

Assessment report  
Limited Framework Programme Assessment

**Master Electrical Engineering**

Eindhoven 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 Master Electrical Engineering programme of Eindhoven 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 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 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 are done adequately.

The panel recommends to reconsider the labelling of the specialisations and tracks of this programme, achieving more clarity and more coherence in the programme's structure and improving the alignment of the Bachelor and Master programmes. Adapting the labels may also add to the understanding of the programme by prospective students.

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

The 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 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 graduation projects, and is well aligned with the intended learning outcomes of the programme. The courses themselves are well-organised as well. The 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 notes the substantial number of electives and advises to consider limiting this number.

The teaching staff is very much suited to teach in this programme. Their educational capabilities are up to standard, as 75 % of them are BKO-certified. Teachers relate teaching to their research. Industry representatives teaching in the programme enable students to get a view of the professional practice.

The study methods of the programme are adequate means to convey knowledge and skills in the programme domain. The design-based or challenge-based learning projects are welcome additions to the range of study methods.

The academic advisors in the programme as well as the mentors assure effective student guidance. The student success rates and drop-out rates of the programme are favourable.

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 in the Covid pandemic are sound. The Examination Committee 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 are in line with university and department rules and regulations. The measures to assure the quality of examinations and assessments are adequate. The Examination Committee is solid and active in performing their duties.

The examination and assessments of the courses are well-aligned with the course goals and through these course goals with the programme intended learning outcomes. The predominance of written examinations is understandable, but other examination methods are beneficial. The instruments adopted to assess performances of individual students and to counter free-riding are many-sided and effective. The assessment of the internships is reliable.

The procedures for the assessment of the Master graduation projects, with the Graduation Committees of examiners, and the standardised graduation project evaluation form, assure well-founded assessments. The introduction of qualitative guidelines for grading or rubrics has further improved the grading of these projects. The panel advises to continue and strengthen the theses carousel with the other universities' programmes and to invite the Bachelor programme to extend this carousel to this programme.

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 graduation projects meet the requirements of a master programme in the electrical engineering domain. The Master graduation projects 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 Board of Advice are instrumental in aligning the programme with professional field requirements. Seeing the range of relations between programme management and staff and the professional field, the panel advises to adjust and combine these relations to be more effective.

Having conducted the assessment of the Master Electrical Engineering programme of Eindhoven 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, 15 January 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
Tracks:	Connected World Technologies Care and Cure Artificial Intelligence Engineering Systems (until September 2022)
Location:	Eindhoven
Mode of study:	Full-time (language of instruction: English)
Registration in CROHO:	21PG-60353
Name of institution:	Eindhoven 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 Master Electrical Engineering programme is one of the programmes of the Department of Electrical Engineering of Eindhoven University of Technology. The Departmental Board, chaired by the Dean, is responsible for decisions on research, education, finances, personnel and support at the departmental level. The Vice-Dean Education, who is one of the members of the Departmental Board, serves as the programme director of both the Bachelor and Master Electrical Engineering programmes and has the responsibility to assure the quality of these programmes. The programme director is assisted by two programme leaders, one for each of the two programmes. They take care of the day-to-day management of these programmes. The Programme Committee for both the Bachelor and Master Electrical Engineering programmes, being composed of lecturers and students, advises programme management on the quality of these programmes. The Examination Committee, being positioned at departmental level, monitors and assures the quality of examinations and assessments of both this programme and the Bachelor Electrical Engineering programme.

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, more staff has been recruited to keep up with rising student numbers. Secondly, the number of staff having obtained the University Teaching Qualification (BKO-certified) was raised. Thirdly, students are informed better about available internships, the internships' learning goals and process are better communicated and the assessment of internships has been clarified. Fourthly, the form used for the assessment of the Master graduation project has been updated, with five distinct criteria to be graded and motivated by examiners and with qualitative guidelines for grading (rubrics).

This programme is a two-year or 120 EC academic master programme in the electrical engineering domain. The objectives of the programme are to prepare students for academic-level professional careers in this domain. The programme aims to train students to be able to do innovative research and design activities, and to analyse and realise electrical components and systems. Students of this programme 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 command of the electrical engineering domain, being familiar with the latest theories, methods and techniques in this domain, being competent in one of the electrical engineering subdomains, being able to do research and to design independently, knowing how to reflect critically, reason and form opinions, taking scientific approaches to solve complex problems, knowing how to communicate about their work and the results thereof in international contexts, and being able to work in multi-disciplinary or inter-disciplinary contexts. The intended learning outcomes build upon those of the Bachelor Electrical Engineering programme.

The programme allows students to select specialisations and tracks. Students select one of the specialisations offered by the nine research groups in the Department of Electrical Engineering. The specialisations are *Control Systems*, *Electro-Optical Communication*, *Electrical Energy Systems*, *Electromagnetics*, *Electromechanics and Power Electronics*, *Electronic Systems*, *Integrated Circuits*, *Photonic Integration*, and *Signal Processing Systems*. The tracks are optional and offer students certificates upon completion. These tracks are *Connected World Technologies*, studying the continuously increasing societal demand for communication services, *Care and Cure*, addressing challenges arising out of the ageing society, or *Artificial Intelligence Engineering Systems*, dealing with the development of new products in a wide range of applications. This last track was ended in September 2022 to become a separate master programme.

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 demonstrated in the self-evaluation report, the intended learning outcomes match the Meijers criteria for master programmes.

This programme meets university-wide Graduate School requirements. Around 2026, the Graduate School framework will change. This programme will then change as well, which will also be in response to changes in the Bachelor programme in 2023. Regular updates in the intended learning outcomes and curriculum are seen by programme management as important to adjust to new developments in the electrical engineering domain and to new educational views.

The name of the programme is in English. The language of instruction is English as well. This is the case since 2012. The main reason for adopting English in the name and in education is to prepare students for careers in international organisations, also in the Eindhoven Brainport region. In addition, English allows international students to enrol and enables to recruit international staff. In 2020, Eindhoven University of Technology adopted English as the official working language in research and education.

#### *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 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 of this programme by programme management.

The labelling of the structure of the specialisations and the tracks of this programme should, in the panel's eyes, be organised with better labels more clearly and more coherently. The panel advises to reconsider this labelling to achieve more clarity and more coherence in the programme's structure and to improve the alignment of the Bachelor and Master programmes in this respect.



Adapting the labels may also add to the understanding of the programme by prospective students, and manage students' expectations better.

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 the last eight years, but the gradual increase of incoming students has been the trend. While in the years 2013 to 2015 the intake was yearly 95 students on average, the intake in the years 2018 to 2020 had grown to 120 students per year on average. About 30 % of the incoming students are international students, coming mainly from countries outside of Europe. Programme management is content about the intake numbers of international students. Both staff and students indicated students from different backgrounds to mix well in the programme. The proportion of female students in the last five years is quite stable at about 15 % of total intake. Programme management is making efforts to raise the percentage of female students.

Interested students are offered a range of opportunities to get information about the programme. 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. Applicants with university of applied sciences (HBO) diplomas in electrical engineering or mechatronics have to take the pre-master programme first. Applications by students with university bachelor degrees in disciplines other than electrical engineering or students with university degrees in electrical engineering coming from abroad are screened by the Departmental Admissions Committee. This Committee decides on the admission of these students and on their obligation to take homologation courses in this Master programme or to complete the pre-master programme.

This Master programme is embedded in the university-wide Graduate School framework. Students are to select one of the twelve specialisations offered. Students' study plans are largely determined by the specialisation they opt for. Mentors, who are staff members, are assigned to every one of the students to assist them in composing the study plans, bringing these in line with the specialisation they have chosen. The Examination Committee formally approves these study plans. Nearly all courses are scheduled in the first year and have 5 EC of study load. Some courses carry 2.5 EC of study load. All students take three compulsory core courses in the first quarter of the programme, selecting these from a list of nine courses. The choice is free, but may be restricted by the specialisation chosen. Students take two specialisation elective courses, obviously depending upon the selected specialisation. Students taking one of the optional tracks *Connected World Technologies*, *Care and Cure* or *Artificial Intelligence Engineering Systems* (ended in September 2022) are obliged to take pre-determined specialisation courses. Students have six more free elective courses they can choose. These electives are meant as the preparation for the internship and the Master graduation project in the second year of the programme. Students may study the subjects of artificial intelligence and machine learning in their elective space. In addition, students take two shorter courses of 2.5 EC on professional development. They take the course *Research*

*Set-Up* and one out of two courses *Tutoring & Coaching*, training them to coach groups of bachelor students or *Career Development*, introducing them to job orientation and acquisition. The internship in the second year (15 EC) is meant to train students the research skills and design skills within their specialisation. Students can do their internship within any of the nine research groups of the Department or in research institutes or companies in the Netherlands or abroad. The curriculum ends with the Master graduation project (45 EC), in which students further develop research skills and design skills within the specialisation of their choice. The projects are advertised on the programme website and are done at one of the research groups of the Department. Excellent students may opt for courses offered by the university Honours Academy, allowing them to take 20 EC of courses on top of their regular programme. Yearly, about ten to twenty students are admitted to the honours programme. The NXP Foundation, related to the company with this name, offers ten scholarships every year. These students take part in the honours programme as well. Programme management is pleased with these scholarships, as are students.

In the self-evaluation report, programme management presented the overview of relations between the intended learning outcomes and curriculum components. This overview showed the core courses, specialisation courses, internship, and graduation project to cover the intended learning outcomes of the programme.

The teaching staff is composed of full professors, associate professors, assistant professors and teachers. Staff members are researchers in this domain and connect teaching to their research. About 47 FTE of staff (40 % educational time of the total of 117 FTE of staff in the Department of Electrical Engineering) are involved in teaching in the Bachelor and Master Electrical Engineering programmes. The proportion of BKO-certified teachers is about 75 %. In addition, PhD students in the Department of Electrical Engineering spend 10 % of their contracted time on education (tutoring lab work, instructing in guided self-study sessions, supporting examiners in examinations' correction). Some PhD students have extended, five-year contracts and are for 25 % of their time involved in teaching activities. PhD students are trained to be able to guide students. Some teachers in the programme are working in industry, teaching one day per week in the programme. These hybrid teachers are supported in their teaching and are encouraged to obtain their BKO-certification.

In the programme courses, a variety of teaching methods is offered. The methods include lectures, guided self-study sessions, instructions, practical sessions, tutoring in small groups, and design-based or challenge-based learning projects. In design-based or challenge-based learning projects, students work in small groups and are taught to design systems, artefacts or solutions.

In the first quarter, students have twelve hours of face-to-face education per week. On the basis of 47 FTE of teaching staff, the students-to-staff ratio can be calculated at about 25 : 1. The academic advisors in the programme support students with information, track their study progress, provide study advice and refer them to other services, when needed. As has been mentioned above, students are guided in the composition of their study plans by mentors, being staff members of one of the research groups of the Department. The student success rates within three years are quite stable for the last six years at about 77 %. The average study duration is somewhat below 2.5 years, with

reasonable differences, however, in students' gender or origin. Over the most recent six years, only about 7 % of the students per year drop out of the programme.

At the beginning of the Covid pandemic, a departmental working group was installed to make the transfer to online education during the pandemic as smooth as possible for students and teachers. Theoretical lectures were transformed into online lectures. Practical sessions were organised on-campus as much as possible. When this was not feasible, online labs were organised and home study kits were made available. The departmental working group made arrangements to facilitate students doing internships and graduation projects, as these proved especially hard to organise. Students struggled in the pandemic, but were, as is evident from student surveys held during the pandemic, positive about the transition to online education and online examinations. Currently, programme management is in the process of evaluating online education to see which formats may be retained.

#### *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 notes the relatively low proportion of female students and advises programme management to take steps to raise their numbers.

The panel evaluates the entry requirements and admission procedures to be 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 panel approves of the curriculum set-up with courses, internships and Master graduation projects. The courses themselves are well-organised as well. The 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 notes the substantial number of electives and advises to consider limiting this number.

The panel considers the staff as very much suited to teach in this programme. The educational capabilities of the teachers are up to standard, as 75 % of them are BKO-certified. 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 appreciates industry representatives teaching in the programme, as this enables students to get a view of the professional practice.

The panel evaluates the study methods of the programme as adequate means to convey knowledge and skills in the programme domain. The panel is positive about the design-based or challenge-based learning projects.

The panel approves the student guidance in the programme, as provided by the academic advisors and the mentors. The student success rates, study duration, and drop-out rates of the programme are favourable. Special attention should, however, be given to differences in gender and students' origin.

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 during 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 guidelines of the Graduate School of the university and to the assessment policy of the Department of Electrical Engineering. Along with the Regulations of the Examination Committee, they lay the groundwork for the examinations and assessments. As has been indicated, the Examination Committee has the authority to monitor and assure the quality of examination and assessment processes and products of this and the Bachelor Electrical Engineering programme of the Department.

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, being written examinations, oral examinations, presentations, homework assignments, quizzes and projects. Examination methods are selected in line with the course goals to be assessed. Because of the programme scale and for efficiency reasons, written examinations are predominant in the programme. The course coordinators determine the weights of the components within the courses. The Examination Committee regularly checks the course goals, the various examination components, and the weights. Fraud and plagiarism procedures are in place. In the design-based or challenge-based learning projects, students work together in small groups. To prevent free-riding in these projects, individual examinations within these projects are scheduled and additional means, such as peer review among students, are adopted.

The internships are graded on the basis of students' specialisation knowledge, design and research, execution, report, presentation and defence. The assessments are done with the use of the internship evaluation form, specifying these categories.

The Master graduation projects are assessed by graduation committees of at least three examiners from the Department of Electrical Engineering, in some cases joined by advisors. Halfway through the projects, students are to present their results at that point in time. The graduation committee gives feedback on these results in terms of progress, timeline and planning. The committee assesses the Master graduation projects at completion, using the standardised graduation project evaluation form. This form lists criteria to determine students' knowledge of the specialisation, research and design qualities, execution of the project, report writing and oral presentation and defence. For these Master graduation projects, programme management introduced qualitative guidelines or rubrics for grading.

Recently, the Master Electrical Engineering programmes of the three universities of technology started the theses carousel, exchanging theses among them and comparing the assessments.

Programme management and the Examination Committee have taken measures to assure the quality of the examinations and assessments in the programme. The assessment of the courses

conforms to the course goals. In the programme course catalogue, the assessment of courses, including the calculation of the final grades of courses, are clarified for students. Students with whom the panel met, found the grading in the curriculum components transparent.

The departmental working group, which was installed at the beginning of the Covid pandemic for the transition to online education, also had the task to make the transfer to online examinations and assessments during the pandemic as smooth as possible for students and teachers. Teachers designed alternative examinations for courses, such as take-home assignments, oral examinations and online examinations. The Examination Committee ensured these examinations to cover the course goals and took measures to counter fraud. At the moment, programme management is in the process of evaluating online examinations to see which formats may be retained.

#### *Considerations*

The panel approves of the examination and assessment procedures in the programme, which are in line with university and department rules and regulations. The panel is positive about the position and responsibilities of the Examination Committee.

The examination and assessments of the courses are well aligned with the course goals and through these course goals with the programme intended learning outcomes. The panel understands the reason for the predominance of written examinations, but is pleased to see other examination methods as well. The instruments adopted to assess the performances of individual students and to counter free riding are many-sided and effective. The assessments of the internships are reliable.

In the panel's opinion, the procedures for the assessment of the Master graduation projects, with the graduation committees of examiners, are effective to arrive at reliable assessments. The panel is equally positive about the standardised graduation project evaluation form adopted in this assessment process. The panel sees the introduction of qualitative guidelines for grading or rubrics as important for further improving the grading of the Master graduation projects. The panel advises to continue and strengthen the theses carousel with the programmes of the other universities and to invite the Bachelor programme to extend this carousel to this programme.

The panel finds the measures taken to monitor and assure the quality of examinations and assessments to be up to standard. The Examination Committee is solid and active in performing their duties.

The panel finds the measures taken by programme management to organise examinations and assessments in the Covid pandemic to be sound. The Examination Committee 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 Master graduation projects of graduates of the programme of the last three years. The average grade for all projects of the last three years is about 8.0.

The proportion of students graduating with the cum laude distinction is about 15 % in the last eight years. The Examination Committee intensively monitors this figure to keep the percentage of cum laude distinctions within bounds. Thus far, the Examination Committee regards the grades given as warranted and not inflated.

As explained before, graduates of this programme are explicitly prepared to enter the labour market. Graduates tend to find suitable positions quite easily. More than 80 % of them secured positions within three months after graduating. About 40 % of the graduates continued their studies in PhD trajectories. Excluding these PhD students, more than 90 % of the graduates found positions in industry. In the alumni survey held in 2022, programme alumni rated the programme quality at 8.2 out of 10.

Programme management maintains relations with the professional field, to ensure the programme to be aligned with industry requirements. The Board of Advice, 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 finds these examinations to conform to and to test adequately the goals of the courses.

The Master graduation projects the panel studied, match the programme 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 projects are evaluated by the panel as very good. The quality and academic level of the graduation 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 Board of Advice as a means to align the programme with professional field requirements. As the panel detected variety in



relations of programme management and staff with the professional field, the panel advises to adjust and combine the relations to be more effective.

*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 reconsider the labelling of the specialisations and tracks, achieving more clarity and more coherence in the programme's structure, improving the alignment of Bachelor and Master programmes, and adding to the understanding of the programme by prospective students.
- To take steps to raise the number of female students.
- To consider limiting the number of electives.
- To continue and strengthen the theses carousel with the other universities' programmes and to invite the Bachelor programme to extend this carousel to this programme.
- To adjust and to combine the relations with the professional field to be more effective.

## Appendix: Assessment process

Eindhoven University of Technology 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 the 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 Eindhoven 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 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 forwarded the list of Master graduation projects of students graduated in the most recent years (2018, 2019, 2020, 2021). Acting on behalf of the assessment panel, the process coordinator/secretary selected fifteen projects from this list. The grade distribution in the selection corresponded to the grade distribution in the list forwarded by programme management. In the selection of the projects, the programme tracks and the programme specialisations were covered.

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

- Relation between study components and intended learning outcomes
- Preference core courses per specialisation
- Overview specialisation courses
- Student data
- Overview of study methods and examination methods
- 3TU Domain-Specific Frame of Reference Electrical Engineering
- Graduate School Guidelines 2021
- Examination Committee Regulations Electrical Engineering 2020/2021
- Programme and Examination Regulations Master Electrical Engineering 2020/2021
- Quality assurance plan Electrical Engineering 2021/2022
- Assessment policy Electrical Engineering 2021
- Examination Committee annual reports 2019/2020 and 2020/2021
- Programme Committee annual reports 2019/2020 and 2020/2021
- Education 2030, drivers of change, Eindhoven University of Technology
- Department of Electrical Engineering educational vision
- Overview teaching staff
- 4TU BKO regulations
- Language policy, Eindhoven University of Technology
- Minutes departmental Board of Advice, June 2021
- Board decisions related to Coronavirus measures
- Electrical Engineering Corona regulations 2020/2021
- Student project regulations during the Corona period
- Use of proctorio, Eindhoven University of Technology
- Report evaluations Master graduation project Electrical Engineering 2020/2021
- Report evaluations Internship Electrical Engineering 2020/2021
- Report end-of-year surveys Electrical Engineering, 2020/2021
- Report hybrid education survey Electrical Engineering
- Alumni survey results Master Electrical Engineering
- Course descriptions
- Course material and course examinations

In addition, all of the expert panel members studied a number of Master 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 self-evaluation report and the Master 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 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 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 16 November 2022, the panel conducted the site visit on the campus of Eindhoven 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 Department of Electrical Engineering representatives and programme management
- 09.30 – 10.30 Programme management, core lecturers, academic advisor
- 10.45 – 11.15 Examination Committee
- 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, and programme alumni
- 14.45 – 15.15 Representatives professional field
- 15.15 – 16.45 Deliberations panel (closed session)
- 16.45 – 17.00 Presentation main findings by panel chair to programme representatives
- 17.00 – 17.30 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.