

Assessment report  
Limited Framework Programme Assessment

**Master 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 Master 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 master programmes in the electrical engineering domain. This Master Electrical Engineering programme builds upon the Bachelor Electrical Engineering programme and prepares students to enter 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 master 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, nevertheless, recommends to attract more students. The panel also advises 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 with courses, internships and Master thesis projects, and is well aligned with the intended learning outcomes of the programme. The courses themselves are also well-organised. On behalf of the research chairs who offer the programme specialisations, programme mentors assist students in arranging coherent study plans, enabling them to become knowledgeable and skilful in the specialisation of their choice.

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 the combination of theoretical knowledge and practical design and application, 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, programme mentors and supervisors, is effective. Interaction between staff and students is informal. As the student drop-out rates/student success rates of the programme are less favourable, the panel advises programme management 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 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.

The 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 procedures for the assessment of the Master 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 panel advises to continue and strengthen the theses carousel with the programmes of the other universities and to extend this carousel to the Bachelor programmes.

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 Master thesis projects meet the requirements of a master programme in the electrical engineering domain. The Master thesis projects, which the panel

studied, match the intended learning outcomes. The panel agrees with the grades given by the programme examiners.

The positions, which graduates of this programme manage to secure, 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 Master 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:	Master Electrical Engineering
Orientation, level programme:	Academic Master
Grade:	Master of Science (MSc)
Number of credits:	120 EC
Specialisations:	Communication Networks Computer Vision and Biometrics Dependable Integrated Systems Integrated Circuit Design Integrated Optical Systems Lab on a Chip Systems Micro Sensors and Systems Nanoelectronics Neurotechnology and Biomechatronics Power Electronics Radio Systems Robotics and Mechatronics Semiconductor Devices and Technology
Location:	Enschede
Mode of study:	Full-time (language of instruction: English)
Registration in CROHO:	21PH-60353
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 Master 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 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, the organisation of acquiring internship positions and giving students information about and access to internship options has been formalised. Secondly, programme management has made efforts to introduce course files for the programme. Thirdly, the consistency of grading of Master thesis projects across research chairs has been improved by having one of the members of the thesis assessment committee come from one of the other research chairs, i.e. not being the research chair under whose supervision the project was conducted.

This programme is a two-year or 120 EC academic master programme in the domain of electrical engineering. The programme objectives are to prepare students for academic-level professional careers in this domain and to offer them advanced academic knowledge, and academic, professional and personal skills in one of the thirteen specialisations offered in the programme. Students are trained to analyse and research innovative systems in one of these specialisations. In this programme, students are 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 having thorough knowledge and skills in one of the electrical engineering subdomains or specialisations offered in the programme, being competent in academic research, having knowledge and skills in design, being acquainted with scientific trends in this domain, knowing how to reflect critically, to reason logically and to act constructively, knowing how to communicate about their work and to work together with colleagues, non-colleagues and other parties, and being aware of societal consequences of developments in this domain. The intended learning outcomes build upon those of the Bachelor Electrical Engineering programme.

The programme offers thirteen specialisations. Students select one of the specialisations offered by the electrical engineering research chairs in the faculty of Electrical Engineering, Mathematics and Computer Science. These specialisations are Communication Networks, Computer Vision and Biometrics, Dependable Integrated Systems, Integrated Circuit Design, Integrated Optical Systems, Lab on a Chip Systems, Micro Sensors and Systems, Nanoelectronics, Neurotechnology and Biomechatronics, Power Electronics, Radio Systems, Robotics and Mechatronics, and Semiconductor Devices and Technology.

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 master 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 in the coming years.

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 master programmes in the electrical engineering domain. The panel acknowledges this Master Electrical Engineering programme to build upon the Bachelor Electrical Engineering programme and to prepare students to enter 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 master 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 25 students in 2015 to 57 students in 2021. In 2019 and 2020, the intake numbers were the highest in these seven years at 89 and 74 students. Over the years, the proportion of international students varies between 20 % and 50 % of total inflow, being on average 35 % over the last seven years. The proportion of female students is quite low, varying between 4 % and 21 % of total intake in these seven years and being on average about 13 % of the inflow. Programme management is making efforts to raise the percentage of female students.

Three categories of applicants are eligible for admission to the programme. Applicants having completed the Bachelor Electrical Engineering programmes of one of the Dutch universities of technology are admitted directly. Applications by students with other university bachelor degrees are screened by the admission committee. This committee decides on the admission of these students and on their obligation to complete a tailor-made pre-master programme or to take homologation courses in this Master programme. Applicants with suitable university of applied sciences (HBO) diplomas have to take the fixed pre-master programme (30 EC) first. Interested students are offered a range of opportunities to obtain information about the programme.

In the curriculum of this programme, students are to select one of the thirteen specialisations offered. Students' study plans are largely determined by the specialisation they opt for. Programme mentors, who are staff members, are assigned to students to assist them in composing the study plans, and in bringing these in line with the specialisation they have chosen. The Examination Board approves study plans. The specialisations are offered by the research chairs in the faculty, and relate to application subdomains in the electrical engineering domain. The first year of the programme consists of course work, covering compulsory specialisation courses (20 EC), non-technical courses (5 EC to 10 EC), and advanced specialisation courses and electives (30 EC to 35 EC). The compulsory specialisation courses are defined for each of the specialisations separately and offer students basic knowledge and skills in the specialisation subdomain. The non-technical courses (5 EC) are mandatory and address ethical issues, and social and ecological dimensions of design processes. Students may add another 5 EC of non-technical courses. The specialisation courses and electives are meant for students to obtain advanced in-depth knowledge and skills in the specialisation subdomain. In the selection of these courses, the programme mentor guards the coherence of the study plan and matches the study plan to the subject of the Master thesis project. In the second year of the curriculum, students do the internship (20 EC) and complete the Master thesis project (40 EC). Internships are done in companies, where students work on well-defined problems in the professional environment of these companies. Master thesis projects are individual research projects, meant to solve complex problems in the selected specialisation.

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. PhD students are involved in the programme as teaching assistants in labs, tutorials or projects. They are trained to perform these duties and they are always guided by staff members.

The educational concept of the programme rests upon the combination of theoretical knowledge and practical design and application, matching students' future professional environment. In the programme courses, a variety of teaching methods is offered. The methods include lectures, tutorials, supervised practical work, self-study activities, and projects.

Students experience this programme as demanding, but manageable. Programme management has organised educational processes and study guidance to support students. Face-to-face education amounts to 8.5 hours per week in the first year, and 1.3 hours per week in the second year. The other hours in the first year are non-supervised practical work. In the second year, the vast majority of study hours are spent on project work in internships and Master thesis projects. The student-to-staff ratio is little over 21 : 1. Onboarding processes at the beginning of the programme foster students getting acquainted with and integrating in the programme and mixing among themselves. Both staff and students indicated students from different backgrounds to mix fairly well in the programme, although mixing is harder than in the Bachelor programme on account of the diversity of students' study paths. The programme's study advisors support students, provide study advice and refer them to other services, when needed. As has been said, students are guided in the composition of their study plans by programme mentors, being staff members of one of the research chairs, which offer the programme specialisations. Specialisations are presented during a market event, allowing students to choose between them. Students are assisted in finding and acquiring internships. In internships, students are guided by the internship supervisor of the university in collaboration with the company supervisor. When students start their Master thesis projects, the Master thesis supervisor guides them in this process. The student success rate for students graduating within three years for this programme was on average 55 % for the last six years. The student drop-out rate was on average 14 % for the last four years, ranging from 9 % to 22 %. Programme management acknowledges these relatively disappointing figures 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. Online internships were permitted and the order of internships and Master thesis projects could be reversed to wait for favourable conditions for the thesis work. Steps were taken by programme management 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 gradually rising number of incoming students in the programme, as the demand for electrical engineers will continue to increase over the years. The panel endorses, nevertheless, efforts by programme management to increase the influx of students and advises to raise this number. 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 regards the curriculum to be well aligned with the intended learning outcomes of the programme. The curriculum has been logically and coherently structured. The panel approves of the curriculum set-up with courses, internships and Master thesis projects. The courses themselves are well-organised as well. The programme mentors are very helpful in arranging coherent study plans for students, enabling them to become knowledgeable and skilful in the specialisation of their choice.

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 in teaching activities is seen as beneficial by the panel.

The panel considers the educational model of the programme, based upon the combination of theoretical knowledge and practical design and application, 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 welcomes students being encouraged to look for theory to match practical problems, which is the reverse order from the Bachelor programme.

The panel is positive about the student guidance in the programme, as provided by study advisors, programme mentors, internship supervisors and Master thesis projects supervisors. Interaction between students and staff is informal. As the student success rates and the student drop-out rates of the programme are less favourable, the panel advises programme management to take steps to improve these figures.

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 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 courses in 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, reports or papers, or presentations. Examination methods are selected in line with the teaching methods adopted and the course goals to be assessed. Fraud and plagiarism procedures are in place. Internships are assessed on the basis of the report by the university internship supervisor, having consulted with the company supervisor.

The Master thesis projects are individual research projects. They may be written as reports or in scientific article format. The projects are guided by committees, led by senior examiners. Day-to-day supervision may be in the hands of one of the PhD students in the research chair. 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.

Recently, the Master Electrical Engineering programmes of the three universities of technology started the theses carrousel, exchanging theses among them and comparing the assessments. The Examination Board considers the theses carrousel as an important, good practice quality measure and recommends to continue and expand it.

Programme management and the Examination Board have taken measures to assure the quality of the examinations and assessments in the programme. The Examination Board monitors the relations between the programme intended learning outcomes, the learning goals of the courses and the assessments. For all courses, 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 Master 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 proctored written examinations, online oral tests, assignments with reports or open-book 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 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 courses.

In the panel's opinion, the procedures for the assessment of the Master 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 the rubrics. The panel welcomes the steps which have been taken to promote consistent and balanced grading of these Master thesis projects. The panel advises to continue and strengthen the theses carousel with the programmes of the other universities and to extend this carousel to the Bachelor programmes.

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 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 Master thesis projects of graduates of the programme of the last three years. Students do their projects at one of the electrical engineering research chairs within the faculty. The average grade for all projects is about 7.7 for the last three years.

As said before, graduates of this programme are prepared to enter the labour market. Graduates of the programme tend to find suitable positions quite easily. About 21 % of them entered PhD trajectories. About 58 % of the graduates found positions in industry in the Netherlands. The others were mainly employed in industry outside of the Netherlands or at research/education institutes. In the alumni survey held in 2020, programme alumni rated the programme quality at 4.5 out of 5.

Programme management maintains relations with the professional field, to ensure the programme to meet 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 the examinations to conform to and to test appropriately the goals of the courses.

The Master 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 master level requirements in the domain of electrical engineering.

The positions, which graduates of this programme manage to secure, 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 and to raise the intake of the programme.
- To take steps to raise the proportion of female students.
- To take measures to improve the student drop-out rates
- To take steps to raise the student success rates.
- To continue and strengthen the theses carrousel with the programmes of the other universities and to extend this carrousel to the Bachelor programmes.

## Appendix: Assessment process

University of Twente requested evaluation agency Certiked VBI to support the limited framework programme assessment process for the Master 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 Master thesis projects of students having graduated in the three most recent years (all graduates from 1 September 2019 to 24 June 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 specialisations were 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 Domain-Specific Frame of Reference
- Relations of intended learning outcomes to curriculum
- Overview of curriculum
- Concise course descriptions
- Education and Examination Regulations
- Overview of staff
- Overview of staff qualifications
- Number of incoming students
- Student success rates
- Drop-out rates
- Student-to-staff ratio
- Contact hours
- Specialisations, Electrical Engineering disciplines and domains of application
- 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 Master 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 Master 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 Master 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.