

Assessment report
Limited Framework Programme Assessment

Bachelor Electrical Engineering

University of Twente

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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 University of Twente. 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 recommendations 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, and the generic bachelor level requirements. The intended learning outcomes of the Bachelor and Master Electrical Engineering programmes of this university are clearly differentiated. The monitoring and updating of the intended learning outcomes and curriculum are done adequately.

The choice for the English name and English as the language of instruction for the programme is well-considered and plausible.

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 advises to attract more Dutch students by advertising the programme more intensively at Dutch high schools. The panel also recommends 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 in twelve modules and is well-aligned with the intended learning outcomes. The modules are well-organised, theory courses and projects being addressed in a balanced way. The learning lines are effective instruments to lead students to the required levels of mastery of the subjects addressed in the programme. The study load for mathematics and physics is adequate. Academic, professional and personal skills are addressed

well. Programme management takes appropriate steps, in case student survey scores for modules are not on target.

The teaching staff is very well equipped to teach in this programme. Their educational capabilities are good, as 58 % of them are BKO-certified and 24 % of them are in the certification process. Staff invest in teaching. Teachers are active researchers in the programme domain and relate their teaching to their research.

The educational model of the programme, based upon project-based education and student-centred learning, is suitable for this programme. The teaching methods are sufficiently diverse and are adequate means to convey knowledge and skills in the programme domain.

The student guidance in the programme, as provided by study advisors, staff mentors and student mentors, is effective. Interaction between staff and students is informal. The student-to-staff ratio is favourable. The single point of contact for information about modules is working well for students. As the student drop-out rates of the programme are less favourable, the panel advises programme management to take steps to improve these figures.

The quality of study rooms and labs provided for students is up to standard. Lab space is, however, limited. The panel, therefore, advises to assure sufficient lab space for students.

The measures taken by programme management to organise education and examinations during the Covid pandemic are sound. The Examination Board 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 programme examination and assessment procedures correspond to university and faculty guidelines. The measures to assure the quality of examinations and assessments are adequate. The Examination Board is solid and active in performing their duties.

Through the assessment schemes and assessment plans, examinations and assessments of courses are well-aligned with the course goals and with the programme intended learning outcomes. The variety of examination methods mirrors the course goals and teaching methods. The instruments adopted to assess the performances of individual students and to counter free-riding are many-sided and effective.

The procedures for the assessment of the Bachelor thesis projects, with the assessment committees of examiners and the standardised final project evaluation form with rubrics, are effective to arrive at reliable assessments. Useful steps have been taken to promote consistent and balanced grading of these projects.

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 thesis projects meet the requirements of a bachelor programme in the electrical engineering domain. The Bachelor thesis projects, which the panel studied, match the intended learning outcomes. The panel agrees with the grades given by the programme examiners.

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 External Advisory Board are instrumental in aligning the programme with professional field requirements.

Having conducted the assessment of the Bachelor Electrical Engineering programme of University of Twente, 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, 8 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: Enschede
Mode of study: Full-time (language of instruction: English)
Registration in CROHO: 21PH-56953

Name of institution: University of Twente
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 University of Twente. The Faculty Board, chaired by the Dean, is responsible for decisions on research, education, finances, personnel and support at the faculty level. The programme director of both the Bachelor and Master Electrical Engineering programmes manages these programmes and has the responsibility to assure the quality of the programmes. The programme director is assisted by the programme coordinator and the study advisor, who take care of the day-to-day management of the programme. The Programme Committee, being composed of lecturers and students, advises programme management on the quality of the Bachelor Electrical Engineering, Master Electrical Engineering, and Master Embedded Systems programmes. The Examination Board of the faculty monitors and assures the examinations' and assessments' quality of all faculty programmes. The sub-committee of the Board for the programmes Bachelor Electrical Engineering, Master Electrical Engineering and Master Embedded Systems takes decisions and handles requests about these programmes.

The panel was informed about the recommendations of the assessment panel in the previous assessment process, six years ago, and about the follow-up actions by management of this programme on these recommendations. Firstly, grades given for the Bachelor thesis projects are benchmarked across research groups (research chairs) by having one of the members come from one of the other research chairs, i.e. not being the research chair under whose supervision the project was conducted. Secondly, the grading system of the University of Twente has been changed to allow half points, in order to better reflect differences in students' performances. Thirdly, students' command of the English language is from the start of the programme onwards actively screened and promoted. Fourthly, students are to present all of the appendices and all of the relevant data to the Bachelor thesis assessment committee, while failure to do so may result in lower grades.

This programme is a three-year or 180 EC academic bachelor programme in the electrical engineering domain. The objectives of the programme are for students to acquire academic and professional knowledge and skills in the electrical engineering domain, which will enable them to proceed without major hindrances to programmes at master level in electrical engineering, or in other technical domains. Students of this programme are, therefore, not explicitly prepared to directly 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. These intended learning outcomes include students obtaining knowledge of and skills in the electrical engineering domain, gaining knowledge of and skills in mathematics, physics and computer programming, acquiring knowledge of and skills in research and design, knowing how to organise projects and to work with others of the same or other disciplines, having reporting and presentation skills, being aware of societal and temporal contexts, and steering their own personal development. The programme does not offer any specialisations.

As programme management has shown in the self-evaluation report, the programme's intended learning outcomes comply with the Domain-specific Frame of Reference. As is also demonstrated in the self-evaluation report, the intended learning outcomes match the Meijers criteria for bachelor programmes.

Every few years, programme management discusses updates of the intended learning outcomes and the curriculum, considering it to be important to adjust to new developments in this domain and to new educational views. Any major changes are not foreseen before 2024.

The name of the programme is English. The language of instruction is English as well. The main reason for adopting English in the name and in education is to prepare students for careers in the academic-level electrical engineering labour market, which is highly international.

Considerations

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

The panel notes programme management responded adequately to the recommendations 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 to be 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 intended learning outcomes also meet the requirements for the bachelor level, as specified by the Meijers criteria for this level. The intended learning outcomes of the Bachelor and Master Electrical Engineering programmes of this university are clearly differentiated, ensuring relevant differences in knowledge and skills between these programmes. The panel is positive about the monitoring and updating of the intended learning outcomes and the curriculum of this programme.

The panel endorses the English name of the programme, as it regards the reasons given by programme management for this name as valid. The choice for English as the language of instruction for the programme is seen by the panel as well-considered and plausible as well.

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.

Findings

The number of students enrolling in the programme fluctuated to some extent in the last seven years, but rose on balance from 80 students in 2015 to 110 students in 2021. Over the years, the proportion of international students is quite constant at about 30 % of total inflow. The proportion of female students is low, varying between 5 % and 11 % of total intake and being on average about 9 % of the intake. Programme management is making efforts to raise the percentage of female students.

Interested students are offered a range of opportunities to obtain information about the programme. Three categories of applicants are eligible for admission to the programme. These are (a) applicants having Dutch pre-university diplomas with mathematics and physics in their study programmes or (b) applicants having completed the first year of programmes in relevant fields taken at Dutch universities of applied sciences, or else (c) applicants from abroad having officially established, comparable qualifications. International applicants are to show good grades in mathematics and physics and have to meet English language command requirements. To be admitted, applicants have to complete the compulsory Study Choice Check procedures, which include filling out the programme questionnaire and attending educational activities. For international students, these procedures are organised online. Students may be invited to discuss their choice with one of the study advisers, when the completed forms would lead to questions.

The curriculum of this programme is organised in accordance with the Twente Educational Model, which is adopted for all bachelor programmes of this university. In line with this model, the curriculum is divided into twelve modules of 15 EC each, which consist of theory courses and projects to apply this theory. Courses and projects may include lab courses. The theory courses are instrumental in doing the projects. In the projects, students are also trained academic, professional and personal skills, which include research and design skills, organisation and collaboration skills, reporting and presenting skills, and personal development. The twelve modules address different subjects in the electrical engineering domain. Courses and projects in the modules are part of learning lines. These learning lines are mathematics, physics, electronics, signals and systems, computer engineering (hardware and software), and projects/experimentation. The courses within the learning lines build upon each other, leading for each of the subjects/fields mentioned to the required level for the programme. Although the programme has no specialisations, the programme has one elective module in the second year and students have some degree of choice in the minor space (30 EC) in the first part of the third year. Students may then take deepening or broadening courses, may use the minor space for courses needed to be admitted to specific master programmes, or may qualify to be teachers for lower classes of Dutch secondary education. The final component of the curriculum is the individual, research-oriented Bachelor thesis project (15 EC), covering all of the programme intended learning outcomes.

In the self-evaluation report, programme management presented the overview of relations between the intended learning outcomes of the programme and curriculum components, demonstrating the correspondence between the curriculum and the intended learning outcomes.

The staff teaching in the programme is composed of full professors, associate professors, assistant professors, docents, and guest teachers. Staff members are researchers in this domain and connect teaching to their research. Nearly 100 staff members (69.2 FTEs) are involved in teaching in both the Bachelor and Master Electrical Engineering programmes. Nearly all staff members have PhDs. The proportion of BKO-certified teachers is 58 %, while 24 % of total staff currently are in BKO-certification process. The other teachers are exempt on account of long teaching careers or on account of small part-time appointments. Support staff is very effective in assisting teachers in module management. PhD students are involved in the programme as teaching assistants in labs, tutorials or projects. They are always guided by staff members. Student assistants are involved as well. Both teaching assistants and student assistants are trained.

The educational concept of the programme rests upon project-based education (projects allowing students to apply theoretical concepts to practical exercises and implementation and thereby to improve their understanding of theory) and student-centred learning (students taking the learning processes into their own hands). In the programme modules, an array of teaching methods is offered. These methods include lectures, tutorials, lab sessions, projects, and supervised self-study sessions.

Students experience this programme as demanding, but manageable. Programme management has organised educational processes and study guidance to support students. Face-to-face education ranges from 26.4 hours per week in the first year to 20.1 hours in the second year, and to 14.2 hours in the third year. The students-to-staff ratio in the programme is 16.5 : 1. Onboarding processes at the beginning of the programme strongly foster students integrating in the programme and mixing among themselves. Both staff and students indicated students from different backgrounds to mix rather well in the programme. In the Twente Educational Model 2.0, the modules have been split up in separate courses to prevent major study delays. Previously, entire modules had to be passed. The programme's study advisors support students, provide study advice and refer them to other services, when needed. Senior students as mentors assist students from the very start of the programme. Staff mentors are assigned to each of the project groups in the first module to guide students in project organisation. Staff mentors also advise on study planning. The student success rate for students graduating within four years for this programme is on average 68 % of students re-enrolled in the second year. The student drop-out rate in the first year is on average 31 % for the last six years. The proportion of drop-outs over all study years together is on average 36 % for the last four years. Programme management acknowledges the relatively disappointing drop-out rates and is working on improvements.

At the beginning of the Covid pandemic, the crisis team of the programme was installed to make the transfer to online education during the pandemic as smooth as possible for students and teachers. Theory courses were transformed into online courses. When no practical sessions could

be organised, online labs and simulations were offered. Home experimentation kits (EE kits), which students also have to acquire in normal circumstances, proved valuable in enabling students to do practical work at home. Programme management took steps to promote students' well-being. Programme management plans to retain from the pandemic offering students digital study material.

Considerations

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

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

The panel sees the curriculum as well-aligned with the intended learning outcomes. The curriculum has been logically and coherently structured in twelve separate modules. The modules are well-organised, theory courses and projects in the modules being addressed in a balanced way. The learning lines, covering the subjects of the programme, are effective instruments to lead students to the required levels of mastery of these subjects. The panel regards the study load for mathematics and physics to be up to standard. Academic, professional and personal skills are addressed well. Programme management takes appropriate steps, in case student survey scores for modules are not on target.

The panel considers the staff as very much suited to teach in this programme. The educational capabilities of the teachers are good, as 58 % of them are BKO-certified and 24 % of them are in the certification process. Staff invest in teaching. The panel welcomes teachers relating lecturing to their research, as students are made familiar with research and new developments in this domain. Involving PhD students and senior students in teaching activities is seen as beneficial by the panel.

The panel considers the educational model of the programme, based upon project-based education and student-centred learning, as suitable for this programme. The teaching methods are sufficiently diverse and are adequate to convey knowledge and skills in the programme domain.

The panel is positive about the student guidance in the programme, as provided by study advisors, staff mentors and student mentors. Interaction between staff and students is informal. The student-to-staff ratio is favourable. The panel notes the single point of contact for information about modules is working well for students. As the student drop-out rates of the programme are less favourable, the panel advises programme management to take steps to improve these figures. One of the means to do so may be to fine-tune the information to prospective students, providing them with clear views on the programme contents.

Having been offered the opportunity to visit study rooms and labs of the programme, the panel is positive about the quality of the facilities provided for students. The panel notes, however, lab space is limited. The panel, therefore, advises to assure sufficient lab space for students.

The panel finds the measures taken by programme management to organise education in the Covid pandemic sound. The panel sees the EE-kit as positive. 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 governed by the Quality Assurance Framework for Student Assessment guidelines of the University of Twente and to the assessment policy of the Faculty of Electrical Engineering, Mathematics and Computer Science. As has been said, the Examination Board has the authority to monitor and assure the quality of examinations and assessments of all faculty programmes, while the Board's sub-committee takes decisions and handles requests about the Bachelor Electrical Engineering, Master Electrical Engineering and Master Embedded Systems programmes.

The final grades for each of the study units/courses within the modules of the programme are determined by the weighted average of the results of multiple examination components in the courses. These components have different examination methods, including written examinations, oral examinations, presentations, demonstrations, lab journals, reports/papers, posters, or videos. Examination methods are selected in line with the teaching methods adopted and the course goals to be assessed. Formative assessments are also scheduled to offer students feedback on their learning processes. Fraud and plagiarism procedures are in place. In the projects, students work together in groups. To allow grade differentiation among group members and to prevent free-riding in these projects, individual examinations are part of these projects and peer review among students in the groups, are adopted.

The Bachelor thesis projects are individual projects. They may be written as reports or in scientific article format. The projects are assessed by assessment committees of at least two examiners, one of whom comes another research chair than the project chair. This allows benchmarking of projects and promotes balanced grading. The committee assesses the thesis projects, using the standardised thesis project evaluation form. This form lists the criteria scientific quality, organisation, planning and collaboration, and communication. The evaluation forms include rubrics or grade descriptors for these criteria to enable consistent grading across projects. The projects are assessed on the basis of the report and the oral presentation.

Programme management and the Examination Board have taken measures to assure the quality of the examinations and assessments in the programme. Assessment schemes are drawn up to map the intended learning outcomes to the goals of study units/courses. The Examination Board monitors the relations between the programme intended learning outcomes, the learning goals of the study unit/courses and the assessments. For all modules, assessment plans are drafted, explaining the assessment of the module and the grading to students. At least two examiners are involved in drafting examinations. Some project reports or presentations are assessed by two examiners as well. The Examination Board monitors the assessment quality of the Bachelor thesis projects.

The programme crisis team, installed at the start of the Covid pandemic for the transition to online education, managed the transfer to online examinations and assessments as well. Alternative online examinations were adopted, such as open-book examinations, individually personalised tests or proctored written examinations. All examinations had to be approved by the Examination Board, who ensured these to cover the course goals. To counter fraud, integrity statements were appended to examinations and students could afterwards be requested individually to give oral explanations. The procedures for online examinations were clear, as students said to the panel.

Considerations

The panel approves of the examination and assessment procedures for this programme, which correspond to university and faculty guidelines. The panel is positive about the position and responsibilities of the Examination Board.

Through the assessment schemes and assessment plans, examinations and assessments of courses are well-aligned with the course goals and with the programme intended learning outcomes. The panel welcomes the range of examination methods adopted in the modules. 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 thesis projects, with the assessment committees of examiners, are effective to arrive at reliable assessments. The panel is equally positive about the standardised final project evaluation form with rubrics. The panel welcomes the steps which have been taken to promote consistent and balanced grading of these Bachelor thesis projects.

The panel finds the measures adopted to monitor and assure the quality of examinations and assessments to be up to standard. The Examination Board is solid and active in performing their duties. The activities of the Board are in line with prevailing rules and regulations. The Board has an eye for students' individual circumstances.

The panel regards the measures taken by programme management to organise examinations and assessments in the Covid pandemic to be sound. The Examination Board 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 courses of the programme. The panel also reviewed fifteen Bachelor thesis projects of graduates of the programme of the last few years. The objective of the thesis project is for students, working under the guidance of the supervisor, to transform a broad problem into a specific research question, and to formulate and execute an approach to solve the research problem. Students do their projects at one of the electrical engineering research chairs within the faculty. The average grade for all projects of the last few years is about 7.7.

As explained before, graduates of this programme do not tend to enter the labour market. The vast majority of them continues their studies at master level. Graduates are directly admitted to the university of technology programmes Master Electrical Engineering, Master Embedded Systems or Master Systems and Control. When having taken required courses in their minor, graduates are admitted directly to other master programmes in the technical field as well. About 80 % of the programme graduates proceed to master programmes of the University of Twente. The rest of the graduates go to master programmes elsewhere in the Netherlands or abroad or do enter the labour market.

Programme management maintains relations with the professional field, to ensure the programme to be aligned with industry requirements. The External Advisory Board, being composed of representatives of the professional field, meets twice per year with programme management. The Board comments on 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 regards these examinations to conform to and to test appropriately the goals of the courses.

The Bachelor thesis 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 thesis projects were found to be unsatisfactory by the panel. Some of the thesis projects are evaluated by the panel as very good. The quality and academic level of these 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 External 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 attract more students by advertising the programme more intensively at high schools.
- To take steps to raise the number of female students.
- To take measures to improve the student drop-out rates.
- To assure sufficient lab space for students.

Appendix: Assessment process

University of Twente 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 University of Twente, 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 self-evaluation 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 sent the list of Bachelor thesis projects of students having graduated in the most recent years (all graduates from 1 September 2019 to 1 April 2022). 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 programme has no formal specialisations. The research groups (research chairs) where students did their projects, were, nevertheless, covered in the selection.

The self-evaluation report of the programme was sent in advance to the panel members. In this report, the four standards of the NVAO Assessment framework were discussed. The student chapter was part of the self-evaluation report. The self-evaluation report and the appendices included the following information.

- List of improvements, following the previous assessment
- 3TU Domain-Specific Frame of Reference Electrical Engineering
- Intended learning outcomes
- Relations of intended learning outcomes to Meijers criteria
- Relations of intended learning outcomes to curriculum
- Overview of curriculum
- Concise course descriptions
- Education and Examination Regulations
- Overview of staff
- Proportion of staff with PhD and having BKO-certificate
- Number of incoming students
- Student success rates
- Drop-out rates
- Student-to-staff ratio
- Average number of hours of face-to-face education
- Annual reports of Examination Board
- Annual reports of programme committee
- Course material and course examinations

Extra information for further reading was provided in references in the self-evaluation report

All expert panel members studied a number of Bachelor thesis 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 self-evaluation report and the Bachelor thesis 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 a 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 thesis 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 18 November 2022, the panel conducted the site visit on the campus of University of Twente. The site visit schedule was in accordance with the schedule as planned.

The site visit schedule included the following meetings.

09.00 – 09.30	Dean of Faculty, programme director
09.30 – 10.30	Programme director, core lecturers, study advisor
10.45 – 11.15	Examination Board
11.30 – 12.15	Lecturers, final 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 programme committee student members, 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.