

## Decision Regarding the Assessment of the Physical Sciences Study Programme Group Tallinn University of Technology

15/09/2016

The Quality Assessment Council for Higher Education of the Estonian Quality Agency for Higher Education and VET decided to approve the report by the Assessment Committee and to conduct the next quality assessment of the Physical Sciences study programme group in the first and second cycles of higher education at Tallinn University of Technology in seven years, with a secondary condition

On the basis of the following references: subsections 12<sup>2</sup> (1) and 10 (4) of the Universities Act, point 3.7.3 of the Statutes of the Estonian Quality Agency for Higher Education and VET (hereinafter referred to as 'EKKA'), points 41.1 and 42 of the document, 'Quality Assessment of Study Programme Groups in the First and Second Cycles of Higher Education', authorised in point 3.7.1 of the above-mentioned EKKA Statutes, and clauses 53 (1) 2) and 53 (2) 2) and 3) of the Administrative Procedure Act; the Quality Assessment Council for Higher Education of EKKA (hereinafter referred to as 'the Council') affirms the following:

1. On 28.05.2015 Tallinn University of Technology and EKKA agreed upon a time frame to conduct the quality assessment of the study programme group.
2. The Director of EKKA, by her order on 15.02.2016, approved the following membership of the quality assessment committee for the Physical Sciences study programme group in the first and second cycles of higher education at the University of Tartu and Tallinn University of Technology (hereinafter referred to as 'the Committee'):

<b>Bob Munn (Chair)</b>	Consultant, Finchwood Academic, UK
<b>Dimitris Ballas</b>	Senior Lecturer, University of Sheffield, UK
<b>Lars Erik Holmer</b>	Professor, Uppsala University, Sweden
<b>Juha Karhu</b>	Professor, University of Helsinki, Finland
<b>Dionis Martsinkevichus</b>	Student, Vilnius Gediminas Technical University, Lithuania
<b>Mamoun Muhammed</b>	Senior Research Director, Royal Institute of Technology, Sweden

<b>Risto Nieminen</b>	Professor, Aalto University, Finland
<b>Barbara A. Sawrey</b>	Professor, University of California San Diego, USA

3. Tallinn University of Technology submitted the following programmes for evaluation under this study programme group:
  - Earth Science and Geotechnology (BSc)**
  - Earth Science and Geotechnology (MSc)**
  - Engineering Physics (BSc)**
  - Engineering Physics (MSc)**
  - Applied Chemistry and Biotechnology (BSc)**
  - Applied Chemistry and Biotechnology (MSc)**
4. Tallinn University of Technology submitted a self-evaluation report to the EKKA Bureau on 2.02.2016 and the assessment coordinator forwarded it to the Committee on 17.02.2016.
5. An assessment visit was made to Tallinn University of Technology during 5–6.05.2016.
6. The Committee sent its draft assessment report to the EKKA Bureau on 14.06.2016, EKKA forwarded it to Tallinn University of Technology for its comments on 14.06.2016, and the University delivered its response on 29.06.2016.
7. The Committee submitted its final assessment report to the EKKA Bureau on 1.07.2016. That assessment report is an integral part of the decision, and is available on the EKKA website.
8. The Secretary of the Council forwarded the Committee's final assessment report along with the University's self-evaluation report to the Council members on 30.08.2016.
9. The Council with 7 members present discussed these received documents in its session on 15.09.2016 and, based on the assessment report, decided to point out the following strengths, areas for improvement, and recommendations regarding the Physical Sciences study programme group in the first and second cycles of higher education at Tallinn University of Technology.

### Assessment at the Level of the Study Programme Group

#### Strengths

- Tallinn University of Technology (TUT) is engaged in compiling teaching materials in Estonian as well as translating textbooks into Estonian.
- The student-to-staff ratio is favourable and teaching staff are readily available to students.
- All study programmes are associated with significant research activities and students are involved in research from the very first year of their BSc studies.
- Teaching and learning are carried out in excellent facilities.
- MEKTORY contributes to the development of entrepreneurial thinking by both students and teaching staff.

#### Areas for improvement and recommendations

- The assessment committee recommends that all MSc programmes be taught entirely in English. Both students and employers support this idea. The University has the capability and prerequisites to provide high-quality education, and this would also help to increase the number of students. English is the *de facto* language of science, and students need to become fluent in

scientific English. MSc programmes in English would also facilitate inward and outward mobility of both staff and students.

- More active cooperation with the University of Tartu is needed, to share resources and to develop and conduct study programmes, offering specialisation and elective courses to each other's students, among other things. Opportunities should be created to seek funding for joint research projects.
- Teaching should be more student-centred. Study programmes reflect the narrow research interests of the chairs and laboratories, and therefore they are not well balanced. The programmes should give students a substantive introduction to their chosen discipline from the very beginning of their studies.
- The University has taken a positive direction towards offering broader BSc programmes, but it is vital to ensure integration of the new programmes rather than just presenting an array of individual programmes. Programme managers should have greater powers to so integrate the programmes.
- Not all staff members have acted to improve their pedagogical skills. The assessment committee recommends that all staff be required to take courses in pedagogy.
- Programme managers should be provided with trainings in programme design to avoid a situation, for example, where teaching staff discuss the intended learning outcomes only after having agreed on the courses to be taught.
- Staff mobility within and outside of Estonia should be increased and sabbatical leave opportunities should be used to a greater extent.
- Students should be systematically informed about actions taken based on their feedback. The study programme as a whole also needs more systematic feedback.
- Contacts with alumni and employers are weak. Both should be surveyed on a regular basis to determine suitability of the programmes for actual jobs (especially outside of universities) and both allowed to contribute to the process of study programme development.
- The structure of BSc programmes takes into account the progression from BSc to MSc to PhD, and then on to an academic position — and does not adequately consider the possibility of moving into employment after graduating from the BSc programme or changing the speciality in master degree studies.
- Teaching is funded to a great extent (up to 80%) by research funds which might not be sustainable.
- MEKTORY opportunities should be more effectively introduced to the students of this study programme group.
- The University's Career Centre should be more proactive in accommodating the interests of students who seek employment outside of universities, with both small and large companies.
- More teaching staff should be recruited from foreign countries as well as from industry.
- The existing councils of the institutes, which also perform the role of programme councils, are too narrowly based. These councils should include more employer representatives and at least two students.
- Inward and outward mobility of students is low. The institutes should put more effort into providing mobility opportunities and encouraging students to participate in mobility schemes.

## Assessment at the Study Programme Level

### EARTH SCIENCE AND GEOTECHNOLOGY (BSc, MSc)

#### Strengths

- These are new study programmes, combining Oceanography, Meteorology, Geology and Geotechnology. A strength of these programmes is their applicability.
- Contacts and cooperation relationships with employers are good; employers are pleased with graduates.
- Laboratories and field work opportunities are very good; access to the largest geological collection in Estonia is also available.
- Teaching staff are internationally recognised, are productive in research and engaged in a number of international projects. Staff are readily available to students; they motivate and give personal guidance to students, especially in the MSc studies.

#### Areas for improvement and recommendations

- The number of BSc students is small and their dropout rate high. More attention should be given to the selection of students and to their counselling.
- The study programme forces students to specialise in the beginning of their BSc studies and does not support potential changes in chosen specialisations later in their studies. The BSc programme should be broadened and specialisation should take place in the MSc studies.
- The proportion of applied geology in the programme should be increased.
- The study programme includes only one course on environmental protection and sustainable development, but this should be included as a standard element in more courses.
- Management of these study programmes is not clear. Having separate programme managers for the BSc and MSc programmes would make administration clearer and more effective.
- Establishing joint programmes with other universities should be considered.
- The amount of information in English should be increased in geological databases.
- Staff excellence in teaching is not systematically recognised. Neither is teaching performance taken into account when promoting staff.
- The excessive teaching loads of some staff members need to be addressed.

### **ENGINEERING PHYSICS (BSc, MSc)**

#### Strengths

- Graduates enjoy good career opportunities in several fields of science, technology and industry as well as in the public sector.

#### Areas for improvement and recommendations

- The mission of the study programme is unclear. It seems that the objective is to offer a broad-based education in applied mathematics and physics relevant to engineering and to differentiate itself from the more theoretical programmes in physics at the University of Tartu. Its need for differentiation hinders collaboration with the University of Tartu which, in the opinion of the assessment committee, is urgently needed to meet the national demand for graduates, to facilitate student mobility and to reciprocally offer courses to each other's students.
- TUT Institute of Physics is very small and most of the teaching staff work mainly at other TUT units, thereby diluting the focus of this programme.
- The total number of students and admission numbers are small, but the dropout rates are very high. Teaching staff point to poor preparation in upper secondary schools and a lack of motivation by students as reasons for dropouts, but they fail to recognise that the content and teaching methods of the study programme are not sufficiently student-centred. The current introductory laboratory exercises are obsolete and need to be replaced by experiments that are more challenging using modern equipment.

- The study programme should include more technology-related topics such as magnetism, spintronics, acoustics and modern optics. Both the employers and students are of the opinion that the study programme currently contains too few informatics courses and that computer programming should be introduced into the programme.
- The title of the study programme should be changed to better suit the content of the programme, for example, a title like 'engineering science' or 'applied physics' would be a better match.
- The planned new BSc programme should be broad based and include modern mathematical, physical and computational subjects.
- Laboratory equipment needs to be modernised. New student laboratory exercises and experiments using new instruments should be developed.
- Teaching and learning methodology has not much been discussed by the teaching staff. Methods like active e-learning, group work and problem-based learning are used very little.
- Students with learning difficulties should be systematically dealt with.
- The study programme should be better advertised to students of upper secondary schools, who appear not to be aware of it.

### **APPLIED CHEMISTRY AND BIOTECHNOLOGY (BSc, MSc)**

#### Strengths

- The physical facilities are good for delivering these study programmes, the analytical instrumentation is particularly sound. Both BSc and MSc students can work in the research laboratories.
- A number of students have won awards in the national student research competitions.
- Teaching staff are committed and there are enthusiastic and talented young people among them.

#### Areas for improvement and recommendations

- Although a number of BSc students move directly into employment after graduation, the teaching staff still seem to look at the BSc and MSc programmes as a single unit. Such attitude does not take into account the interests of all students. The study programmes should be redesigned so that the BSc programme could as well lead to employment or to other MSc programmes, and that students from outside of TUT could enrol in this MSc programme.
  - Although TUT has a Career Centre, students must seek internship placements for themselves. The Institute should collaborate more closely with the Career Centre to develop a more systematic approach to internships. Students need more internships outside of the University.
  - The Institute does not gather regular feedback from either the students or employers, therefore their contributions to the process of study programme development are insufficient.
  - The programme council should be formed for the 2016/17 academic year rather than waiting for the structural reform in 2017/18.
  - In some laboratories international safety standards are not observed. This applies to the labelling of hazardous chemicals and wearing protective eye glasses and clothing.
  - The Institute should conduct surveys among dropouts to identify their reasons for dropping out and then take measures to reduce the dropout rates.
- 10.** Point 41 of the document, 'Quality Assessment of Study Programme Groups in the First and Second Cycles of Higher Education', establishes that the Quality Assessment Council shall approve an assessment report within three months after receipt of the report. The Council shall weigh the strengths, areas for improvement, and recommendations pointed out in the

assessment report, and then shall decide whether to conduct the next quality assessment of that study programme group in seven, five or three years.

**11.** The Council weighed the strengths, areas for improvement, and recommendations referred to in point 9 of this document and found that the study programmes, the teaching conducted under these programmes, and development activities regarding teaching and learning conform to the requirements if the University eliminates the following shortcomings:

- Subsection 4 (2) of the Government of the Republic Regulation, 'Standard of Higher Education', prescribes that *when specialising in a main field of study, a student acquires the knowledge, skills and attitudes necessary for the relevant study cycle which is a precondition for commencing work in a field or fields of study described in the study programme or continuing studies in the next cycle of higher education*. At present the BSc programmes within this study programme group do not adequately consider the possibility of moving into employment after graduating from the BSc programme or changing the speciality in master degree studies, but only consider the progression from BSc to MSc to PhD and to an academic position within the same speciality.
- The structure and content of the programmes in Engineering Physics do not currently enable students to achieve the learning outcomes which would be sufficiently equivalent and comparable to the learning outcomes of the relevant cycle of higher education described in Annex 1 to the Regulation (according to which students must learn, inter alia, *to know the theoretical schools, development trends, current problems and potential applications of their fields of study and to be able to select and use appropriate technologies and methods when solving problems in their fields of study*). The study programme should include more technology-related topics such as magnetism, spintronics, acoustics and modern optics. Also, the study programmes currently contain too few informatics courses, and computer programming should be introduced into the programme as well.
- The teaching methods employed to deliver the Engineering Physics programmes are not sufficiently student-centred and therefore they do not contribute to attaining the objectives of a study programme as described in subsection 6 (5) of the Government of the Republic Regulation, 'Standard of Higher Education'.
- The title of the Engineering Physics programme should be changed to better reflect its structure, as defined in subsection 6 (5) of the 'Standard of Higher Education', for example, a title 'engineering science' or 'applied physics' would better suit the programme.
- The introductory laboratory exercises in the Engineering Physics programmes are obsolete and need to be replaced by more challenging experiments using modern equipment. This is not in accordance with the requirements provided for in clause 6 (7) 4) of the 'Standard of Higher Education' which states that *the conduct of studies conforms to the requirements if the facilities (auditoriums, laboratories, seminar rooms and a library) needed for teaching and learning, as well as for research and development related to doctoral studies, are available, and whose furnishings and equipment are sufficient and up to date for achieving the objectives of the study programmes*.
- According to clause 6 (7) 4) of the 'Standard of Higher Education', *the physical condition of premises must meet health and safety requirements established in legal instruments*. In some laboratories of the programmes in Applied Chemistry and Biotechnology, international safety standards are not observed, with regard to the labelling of hazardous chemicals and wearing protective eye glasses and clothing.

**12.** According to clause 53 (1) 2) of the Administrative Procedure Act, *a secondary condition of an administrative act is an additional duty related to the principal regulation of the administrative act* and, according to clause 53 (1) 3), it is also *a supplementary condition for the creation of a right arising from the principal regulation of the administrative act*. Clauses 53 (2) 2) and 3) establish that *a secondary condition may be imposed on an administrative act if the administrative act cannot be*

*issued without the secondary condition, or if issue of the administrative act must be resolved on the basis of an administrative right of discretion.* The Council found that, without a secondary condition, the next quality assessment of the study programme group should be conducted in less than seven years, and therefore, on the basis of points 41.1 and 42 of the document, 'Quality Assessment of Study Programme Groups in the First and Second Cycles of Higher Education', the Council

## **DECIDED**

**to approve the assessment report and to conduct the next quality assessment of the Physical Sciences study programme group in the first and second cycles of higher education at Tallinn University of Technology in seven years with the following secondary condition:**

No later than 15.09.2017, Tallinn University of Technology shall submit an action plan and a progress report to the Council on eliminating the shortcomings referred to in point 11 of this document.

The decision was adopted by 7 votes in favour. Against 0.

- 13.** In case Tallinn University of Technology does not comply with the secondary condition by the due date, the Council will repeal this assessment decision and set a new date for a quality assessment of the study programme group, or establish a new secondary condition.
- 14.** The Council proposes that Tallinn University of Technology will submit an action plan to EKKA with regard to the areas for improvement and recommendations pointed out in the report no later than 15.09.2017.
- 15.** A person who finds that his or her rights are violated or his or her freedoms are restricted by this decision may file a challenge with the EKKA Quality Assessment Council within 30 days after the person filing the challenge became or should have become aware of the contested finding. A judicial challenge to the decision may be submitted within 30 days after its delivery, filing an action with the Tallinn courthouse of the Tallinn Administrative Court pursuant to the procedure provided for in the Code of Administrative Court Procedure.

**Tõnu Meidla**  
Chair of the Council

**Hillar Bauman**  
Secretary of the Council