is appreciated by the students. There are systems in place to identify early when intervention is needed.

The teaching staff are enthusiastic and demonstrate strong commitment to providing a first-class education. There is frequent formal and informal interaction with the students about the courses, and monitoring and feedback after each course and semester. The students are equally enthusiastic and generally satisfied, and participation rates in the surveys and feedback are high. As a result, the quality assurance systems are robust.

While the quality of the courses on offer is high, only two universities offer physics degrees, and of those only one offers a pure physics degree. The number of graduates produced each year is around 140 (B.Sc), and probably falling. This is a cause for concern since the number of physics graduates is probably slightly lower than desirable for a stable economy. A related issue is the number of graduates who go into teaching in schools; at least 40 new physics teachers are required each year, and probably twice this number would be better, in order to ensure that all High School students have access to professionally qualified physics teaching.

The second observation is that the number of non-Lithuanian Faculty and students is small. There is good evidence that having a higher proportion of "international" researchers improves research competitiveness and ranking. The difficulty with having only two universities producing physics degrees is that there is not much “genetic diversity“; in general, academic mobility is beneficial for both individuals and institutions.

III. RECOMMENDATIONS

MAIN STRATEGIC RECOMMENDATIONS FOR THE IMPROVEMENT IN PHYSICS STUDY FIELD

- **Strategic recommendations at institutional level:**

1. **Engagement with Schools**
   It would be beneficial for the Universities to enhance their engagement with High School students, particularly in their early years, to introduce them to modern physics ideas and challenges and thus stimulate their interest in the subject, and to provide further support to physics teachers to allow them to maintain their expertise.
2. **Encouragement of teacher training**
   Physics in High Schools should be taught by people with a good physics degree, and there should be an emphasis on the option of a career in teaching as well as in industry.
3. **International students, researchers and faculty**
   It would be generally beneficial to increase the number of non-Lithuanian students, researchers and faculty, although this requires careful planning and implementation to achieve the correct balance between national and international standards, for example, in the language of tuition.

- **Strategic recommendations at national level:**

1. **Encouragement of teacher training**
   Consideration should be given to creating incentives for suitably qualified physics graduates to enter the teaching profession.
2. **Combined B.Sc. And M.Sc. course**
   The present structure means that it takes at least 6 years of study to reach Master’s level. However, most Master’s students have already taken their Bachelor’s degree at the same university. In many countries, it is possible to do combined Bachelor’s and Master’s degrees in a shorter period (say, five years). Consideration should be given to amending the governance of degrees to allow universities to consider this option. The two-year Master’s course would still be appropriate for those transferring between universities, returning to university, or from other countries.
3. **International students, researchers and faculty**
   Given the correlation between international university ranking and the level of internationalization of its staff and students, it would be worthwhile considering whether there are any initiatives at national level that could encourage internationalization.