

Assessment report  
Limited Framework Programme Assessment

**Bachelor Electrical Engineering**

Delft University of Technology

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## 1. Executive summary

In this executive summary, the assessment panel presents the main findings and considerations underlying the assessment of the quality of the Bachelor Electrical Engineering programme of Delft University of Technology. The programme was assessed according to the four standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands.

The organisation of the programme is effective, enabling programme management to appropriately monitor and assure the quality of the programme.

Programme management responded adequately to the recommendation of the assessment panel, made during the previous assessment process in 2016.

The programme's objectives specify the requirements of bachelor programmes in the electrical engineering domain. This Bachelor programme is predominantly the stepping stone for subsequent master programmes in this or related domains, and not for directly entering the labour market.

The Domain-specific Frame of Reference is valuable. The electrical engineering domain is well described. International standards and benchmarks have appropriately been taken into account, which allows this programme to be aligned with international trends in this domain.

The programme's intended learning outcomes are well-aligned with the objectives. They meet the Domain-specific Frame of Reference requirements. The monitoring and updating of the intended learning outcomes and the curriculum are done adequately. The intended learning outcomes largely correspond to the requirements for the bachelor level, as specified by the Meijers criteria for this level. Some of the intended learning outcomes of this programme have, however, been phrased at levels, to some degree surpassing the bachelor level. The panel advises to rephrase these intended learning outcomes and to adjust them to the bachelor level.

The English programme name is appropriate for this domain. The formal language of instruction is Dutch. Lectures and assessments are in English, as literature and study materials are in English.

The gradually rising number of incoming students in the programme is positive, as the demand for electrical engineers will continue to increase over the years. The panel recommends to attract more students by advertising the programme more intensively at Dutch high schools. The panel advises also to take steps to raise the number of female students.

The entry requirements and admission procedures are valid for this programme.

The curriculum has been logically and coherently structured and is well-aligned with the intended learning outcomes of the programme. The courses are well-organised. The study load for mathematics and physics is appropriate and will remain so in the new Bachelor programme. The

panel advises to reconsider offering quantum physics and VHDL programming, as these subjects may be too demanding in the first year. The panel also advises programme management to improve courses more promptly in response to students' criticisms.

Teachers are researchers in this domain and connect teaching to their research. The panel endorses the steps programme management is taking to raise the number of female staff. Nevertheless, the panel advises to pay generally more attention to the on-boarding programme for new teachers. The educational capabilities of the teachers are up to standard, as 56 % of them are BKO-certified and another 21 % of them will obtain the certificate in the coming years. Teachers are accessible for students.

The educational concept and study methods of the programme are adequate to convey knowledge and skills in the programme domain. The mix of theoretical and application courses is well-considered. The panel, nevertheless, recommends to assure courses to be not too complex and to ascertain all students meeting knowledge and skills prerequisites when starting courses.

Academic counsellors, teacher mentors and student mentors assure adequate guidance of students in the programme. The panel welcomes measures in the new Bachelor programme to strengthen the bonding of students. The panel advises to improve the internal alignment and communication between staff members in view of staff-student interaction. As the BSA rates, student success rates and drop-out rates are less favourable, the panel recommends to take steps to improve these figures.

The panel is very positive about the study and lab facilities provided for students.

The measures taken by programme management to organise education and examinations during the Covid pandemic are sound. The Board of Examiners ensured the intended learning outcomes of the programme to be achieved in the Covid period. Programme management made appropriate efforts to mitigate the effects of the pandemic on students.

The examination and assessment procedures in the programme are aligned with university and faculty rules and regulations. The position and responsibilities of the Board of Examiners are clear and well-founded. Through the programme assessment plan, course examinations and assessments are well-aligned with the course goals and with the programme intended learning outcomes. The measures to assure the quality of examinations and assessments are up to standard. The Board of Examiners performs the duties adequately.

The examination methods are in line with the course goals and contents. Final course grades are transparently deduced from grades of course components. The instruments adopted to assess the performances of individual students and to counter free-riding are many-sided and effective.

The assessment procedures for the Bachelor graduation projects, with the juries of examiners and the rubrics assessment forms, are effective to arrive at justified assessments. Students' individual performances are reliably assessed.

The quality and level of the course examinations are up to standard and conform to the goals of the courses.

The quality and academic level of the Bachelor graduation projects meet the requirements of bachelor programmes in the electrical engineering domain. The Bachelor graduation projects, which the panel studied, match the intended learning outcomes. The panel agrees with the grades given by the programme examiners.

The Board of Examiners monitors the proportion of students graduating cum laude.

The master programmes, to which graduates are admitted, showcase the results these graduates have achieved at completion of this programme.

The relations of programme management with the Industrial Advisory Board are instrumental in aligning the programme with professional field requirements.

Having conducted the assessment of the Bachelor Electrical Engineering programme of Delft University of Technology, the assessment panel finds this programme to meet all four standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands, and consequently judges the programme to be positive in terms of the NVAO Assessment framework. Therefore, the panel recommends NVAO to prolong the accreditation of this programme for another term of six years.

Rotterdam, 7 February, 2023,

Prof.dr.ir. Dr. h.c. R.W. De Doncker  
(panel chair)

W. Vercouteren  
(panel secretary)

## 2. Programme administrative information

Name programme in CROHO: Bachelor Electrical Engineering  
Orientation, level programme: Academic Bachelor  
Grade: Bachelor of Science (BSc)  
Number of credits: 180 EC  
Specialisations: None  
Location: Delft  
Mode of study: Full-time (language of instruction: Dutch)  
Registration in CROHO: 21PF-56953

Name of institution: Delft University of Technology  
Status of institution: Government-funded University  
Institution's quality assurance: Approved

### 3. Findings, considerations and assessments per standard

#### 3.1 Standard 1: Intended learning outcomes

The intended learning outcomes tie in with the level and orientation of the programme; they are geared to the expectations of the professional field, the discipline, and international requirements.

##### *Findings*

From the organisational perspective, the Bachelor Electrical Engineering programme is one of the programmes of the Faculty of Electrical Engineering, Mathematics and Computer Science of Delft University of Technology. The faculty offers a range of bachelor, master and PhD programmes. The management team of the faculty, chaired by the Dean, includes the heads of the six faculty research departments, the heads of human resources and finance and the director of education. The director of education is responsible for the educational processes and quality of the bachelor and master programmes of the faculty. Acting on behalf of the director of education, the director of studies has the responsibility for managing both the Bachelor and Master Electrical Engineering programmes. The Board of Studies for both these programmes, being composed of lecturers and students, advises the director of studies on the quality of these programmes. The Board of Examiners, being positioned at faculty level, monitors and assures the quality of examinations and assessments of all bachelor and master programmes of the faculty. One dedicated subcommittee of this Board oversees the examinations and assessments of both the Bachelor and Master Electrical Engineering programmes.

The panel was informed about the only recommendation in the previous assessment process, six years ago, and about the follow-up actions by programme management on this recommendation. The recommendation was to continue to fit the programme's profile to modern T-shaped engineering requirements. The projects in the courses and the Bachelor graduation project require students to work together and to master and apply academic and professional skills, thereby enhancing the T-shaped engineering profile of the programme.

This programme is a three-year or 180 EC academic bachelor programme in the electrical engineering domain. The programme objectives are to educate students at bachelor level in this domain, and to enable them to proceed to master programmes in this or related domains. In this programme, students are offered the breadth of electrical engineering, profound teaching in mathematics and physics, and academic orientation in science and design. Upon completion of the programme, students have direct access to master programmes in electrical engineering, computer engineering, embedded systems, biomedical engineering, or systems & control. Students may also enrol in other master programmes directly or after having fulfilled extra requirements. Students of this programme are not explicitly prepared to enter the labour market.

Programme management of the Bachelor and Master Electrical Engineering programmes of the universities of technology in the Netherlands, Delft University of Technology, Eindhoven University of Technology, and University of Twente, convened to draw up the Domain-specific

Frame of Reference for Electrical Engineering studies in the Netherlands. In 2016, the first draft of this Frame of Reference was completed. The current Frame of Reference has been updated, but retains important, still valid parts of this 2016 version. In this Domain-specific Frame of Reference, the domain of electrical engineering has been described and the requirements for academic degree programmes in this domain have been specified. These requirements have been derived from the specifications for programmes in electrical engineering by the international renowned accreditation organisations in this domain ABET, the United States Accreditation Board for Engineering and Technology, and ASIIN, the German Accreditation Organisation for study programmes in Engineering, Informatics, Natural Sciences and Mathematics. In addition, the requirements have been drafted to meet the Meijers criteria. The Meijers criteria are generic academic qualifications for bachelor and master programmes of universities of technology in the Netherlands. The Meijers criteria have been approved by NVAO in this sense. The requirements have also been compared to the Bachelor and Master Electrical Engineering programmes of three reputed universities, ETH Zurich, TU Munich and KU Leuven. In this Frame of Reference, the subdomains of electrical engineering, as represented by the societies within the global organisation IEEE, Institute of Electrical and Electronics Engineers, have been identified. In view of the wide range of subdomains, the Frame of Reference states it not to be feasible for programmes to cover all subdomains. Therefore, programmes are to convey the core of electrical engineering, thereupon allowing students to specialise in subdomains.

The objectives of the programme have been translated into the programme's intended learning outcomes. The intended learning outcomes include students being trained thoroughly and broadly in mathematics, physics, computer science, and systems and models, having basic knowledge and skills in the most important electrical engineering subdomains, knowing how to analyse and synthesise electrical systems, taking scientific approaches to solve technological problems, being able to work individually in multi-disciplinary or inter-disciplinary contexts, knowing how to communicate about their work and the results thereof, being able to collect and interpret relevant information, and knowing how to critically reflect.

All components of the programme are compulsory. The programme does not offer students the opportunity to take electives. In the new Bachelor programme, to begin in 2023, programme management intends to offer electives, allowing students some degree of choice.

As was shown in the critical reflection report, the programme's intended learning outcomes comply with the Domain-specific Frame of Reference. As also demonstrated in the critical reflection report, the intended learning outcomes match the Meijers criteria for bachelor programmes.

Programme management sees regular updates in the intended learning outcomes and curriculum as important to adjust to new developments and new educational views in the electrical engineering domain.

The programme name is English, meeting international standards in this domain. The formal language of instruction is Dutch. Lectures and assessments are, however, in English, mainly

because literature and study materials in this domain tend to be in English. The new Bachelor programme from 2023 onwards will adopt the same language policy.

#### *Considerations*

The panel regards the organisation of the programme to be effective and to enable appropriate monitoring and assuring of the quality of the programme.

The panel notes programme management responded adequately to the recommendation of the assessment panel, made during the previous assessment process in 2016.

In the panel's view, the programme's objectives specify the requirements of bachelor programmes in the electrical engineering domain. The panel acknowledges this Bachelor programme to be predominantly the stepping stone for subsequent master programmes in this or related domains, and not for directly entering the labour market.

The panel regards the Domain-specific Frame of Reference as valuable. The electrical engineering domain is well described. International standards and benchmarks have appropriately been taken into account, which allows this programme to be aligned with international trends in this domain.

The programme's intended learning outcomes are well-aligned with the programme's objectives. The panel evaluates the intended learning outcomes to meet the Domain-specific Frame of Reference requirements. Therefore, the programme matches the international standards for programmes in the domain of electrical engineering. The panel is positive about the monitoring and updating of the intended learning outcomes and the curriculum of this programme.

The intended learning outcomes largely meet the requirements for the bachelor level, as specified by the Meijers criteria for this level. The panel evaluates, however, some of the intended learning outcomes of this programme as having been phrased at levels, to some degree surpassing the bachelor level. Some intended learning outcomes require students to be self-reliant in the areas mentioned in these learning outcomes, which is contrary to the bachelor level of working or acting under supervision. The panel advises to rephrase these intended learning outcomes and to adjust them to the bachelor level.

The panel approves of the English name of the programme. The panel notes the formal language of instruction of the programme is Dutch, but lectures and assessments are in English.

#### *Assessment of this standard*

These considerations have led the assessment panel to assess the programme to meet Standard 1, Intended learning outcomes.



### 3.2 Standard 2: Teaching-learning environment

The curriculum, the teaching-learning environment and the quality of the teaching staff enable the incoming students to achieve the intended learning outcomes.
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#### *Findings*

The number of students enrolling in the programme fluctuated over the last seven years between 147 and 222 incoming students per year, being on average yearly 175 students. On balance, the intake rose from 174 students in 2015 to 222 students in 2021. The proportion of female students is rather low, varying between 6 % and 13 % of total intake and being on average 9 % over the last seven years. Programme management is making efforts to raise the percentage of female students, using the advice of the Dutch centre on gender diversity (VHTO). As the official programme language of instruction is Dutch, the number of international students is very limited.

Interested students are offered a range of opportunities to obtain information about the programme, such as open days, brochures and student-for-a-day events. Applicants having Dutch pre-university diplomas with mathematics and physics in their study programmes are eligible for admission to the programme. Applicants with propaedeutic diplomas in technical domains from Dutch universities of applied sciences or applicants from abroad with comparable qualifications are admitted as well, in some cases after having fulfilled additional requirements. To be admitted, applicants have to complete compulsory Study Choice Check procedures, which include filling out questionnaires, preparing homework, attending lectures and meeting with staff members. Special attention is given to students who switch programmes. These procedures result in non-binding advices to prospective students on enrolment.

The programme curriculum has been divided into teaching tracks, which cover the fundamentals and the electrical engineering subdomains. The teaching tracks are mathematics, physics, circuits, computer engineering, electrical energy, signals and systems, telecommunication, and projects and labs. Each of the courses in the curriculum, which all have 5 EC of study load, is part of one of these teaching tracks. The teaching tracks, which are each comprised of two to five courses, offer students the opportunity to achieve the required bachelor level of knowledge and skills in the fundamentals and in the electrical engineering subdomains in this programme. The new curriculum is expected to add the subject of artificial intelligence, but this has not yet formally been decided. All courses are compulsory and the curriculum does not allow for electives, except for the minor of 30 EC in the first half of the third year. Students may qualify to become teachers in lower classes of Dutch secondary education by taking the educational package in the minor. Some students do internships or go abroad in their minor. The Bachelor graduation project, with 15 EC study load, is scheduled in the last quarter. Excellent students may opt for the university Honours Programme, allowing them to achieve higher level knowledge and skills in 20 EC of courses on top of the regular programme. About 8 % of all students in the programme take this Honours Programme, achieving very good results.

In the critical reflection report, programme management presented the overview of the relations of the curriculum components to the intended learning outcomes. The correspondence between the curriculum and the intended learning outcomes of the programme has been demonstrated.

Little over hundred staff members are involved in the programme. In recent years, new staff were recruited, accommodating the growth in student numbers. Programme management makes efforts to raise the number of female staff (currently 13 %) for the gender balance and for female students to identify with them (see them as role models). The teaching staff is composed of full professors, associate professors, assistant professors and lecturers. Nearly all staff members have PhDs and are researchers in this domain, connecting teaching to their research. Staff mainly come from the research departments Electrical Sustainable Energy, Microelectronics, or Quantum and Computer Engineering. Teachers from other departments teach specialised subjects. Mathematics courses are offered by the Department of Applied Mathematics. Academic and professional skills training is provided by the Centre for Languages and Academic Skills. The proportion of BKO-certified teachers is 56 %, while 21 % of all teachers are in the certification process.

The curriculum consists of both theory courses and application courses in the proportion of 2 : 1. Application allows students, among other things, to understand concepts and to connect theory to the real world. The educational concept in the theory courses is the instruction-practice-feedback cycle. Teaching methods in these courses include lectures, tutorials and hands-on tutorials and hands-on tutorials in lab sessions. The application components of the curriculum are composed of labs and projects. In the labs, students are taught to demonstrate, apply and practise theoretical concepts. They either work alone or in pairs. The labs prepare for the open-ended EPO-projects (Electrical Engineering Project Education), to be completed by groups of 6 to 12 students. The projects require students to go through the cycle of analysis and specification, design, modelling and simulation, prototyping, and verification.

Students experience this programme as demanding. Programme management has organised the educational processes and study guidance to support students. The number of hours of face-to-face education is 17 hours per week in the first year, 15.5 hours in the second year, and 11 hours in the third year. The rest of the time is reserved for self-study activities. The students-to-staff ratio is 27 : 1. First-year students are supported in groups of 25 students by both teacher mentors and student mentors. Teacher mentors are also the tutors of the lab sessions and projects. These teachers, having been brought together in the Electrical Engineering Education group, have specific responsibilities in improving education and assisting first-year students to become accustomed to academic education in general and this programme in particular. Student mentors are trained for their tasks are regularly interviewed about them. Students have access to academic counsellors for further assistance. Every quarter, programme management schedules briefings to inform students and to inquire about any issues they might have.

The proportion of students with positive BSAs (only positive BSA (binding study advice) gives access to the second year) is about 50 % for the most recent years. The student drop-out rate in the first year is on average 20 %, while on average another 20 % of the students leave the programme in later years. The other non-positive BSA students leave very early in the first year and/or switch

to other programmes. The student success rate after four years is on average 55 % of students re-enrolled in the second year. Programme management acknowledges the relatively disappointing results in terms of positive BSA's, drop-out rates and student success rates and is working on improvements. In the new Bachelor programme, improvements will be made, such as strengthening the curriculum structure, raising the motivation of students through a new introductory course, increasing the bonding of students (strengthening the sense of belonging and the sense of social safety) by continuing some form of mentorship after the first year, and having students sign codes of conduct and commitment.

From the beginning of the Covid pandemic, teachers adapted to the situation and transformed theoretical lectures into online lectures. Practical sessions were replaced by simulations or offered online or rescheduled awaiting on-campus activities being allowed. Programme management took measures to guard students' well-being, the effects of which are reflected in fair results in this respect in student surveys. Programme management intends to retain offering recorded lectures online and servicing communication platforms to facilitate interaction among students and teachers.

#### *Considerations*

The panel welcomes the rising number of incoming students in the programme, as the demand for electrical engineers will continue to increase over the years. The panel, nevertheless, recommends to intensify advertising the programme at Dutch high schools to attract more students. The panel notes the low proportion of female students and advises programme management to take steps to raise their numbers, as programme management is currently already doing.

The panel considers the entry requirements and admission procedures as valid for this programme. These requirements and procedures ensure admitting students who have a reasonable chance to complete the programme.

The panel regards the curriculum to be well-aligned with the intended learning outcomes of the programme. The curriculum has been logically and coherently structured. The courses themselves are well-organised as well. The panel regards the study load for mathematics and physics to be appropriate. The panel is pleased the study load for these disciplines will remain almost the same in the new Bachelor programme. The panel recommends to reconsider offering quantum physics and VHDL programming, as these subjects may be too demanding in the first year. In the student chapter and during the site visit, students criticised some courses. The panel advises programme management to improve courses more promptly in response to students' criticisms.

The panel welcomes teachers being researchers in this domain and connecting teaching to research. This way students are made familiar with research and new developments in this domain. The panel endorses the steps programme management is taking to raise the number of female staff. Nevertheless, the panel advises to pay generally more attention to the on-boarding programme for new teachers. The educational capabilities of the teachers are up to standard, as 56 % of them are BKO-certified and another 21 % of them will obtain the certificate in the coming years. Teachers are accessible for students.

The panel evaluates the educational concept and study methods of the programme as adequate means to convey knowledge and skills in the programme domain. The mix of theoretical and application courses is well-considered. The panel, nevertheless, sees some courses addressing too complex subjects and not all students having the required prior knowledge and skills to master these subjects. The panel, therefore, advises to assure courses to be not too complex and to ascertain all students meeting knowledge and skills prerequisites when starting courses.

The panel approves the student guidance in the programme, as provided by academic counsellors, teacher mentors and student mentors. The panel is pleased to see programme management taking measures to strengthen the bonding of students in the new Bachelor programme. The panel notes divergent information provision to students in terms of information on the Brightspace platform versus the programme website, and in terms of the accessibility of teachers and supervisors. The panel advises to improve the internal alignment and communication between staff members in view of staff-student interaction. As the BSA rates, student success rates and drop-out rates are less favourable, the panel recommends to take steps to improve these figures. One of the means to do so may be to fine-tune information to prospective students, providing them with clear views and the right expectations on the programme contents.

Having been offered the opportunity to visit study rooms and labs of the programme, the panel is very positive about the facilities provided for students.

The panel finds the measures taken by programme management to organise education in the Covid pandemic sound. Programme management made appropriate efforts to mitigate the effects of the pandemic on students.

*Assessment of this standard*

These considerations have led the assessment panel to assess the programme to meet Standard 2, Teaching-learning environment.

### 3.3 Standard 3: Student assessment

The programme has an adequate system of student assessment in place.
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#### *Findings*

The examinations and assessments in this programme are subject to the Faculty of Electrical Engineering, Mathematics and Computer Science Assessment Policy and the Rules and Regulations of the Board of Examiners. The main principle of these assessment policies and regulations is constructive alignment, which implies the correspondence of the programme intended learning outcomes, course learning objectives, contents of courses and course examinations and assessments. For this programme, the principle of constructive alignment has resulted in the programme assessment plan, linking the aforementioned elements. As has been indicated, the Board of Examiners has the authority to monitor and assure the quality of examination and assessment processes and products of all programmes of the faculty. The dedicated subcommittee of this Board oversees the examinations and assessments of both the Bachelor and Master Electrical Engineering programmes.

The assessment of the theory courses in the programme is for most of these courses based upon multiple examination components. These components have different examination methods, being written examinations (in one or two parts), progress tests or assignments. Written examinations are dominant. In the new Bachelor programme, the variety in examination methods will be enhanced. The final course grades are determined by the weighted average of the results of the examination components. In the application courses, lab results are assessed in terms of pass/fail judgements. Students have to repeat failed lab work until they pass the test. In the projects, students are assessed in groups of 6 to 12 students on the basis of reports, oral presentations and/or prototypes, and mandatory contributions by individual students. Although the grades are group-based, observations by the tutor and peer review among students in the group may account for individual differences in the grades. Multiple tutors are involved in the grading of projects to ensure uniformity. For the assessment of projects, rubrics (or grade descriptors) are used.

The Bachelor graduation projects are completed in groups of six students, who actually work in pairs on the projects. The projects are assessed by juries, being composed of two independent senior staff members, the project supervisor, and the project proposer, if this is not the supervisor. The assessment is based upon the process, thesis report and oral defence. Some of the assessment criteria are group-based, while others are individual-based. Group-based criteria concern mainly (the technical content of) the thesis report. Individual-based criteria are, among other, level of activity in the project and technical knowledge exhibited in the oral defence. Peer evaluation among students in the group is used for assessing individual performances. For the assessment of the graduation projects, rubrics (or grade descriptors) are used. Currently, the graduation projects include ethics and technology, and business modules. In the new Bachelor programme, ethics and technology as well as business aspects are planned to be addressed earlier (and in more locations) in the programme.

In addition to the constructive alignment principle and the programme assessment plan, programme management and the Board of Examiners have taken a series of measures to assure the quality of examinations and assessments in the programme. These include draft examinations being peer-reviewed by second examiners, examinations being reviewed by the faculty assessment expert, learning goals, assessment methods and grade calculations for theory courses being published in course guides, assessment criteria for projects being made available for students, and rules and regulations for fraud or plagiarism being in place.

During the Covid pandemic, examiners designed alternative examinations for courses, such as open-book examinations, oral tests or (proctored) online examinations. The Board of Examiners ensured these examinations to cover the course goals and took measures to counter fraud.

#### *Considerations*

The panel approves of the examination and assessment procedures in the programme, which are aligned with university and faculty rules and regulations. The position and responsibilities of the Board of Examiners are clear and well-founded. The panel welcomes the implementation of the constructive alignment principle in the programme. The assessment plan allows the examinations and assessments of the courses to be well-aligned with the course goals and through these course goals with the programme intended learning outcomes.

The panel regards the examination methods to be in line with the course goals and course contents. Seeing the predominance of written examinations, the panel is pleased with some shift to other examination methods in the new Bachelor programme. Final course grades are transparently deduced from grades of course components. The instruments adopted to assess the performances of individual students and to counter free-riding are many-sided and effective.

In the panel's opinion, the procedures for the assessment of the Bachelor graduation projects, with the juries of examiners, are effective to arrive at justified assessments. The panel is equally positive about the rubrics form adopted in this assessment process. Clear distinctions between group-based and individual-based assessments are made and individual performances by students are reliably assessed.

The panel considers the measures taken to monitor and assure the quality of examinations and assessments to be up to standard. The Board of Examiners performs their duties adequately.

The panel regards the measures taken by programme management to organise examinations and assessments in the Covid pandemic to be sound. The Board of Examiners ensured the intended learning outcomes of the programme to be achieved.

#### *Assessment of this standard*

These considerations have led the assessment panel to assess the programme to meet Standard 3, Student assessment.

### 3.4 Standard 4: Achieved learning outcomes

The programme demonstrates that the intended learning outcomes are achieved.
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#### *Findings*

The panel studied the examinations of a number of courses of the programme. In addition, the panel reviewed fifteen Bachelor graduation projects of students in the programme who graduated in one of the most recent four years. The average grade for all graduation projects of these years is about 8.0.

The proportion of students graduating with the cum laude distinction is about 15 % in the last few years. The Board of Examiners monitors the proportion of students graduating cum laude, with the objective of keeping this proportion at no more than 10 %.

As explained before, graduates of this programme do not tend to enter the labour market. They continue their studies at master level. The large majority of the graduates (75 %) continue their studies by enrolling in one of the master programmes Electrical Engineering, Embedded Systems or Computer Engineering. Another 10 % of the graduates enrol in other master programmes of the university, being Biomedical Engineering, Sustainable Energy Technology or Systems and Control. About 5 % of the students enter the labour market. Student survey results indicate students feeling well prepared for these master programmes.

Programme management maintains relations with the professional field, to ensure the programme to be aligned with industry requirements. The Industrial Advisory Board, being composed of representatives of the professional field, was installed in 2019 and met before the beginning of the Covid-pandemic with programme management. The Board comments on, among other things, the programme's intended learning outcomes, curriculum and relations to industry.

#### *Considerations*

The quality and the level of the course examinations, which the panel reviewed, are up to standard. The panel finds these examinations to conform to and to test adequately the goals of the courses.

The panel welcomes the monitoring of the proportion of students graduating cum laude in this programme by the Board of Examiners.

The Bachelor graduation projects the panel studied, match the intended learning outcomes. The panel evaluates the grades given by the programme examiners as being fair. The panel agrees with these grades. No graduation projects were found to be unsatisfactory by the panel. Some of the graduation projects are evaluated by the panel as very good or even surpassing the bachelor level. The quality and academic level of the graduation projects meet the bachelor level requirements in the domain of electrical engineering.

The master programmes, to which the graduates are admitted, showcase the results these graduates have achieved at completion of this programme.

The panel welcomes the relations of programme management with the Industrial Advisory Board as a means to align the programme with professional field requirements.

*Assessment of this standard*

These considerations have led the assessment panel to assess the programme to meet Standard 4, Achieved learning outcomes.



#### 4. Overview of assessments

Standard	Assessment
Standard 1. Intended learning outcomes	Programme meets Standard 1
Standard 2: Teaching-learning environment	Programme meets Standard 2
Standard 3: Student assessment	Programme meets Standard 3
Standard 4: Achieved learning outcomes	Programme meets Standard 4
Programme	Positive

## 5. Recommendations

In this report, a number of recommendations by the panel have been listed. For the sake of clarity, these have been brought together below.

- To rephrase some of the intended learning outcomes of the programme and to adjust them to the bachelor level.
- To intensify advertising the programme at Dutch high schools to attract more students.
- To take steps to raise the number of female students.
- To reconsider offering quantum physics and VHDL programming, as these subjects may be too demanding in the first year.
- To take decisions on improvements of courses more promptly in case of students' criticisms.
- To pay more attention to the on-boarding programme for new teachers.
- To assure courses not to address too complex subjects and to ascertain all students meeting knowledge and skills prerequisites when starting courses.
- To improve the internal alignment and communication between staff members in view of staff-student interaction.
- To take measures to improve the BSA rates, student success rates and drop-out rates.

## Appendix: Assessment process

Delft University of Technology requested evaluation agency Certiked VBI to support the limited framework programme assessment process for the Bachelor Electrical Engineering programme of this University. The objective of the programme assessment process was to assess whether the programme conforms to the standards of the limited framework, as laid down in the NVAO Assessment framework for the higher education accreditation system of the Netherlands of September 2018 (officially published in Stcrt. 2019 no. 3198, on 29 January 2019).

The assessment process of this programme was part of the assessment of the Electrical Engineering cluster (WO Elektrotechniek), constituting the Bachelor and Master Electrical Engineering programmes of the universities of technology in the Netherlands, Delft University of Technology, Eindhoven University of Technology, and University of Twente.

Programme management of the Bachelor and Master Electrical Engineering programmes of these three Universities in the Netherlands drafted the list of panel candidates. Having conferred with programme management of these programmes, Certiked invited candidate panel members to sit on the assessment panel. The panel members agreed to do so.

The panel composition was as follows:

- Prof.dr.ir. Dr. h.c. R.W. De Doncker, full professor, RWTH Aachen University, Germany (panel chair);
- Prof.dr.ir. J. Bauwelinck, associate professor, Ghent University, Belgium (panel member);
- Dr.ir. K. Philips, general manager, IMEC at Holst Centre, Eindhoven, the Netherlands (panel member);
- Dr. C. Terlouw, independent expert in secondary and higher education, Enschede, the Netherlands (panel member);
- R. Helmantel BSc, student Master Educational Sciences, University of Amsterdam, the Netherlands (student member).

On behalf of Certiked, W. Vercouteren served as the process coordinator/secretary in the assessment process.

All panel members and the process coordinator/secretary confirmed in writing that they had no conflict of interest with regard to the programme to be assessed and that they would observe the rules of confidentiality. Having obtained the authorisation by Delft University of Technology, the process coordinator/secretary requested the approval of NVAO of the proposed panel to conduct the assessment. NVAO have given their approval.

To prepare the assessment process, the process coordinator/secretary met with management of this programme to determine, among other things, the outline of the critical reflection report, the subjects to be addressed in this report, and the site visit schedule. In addition, the planning of activities in preparation of the site visit were discussed. In preparation of the site visit, programme

management and the process coordinator/secretary had contact to fine-tune the process. The activities were performed as planned. Programme management approved the schedule for the site visit.

Well in advance of the site visit date, programme management forwarded the list of Bachelor graduation projects of students having graduated in the three most recent examination years (2018, 2019, 2020). Acting on behalf of the assessment panel, the process coordinator/secretary selected fifteen projects from this list. The grade distribution in the selection matched the grade distribution in the list forwarded by programme management.

The critical reflection report of the programme was sent in advance to the panel chair and the panel members. In this report, the four standards of the NVAO Assessment framework were discussed. The student chapter was part of the critical reflection report. The appendices to this report included the following documents.

- Follow-up to recommendations in programme assessment 2016
- Educational vision
- Data on student intake and performance
- Curriculum revision
- 3TU Domain-Specific Frame of Reference Electrical Engineering
- Descriptions of content of curriculum
- Course descriptions
- Teaching and Examination Regulations
- Overview of lecturing staff and staff qualifications
- Selection of course study materials
- Selection of course examinations
- Annual reports of Board of Studies
- Annual reports of Board of Examiners
- Faculty of Electrical Engineering, Mathematics and Computer Science Assessment Policy
- Electrical Engineering Assessment Plan
- Board of Examiners Rules and Regulations

In addition, all of the expert panel members studied a number of Bachelor graduation projects of programme graduates, the total of these projects making up the selection made by the process coordinator/secretary.

Well before the site visit, the panel chair and the process coordinator/secretary discussed the procedures with respect to the assessment process. The panel chair was also informed about the competencies, listed in the profile of panel chairs of NVAO. The meeting between the panel chair and the process coordinator/secretary served as the briefing for panel chairs, as meant in the NVAO profile of panel chairs. The panel chair agreed to work in line with the profile of panel chairs.

The panel members were sent the Trained Eye document of Certiked evaluation agency, this document being the explanation of the NVAO Assessment framework.

Prior to the site visit date, all panel members sent in their preliminary findings, based on the critical reflection report and the graduation projects studied, and forwarded a number of questions to be put to programme representatives on the day of the site visit. The process coordinator/secretary summarised this information, compiling a list of questions, which served as the starting point for the discussions during the site visit.

On 15 November 2022, the panel met to go over the preliminary findings concerning the quality of the programme. During this meeting, the preliminary findings of the panel members, including those about the Bachelor graduation projects were exchanged. The procedures to be adopted during the site visit, including the questions to be put to the programme representatives on the basis of the list compiled, were also discussed.

On 17 November 2022, the panel conducted the site visit on the campus of Delft University of Technology. The site visit schedule was in accordance with the schedule as planned.

The site visit schedule included the following meetings.

09.00 – 09.30	Faculty representatives, department heads, and director of studies
09.30 – 10.30	Director of studies, core lecturers, study advisor
10.45 – 11.15	Board of Examiners
11.30 – 12.15	Lecturers, graduation projects' examiners
12.15 – 12.45	Open-office hours
12.45 – 13.15	Panel lunch (closed session)
13.15 – 14.00	Tour around programme labs and facilities
14.00 – 14.45	Students, with Board of Studies student members, and programme alumni
14.45 – 16.15	Deliberations panel (closed session)
16.15 – 16.30	Presentation main findings by panel chair to programme representatives
16.30 – 17.00	Development dialogue between panel and programme management

Open-office hours were communicated in a timely way by programme management to programme staff, lecturers and students. No-one, however, came forward to make use of these open hours.

In a closed session at the end of the site visit, the panel considered all of the findings, weighed the considerations and arrived at conclusions with regard to the quality of the programme. At the end of the site visit, the panel chair presented the broad outline of findings, considerations, assessments and recommendations to programme representatives.

At the end of the site visit and clearly separated from the process of the programme assessment, panel members and programme representatives met to conduct the development dialogue. The objective of this dialogue was to discuss future developments of the programme.

The assessment draft report was finalised by the process coordinator/secretary, taking into account the findings, considerations, assessments and conclusions of the panel. The draft report was sent to the panel members, who studied it and made a number of changes. Thereupon, the secretary edited the report. This report was then presented to programme management to be corrected for factual

inconsistencies. Programme management were given two weeks to respond. Having been corrected for factual inconsistencies, the final report was sent to the University Board to accompany their request to continue the accreditation of this programme.