FINNISH EDUCATION EVALUATION CENTRE

ACCREDITATIONS OF THE DEGREE PROGRAMMES IN ELECTRONICS AND COMMUNICATIONS ENGINEERING AT THE UNIVERSITY OF OULU 2023

Roger Midtstraum | Kati Isoaho | Terhi Lukkari-Kymäläinen
Matti Mäntysalo | Arnoldas Solovjovas

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Description of the accreditation process and of the degree programmes

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1.1 Aim of the pilot accreditations

The aim of FINEEC's Engineering Programme Accreditations is to support the enhancement of quality in engineering degree programmes and to provide higher education institutions with he means of deciding whether an engineering degree programme provides its graduates with the academic qualifications necessary for a career in the engineering profession. FINEEC's accreditation concept is based on the international EUR-ACE standard owned by the European Network for the Accreditation of the Engineering Education (ENAEE). Accreditation assesses the way an engineering degree programme is planned, delivered and developed to ensure that the students reach the programme outcomes and how the programme outcomes align with the reference programme outcomes set in the FINEEC Engineering Programme Accreditations manual. The reference programme outcomes describe the knowledge, skills and competencies that engineering students should have acquired by the time they have completed a degree programme in engineering. The reference programme outcomes are described separately for the Bachelor's degree programmes and for the Master's degree programmes. The accreditation evaluates the extent to which the set standards for programme's planning, implementation, resources and quality management are met.

FINEEC has carried out engineering degree programme accreditations since 2014 at the Finnish universities of applied sciences. FINEEC is authorized by ENAEE to award the EUR-ACE labels to the 4-year degree programmes of 240 ECTS. To extend its mandate to the 3-year and 2-year degree programmes, FINEEC carries out pilot accreditations in 2022–2023. These accreditations belong to those pilot accreditations. The aim of the extension is to be able to better serve the whole higher education sector in Finland, along with the universities and universities of applied sciences.

1.2 Degree programmes in Electronics and Communications Engineering

This review covers two degree programmes as follows: Bachelor´s Degree Programme in Electronics and Communications Engineering and Master´s Degree Programme in Electronics and Communications Engineering. The main language of instruction is Finnish in the Bachelor's degree programme and English in the Master's degree programme. There are five specializations in the Master´s Degree Programme:

- Electronics Design
- Electronic Materials and Components
- Communications Engineering
- RF Engineering
- Photonics and Measurement Technology

The Master´s degree programme entity also includes two international master´s degree paths, along with separate admissions: Electronics and Wireless Communications Engineering.

The degree programmes belong to the University of Oulu and its Faculty of Information Technology and Electrical Engineering.

The degree programmes lead to a Bachelor of Science (Tech) degree and a Master of Science (Tech) degree. The Bachelor's degree programme consists of 180 ECTS and intended study time for full-time studies is three years. The Master's degree programme consists of 120 ECTS and intended study time for full-time studies is two years.

2023 intake for the combination of the Bachelor´s Degree Programme and the Master´s Degree Programme is 115 students. Admitted students get simultaneously two study rights, both to the Bachelor´s Degree Programme and Master´s Degree Programme. In addition, there is an intake of 20 students directly to the Master´s Degree Programme. Intake for the international Master´s Degree Programmes is 30 for Electronics and 30 for Wireless Communications Engineering.

The curricula for 2021-2022 were used in the review process.

1.3 The accreditation process

The accreditations were conducted in accordance with the principles set in the FINEEC standards and procedures for engineering programme accreditation document (FINEEC 1:2022). The schedule of the accreditations was the following:

- The accreditation team was appointed by the FINEEC Committee for Engineering Education on 8th September 2022.
- University of Oulu submitted the self-evaluation report on 21 October 2022.
- A site visit to the degree programmes was conducted on 5-6 June 2023. The programme
- of the visit is given in table 1. The original date for the visit was 21-22 November 2022. However, due to the force majeure, there was a need to reschedule the review process jointly by FINEEC and the University of Oulu.
- Decision making meeting of FINEEC Committee for Engineering Education on 8 September 2023.

TABLE 1. Site visit programme

Site visit programme	
Monday 5th June 2023	**Tuesday 6th June 2023**
9.00-10.00 Interview with the management of the university and the degree programmes under review 8 persons	09.00-9.50 Interview with the external stakeholders 8 persons
10.15-11.15 (a parallel session) Interview with the academic staff, Master´s degree programme 8 persons	10.05-10.55 Interview with the students of the Bachelor´s degree programme 8 persons
10.15-11.15 (a parallel session) Interview with the academic staff, Bachelor´s degree programme 8 persons	11.10-12.00 Interview with the alumni of the degree programmes 8 persons
11.30-12.20 Interview with the support services staff 8 persons	13.30-14.20 Interview with the Master´s degree programme students 8 persons
13.35-14.35 Academic staff presented examples on the teaching and assessment methods (demos), Bachelor´s degree programme	14.35-15.35 Academic staff presented examples on the teaching and assessment methods (demos), Master´s degree programme
14.40-16.20 Facilities tour	15.35-16.50 Accreditation team´s meeting
16.30-18.30 Accreditation team´s meeting	17.05-17.50 Initial feedback for the university and the degree programmes´ management

1.4 The accreditation team

Team chair:

Roger Midtstraum, Vice-Dean for Education, Faculty of Information Technology and Electrical Engineering, Norwegian University of Technology and Science (NTNU). Norway.

Team members:

Terhi Lukkari-Kymäläinen, Lead service designer & Design team lead, Head of design; Norcloud, an IBM company (by 03/2023, since this a free consultant), Finland.

Matti Mäntysalo, Professor (electronics), Faculty of Information Technology and Communication Sciences, Tampere University, Finland.

Arnoldas Solovjovas, PhD student (electronics and telecommunication technologies), Vilnius University, Lithunia.

Senior Evaluation Advisor **Kati Isoaho** from FINEEC acted as a Project Manager for the accreditations.

1.5 Evidence used in the accreditations

The self-assessment report, along with the following appendices:

- Example of the competence assessment form for the employer.
- Memo of the teaching development seminar.
- Course level learning analysis.
- University of Oulu Education Regulations.
- The list of course responsible teachers.
- The list of all course teachers.
- Quality Handbook.
- Admission statistics.
- Graduate statistics.
- Graduate Survey Results of 2021.
- Career Survey Results of 2021
- Accreditation team had access to the university´s intranet during the review process.
- Information gathered during the site visit within the interviews with the university and the degree programme management, academic staff, support services staff, current students, alumni as well as key stakeholders. Academic staff and students were interviewed separately for the Bachelor´s degree programme and Master´s degree programme.
- Information gathered in the teaching demo sessions arranged during the site-visit. Sessions covered both degree programmes under review.
- The facilities tour on the university and the degree programmes´s facilities, including classrooms, self-study spaces, libraries and laboratories such as FabLab.
- Evidence gathered by the degree programmes for the electronic evidence room, such as course materials, thesis works, project works and examples of course feedback as well as material on the degree programme staff´s research publications.

The accreditation team requested and received the following extra materials from the degree programmes:

- Evidence material about level of reaching the learning outcomes in the following categories: communication and team-working and multidisciplinary competences.
- Number of staff man years allocated to the degree programmes.
- Number of students involved as assistants to the implementation of the degree programmes.
- Description of the level of English language skills of the teachers and how it is assessed.
- Description of the equipment development plan (future view).
- Additional description on the Bachelor´s Degree Programme´s compliancy with the National Qualifications Framework.

2

Evaluation of the fulfilment of the accreditation standards

2

2.1 Planning of the programme

Standard 1 The programme aims, which describe the educational task and purpose of the programme, are consistent with the mission of the higher education institution and reflect the identified needs of employers and other stakeholders.

The strategy of the University of Oulu emphasizes a commitment to "work as part of the international science community to produce new scientific information and science-based solution" and to educate candidates who can be "future pioneers to build a more sustainable, intelligent and humane world". Given the university's location in the north of Finland, the university has a strong commitment in contributing in the development of the northern part of Finland, as stated in the university strategy: "The research done at the University of Oulu benefits people living at all latitudes, but as one of the Northernmost international science universities, we have a particular responsibility toward questions related to the Arctic. We also feel a responsibility toward the well-being of society. The University of Oulu's high-quality research and education have been the basis for the most significant research and innovation hub of the furthers reaches of Northern Europe".

The self-assessment report states that "The Electronics and Communications Engineering (ECE) degree programme aims to meet the needs of electronics and telecommunications experts in Northern Finland especially the regions of Northern Ostrobothnia, Lapland and Kainuu". According to the self-assessment report, Business Oulu has estimated that the number of ICT companies in the region is about 1000 and that approximately 20000 are employed in ICT related jobs.

The degree programmes under review have processes in place for consulting stakeholders on their needs and opinions on educational contents. In addition, many core functions- such as research groups'work - include parts which also serve examining the key features of future education.

The degree programmes under review have defined ICT companies to the be most important partners in identifying the general aims of the programmes. The University's permanent organisational units, namely the Information Technology and Electrical Engineering Faculty Board and the university-level Council for External Relations, elaborate the future educational needs along

with the programme aims for both degree programmes under review. In addition to the staff and student representatives, Faculty Board also includes stakeholder members. Same is also true for the Council for External Relations. The Council represents different stakeholders and fields of activity of the university.

The research units involved in the teaching of the degree programmes also have several networks, which provide a possibility to discuss and elaborate the educational needs in the context of ICT research and industry ecosystems. In many cases there are master's thesis workers on research projects both on the university and company side, and the researchers are part of the teaching staff. As explained in the self-assessment report, the research co-operation also creates an unofficial contact to education which helps the researchers/teachers understand the needs of industry and surrounding society. The teachers constantly hols discussions with ICT companies about the development needs they see. A typical feedback channel is a master's thesis competence assessment form filled by the employer. The employer assesses where the student has been successful and what kind of skills should be improved respectively.

From the degree programmes descriptions, one can learn that the degree programmes aim to "train Bachelors and Masters of Technology for the electrical engineering industry, particularly in electronics and telecommunications industries, as well as research and educational institutions». Important objectives of the programmes are to offer a quality education in a stimulating and international learning environment, to provide the most recent knowledge based on high quality research, and to educate candidates with multi-disciplinary competences, ability to apply their competences, and a solid foundation for lifelong learning".

The programme aims are clearly stated and well aligned with university's strategy and the societal needs of the region. From interviews with external stakeholders and alumni it was apparent that there is high demand for the graduates from the degree programmes under review. There is an extensive level of cooperation between the university and relevant industry; related to joint research as well as more education-oriented activities.

Based on the team's assessment, the Bachelor's degree programme meets Standard 1.

Based on the team's assessment, the Master's degree programme meets Standard 1.

Standard 2 The programme learning outcomes, which describe the knowledge, understanding, skills and abilities that the programme enables graduates to demonstrate, are consistent with the programme aims, with relevant national qualifications frameworks (if applicable) and with the FINEEC reference programme learning outcomes.

The degree programmes in electronics and communications engineering provide students with comprehensive curricula that centre around electronic design, technical physics, and telecommunications technology. These areas are of significant global importance and hold particular relevance for the industry in the Oulu region.

In the self-assessment report, the programme learning outcomes for both the bachelor's and master's degrees are clearly defined. These learning outcomes are aligned with the reference learning outcomes outlined by FINEEC. In addition, the defined learning outcomes are in line with the overall degree programme objectives, emphasizing the acquisition of essential knowledge and skills in the field of electronics and communications engineering.

Bachelor's degree programme

The degree programme has defined its programme outcomes as follows:

"After completing the bachelor's degree, a student

- Knows the key concepts, methods and technologies of electronics and telecommunications technologies, and knows how to analyse, design and implement electronic circuits, devices and systems
- Able to apply electronics and communication technology in the applications of various industries such as the ICT industry, health and welfare sectors, and the automotive industry
- Can apply basic theories and concepts of natural sciences in solving technical problems
- Can apply methods and tools used in engineering work, such as measurement equipment, design and modelling software, programming environments and manufacturing equipment
- Holds the basic skills needed in working life, knows how to communicate in an international work environment and knows how to express technical matters in writing

After graduation as Bachelor of Science (Tech.), the student has an ability to study for a master's degree in electronics and communications engineering, as well as the general prerequisites for other education leading to a master's degree and for continuous learning."

In the self-assessment report it is mentioned that the bachelor's degree programme does not fully meet the requirements of the national qualifications framework, which is same for all the educational fields in Finland (FinnNQF, level 6). In the report it is stated that *"When comparing the BSc degree programme to the national qualification framework the learning outcomes somewhat differ due the framework is more work life oriented. Mainly the qualification levels are achieved".* At the site visit, the university was asked to clarify this statement and the degree programme management provided additional material right after the site visit.

In the framework it is said on level 6 degrees (unofficial translation from Finnish):

"Works independently as an expert in the field and in international cooperation or works as an entrepreneur. Leads complex professional activities or projects. Able to make decisions in unpredictable operating environments. In addition to evaluating and developing his own competence, he is also responsible for the development of individuals and groups."

Based on the extra material provided by the degree programme, the idea presented in the self-evaluation report is that the two degrees (bachelor and master) are tightly connected. It is supposed by the degree programme management that the students who graduate as bachelor continue studying for the last two years to achieve also the master's degree, and that the bachelor's degree is not the final degree for the students.

After reviewing the statement concerning the bachelor's degree, the degree programme management claims that the degree achieves the national qualification framework. They also state, that even though this is not systematically assessed, that many of the students do work in engineering positions after bachelor's degree and are able to work as independent experts. Furthermore, the degree programme management reminds that the bachelor's thesis is independent expert work and, students prove their capabilities in this process.

From the self-assessment report and interviews during the site visit, the accreditation team got the impression that the university primarily sees the bachelor's programme as a steppingstone towards a master's degree at the University of Oulu or elsewhere. As the national qualification framework as well as the EUR-ACE standard require bachelor's programmes to be considered as an independent programme, it could be beneficial if this aspect of the programme were more clearly emphasized in planning, implementation, and evaluation of the degree programme under review.

As the university has confirmed that the degree programme meets the requirements of the national qualification framework, the accreditation team finds that the overall programme learning outcomes are consistent with the relevant framework (level 6), are well aligned with the programme's aims, cover the FINEEC reference learning outcomes, and are formulated in a way that clearly states the competences that a student should have upon graduation.

Master's degree programme

The master's degree programme is designed to train students as specialists in specialization areas. The programme offers five distinct focus areas as follows:

- Electronics design
- Electronics Materials and Components
- Photonics and Measurement Technology
- Radio Engineering
- Telecommunication Engineering

These five areas are aimed for the students who enter the programme after completing the bachelor's degree in the same field at the University of Oulu. In addition – as described in chapter 1 – the degree programme entity includes two international master's degree paths conducted in English and that have separate admission procedures. Therefore, the master's degree programme as a whole works as an umbrella, which includes different study paths and choices.

All the study paths have same programme learning outcomes. The self-assessment report defines them as follows:

> *"to have an in-depth understanding of the key methods and technologies in a particular field of study in electronics and telecommunications technology, and be able to apply this knowledge independently in product development activities*

- to acquire and utilize the latest knowledge and special expertise in the field and to use it in product development, research, and expert tasks in the chosen field of study
- to produce new knowledge in their field of study for the needs of industry and society
- to carry out research using scientific research methods
- to set goals for themselves and work independently and in a group to achieve goals
- communicate and communicate orally and in writing in a clear and reasoned manner and
- to expand and deepen their own skills independently in the spirit of lifelong learning."

The primary goal of the master's degree programme is to produce professionals who are well-equipped to meet the demands of the electrical engineering industry and telecommunications

sectors as well as the demands of research and educational institutions. The curriculum emphasizes the development of electronics and telecommunications products and research capabilities.

To ensure that the degree programme remains relevant and responsive to industry needs, the courses and curriculum have been modified accordingly. For instance, there has been an increased focus on telecommunication hardware. Additionally, in order to meet the growing demand, the degree programme has increased the number of international students admitted. This not only enriches communication skills development during the studies but also addresses the industry's requirements.

As a summary, the programme's learning outcomes are aligned with established FINEEC reference standards, ensuring that graduates possess the necessary skills and knowledge expected in the field. They are also in line with the national qualification framework's level 7.

Based on the team's assessment, the Bachelor's degree programme meets Standard 2.

Based on the team's assessment, the Master's degree programme meets Standard 2.

Standard 3 The course level learning outcomes, including thesis work and possible practical training, aggregate to the programme's learning outcomes.

Bachelor's degree programme

The bachelor's degree programme provides a solid foundation in mathematics and natural sciences, laying the groundwork for in-depth knowledge of electrical engineering. Following a conventional engineering curriculum structure, the programme places a strong emphasis on mathematics and fundamental courses during the initial years, equipping students with a versatile toolbox for further studies.

In addition to core subjects such as mathematics, physics, and signal processing, the bachelor's studies encompass essential professional field studies. These include electronic design, computer technology and programming, measurement technology, electronic components and materials, and communication technologies. These specialized courses along with their own learning outcomes contribute directly to the learning outcomes of the whole programme. The studies are grouped in such a way that the student's professional knowledge accumulates right from the first year of study.

TABLE 2. The number of courses contributing to learning outcomes in the bachelor's degree programme, as presented in the self-assessment material. Categorization follows FINEEC reference programme outcomes.

	Total number of available courses	Knowledge and understanding	Engineering practice	Investigations and information retrieval	Multidisciplinary competences	Communication and team-working
Basic studies	19	9	2	2	12	11
Intermediate studies	19	18	17	14	10	6
Bachelor's thesis	1	0	1	1	1	1
Supplementary/optional studies (obligatory parts for all the students)	7	6	6	7	4	4

Learning outcomes of individual courses are well described in the full curriculum presented via the Peppi system on university website. In addition to learning outcomes, the curriculum contains information related to teaching methods, course content as well as study and student assessment methods.

In addition to the full curriculum, the accreditation team examined the appendix of the self-assessment report, which presented links between the courses and programme outcomes as seen by the degree programme itself. Course level learning analysis shows a strong expertise especially in "Knowledge and Understanding", "Engineering practise" and "Investigation and Information retrieval", as well as necessary skills related to "Multidisciplinary competences" and "Communication and team-working.

As a summary it can be stated that learning outcomes of the courses including the bachelor's thesis are aligned and aggregate to the programme learning outcomes.

Master's degree programme

The master's degree programme primarily prepares graduates for industry roles, and practical training plays a crucial role in their studies. The final year thesis work holds significant importance as it constitutes 25% (30 credits) of the entire master's level studies.

In addition to the curriculum presented on the university website via the Peppi system, the accreditation team evaluated the Course level learning analysis produced by the degree programme as a part of the self-assessment. Course level learning analysis shows the strong expertise especially in "Knowledge and Understanding", "Engineering practise" and "Investigation and Information retrieval" while the number of courses contributing to "Multidisciplinary competences" and "Communication and team-working" are slightly smaller. The table below summarizes the total number of courses and the number of courses contributing to the learning outcomes for each specialization area. The average size of a course is 5 ECTS.

TABLE 3. The number of courses contributing to learning outcomes in the master's degree programme, as presented in the self-assessment material. Categorization follows FINEEC reference programme outcomes.

	Total number of available courses	Knowledge and understanding	Engineering practice	Investigations and information retrieval	Multidisciplinary competences	Communication and team-working
Electronics Design	17	14	17	17	9	8
Electronics Materials and Component	27	25	26	27	18	17
Communications Engineering	29	25	25	26	20	17
RF Engineering	23	21	22	23	14	14
Photonics and Measurement Technology	20	19	20	18	15	13

There are five specialization areas, and the curriculum analysis demonstrates that all five specialization areas are balanced between learning outcomes. In other words, all the specializations allow to achieve the joint programme outcomes set for the master's degree programme as a whole.

As a conclusion, the learning outcomes of the courses including the master's thesis are aligned and aggregate to the programme's learning outcomes.

Based on the team's assessment, the Bachelor's degree programme meets Standard 3.

Based on the team's assessment, the Master's degree programme meets Standard 3.

Standard 4 The curriculum gives comprehensive information on all the individual courses of the programme, including thesis work and possible practical training, and is accessible to students.

The curricula of the degree programmes are publicly available on the university's website for students, applicants and the wider public in Finnish and English. They clearly describe the structure, the courses and schedule of implementations in different years and semesters for both degree programmes under review. Individual courses are appropriately described, including number of ECTS, schedule, course content, teaching and learning methods, assessment methods and grading, prerequisite courses, and learning outcomes. Additional course information will often be provided on the university's Moodle platform. Thesis work as well as practical training are included in the curricula and described accordingly.

From randomly checking a number of courses, the accreditation team found that the course descriptions along with course learning outcomes in general are of good quality and meet expectations. However, there are a few examples of overly short and superficial course descriptions, which would be obvious candidates for quality improvement work. One example of the latter is the course description for the bachelor's thesis, which is very short.

Based on the team's assessment, the Bachelor's degree programme meets Standard 4.

Based on the team's assessment, the Master's degree programme meets Standard 4.

Standard 5 The curriculum and the course timetable enable students to graduate in the expected time.

The University of Oulu has responsibilities and processes in place for ensuring, that students of the degree programmes under review have the possibility to graduate in the intended study time defined in the national regulations. Therefore, the degree programmes under review have established processes for planning and publishing of both curricula and course timetables.

The Vice Rector for Education approves the principles concerning the development and general timetable of planning curricula in the university after hearing from the Education Management Group, while the Education Dean approves the structures and general composition of curricula for degree studies, including course names, learning outcomes, course-specific matters and scope. The Programme Director is responsible for the planning, implementation and quality assurance of a degree programme.

The Programme Director prepares the curriculum structure and the timing plan for the Peppi system and takes them to the Educational Committee to be approved by the Education Dean. The curricula and timing plans are published online in Peppi Study Guide. Timetables are made jointly by degree programmes and a timetabling team at the Academic Affairs. Timetabling work includes all courses belonging to degree programmes. At the University of Oulu, units taking part in timetabling work are defined by the Education Council.

In timetabling work, an essential factor is that the required information is comprehensive and timely when saved to the system. Education deans and the persons in charge of the degree programmes make sure that the timetabling work stays on schedule and that timetabling work follows university level instructions on education planning and descriptions.

The degree programmes use student feedback for developing programme implementation, including the timing of the studies and allocation of the courses for the different study years. The self-assessment report states that feedback from students is collected throughout the academic year and the course of their studies. All the feedback is processed both in the Degree Programme Committee and in the Education Committee. The feedback is then utilized in developing and ensuring the quality of courses, teaching, curriculum, education, and the entire University of Oulu.

A personal study plan (PSP) is a plan made by a student on the contents, scope and duration of studies leading to a degree. The study plan is to be based on the curriculum and is made separately for both bachelor's and master's degree studies. A personal study plans degree studies shall be approved by the Programme Director, or a person appointed by them. Study plans which deviate from the curriculum on justified grounds as regards to the compulsory studies are to be approved by the Education Dean.

All students have a teacher tutor who guides the students in their development of the personal study plan. The teacher tutor meets the students biannually and can monitor the progress of studies for individual students as well as the whole group. Based on the interviews, the degree programmes emphasize this activity also in resourcing, as some of the teaching staff members have a remarkable time allocated for teacher tutor activities.

Students have proposed to have more "barrier-free" studies to help students to graduate within shorter time and by this to facilitate higher throughput at the programme level. To accommodate for this, the five mandatory courses in the final bachelor's study year have been organized so that they can be taken during both the autumn and spring semester.

The university regulations and processes, the student guidance system, and the different feed-back channels should as a system be appropriate to ensure that it is possible to graduate in the expected time. This is confirmed by the graduate statistics, which shows that 20 % of the bachelor's candidates and 38 % of the master's candidates graduate on time.

However, the high dropout rate of the bachelor's programme and the long graduation times for both programmes are perhaps the most challenging problems faced by the degree programmes under review. During the site visit several explanations for these problems were given, most prominently was that many students have part-time jobs in the industry, which take too much of their time. Other explanations given from students were that the first year is hard and packed with theoretical courses, that the foundation in mathematics from upper secondary school is too weak, that the degree programmes under review are more challenging than other programmes in subjects like economics, and that there are other more competitive study programmes. During different interviews there were mixed signals, and the accreditation team does not have sufficient information to a have strong opinion of the root causes of the problem.

Based on the self-assessment report, some adjustments have already been made to enhance the progress of the studies in the bachelor's degree programme. The industrial partners and the students have suggested that the organization of studies should be updated. The main concern has been the too theoretical early phase of studies. Concerning the industry, the problem has been traineeship periods for young students. When the students have studied more subject courses, it has been easier to find suitable positions for students in the organizations. In addition to this, the students have suggested to increase the interest of studies by offering subject courses earlier in studies. One concrete example has been moving the "Introduction to Computer Systems" course to the second study year.

Given that the dropout rate is so high, and the graduation times are so long, it would be wise to make a comprehensive analysis of the situation and initiate mitigating measures. Therefore, although some conclusions and actions have already been taken, there is need to work harder on this topic.

However, the degree programmes and study guidance operations are arranged in a manner, that allows to graduate on time.

Based on the team's assessment, the Bachelor's degree programme meets Standard 5.

Based on the team's assessment, the Master's degree programme meets Standard 6.

Standard 6 The criteria and process for student admission and transfer are clearly specified and published. Students should be informed of the qualifications necessary to enter the programme.

The University of Oulu follows the national regulations at the joint application system. This meand that Finnish universities have a 3+2 model in which secondary level graduates apply for the bachelor's and master's programmes initially and accepted students get two study rights at once. There is an option for choosing either English or Finnish based master's and bachelor's degree programmes. During the site visit and meeting with the stakeholders, the experts could not identify any drawbacks regarding the application system itself or its implementation concerning the degree programmes under review.

Interviewed international students found the application system very convenient and with clear help from the admission office of Oulu University, it becomes even easier for them to fill in all the needed documents.

During the site visit the accreditation team wanted to understand how the university runs its advertisement for attracting potential students to study in Oulu. Oulu University participates in national and local study fairs where they can present degree programmes, curricula etc. All needed information regarding the application, required qualifications to enter the degree programmes, study processes and curricula can be found on the university's website for applicants and the wider public.

The accreditation team feared that the huge drop-out rate for first-year students might be related to the unclear advertisement of the programme's aims and curricula for the newcoming students. However, current students confirmed that the provided information regarding the admission process, and structure of the degree programmes under review were easily approachable during the application process and provided realistic information on the bachelor's programmes profile.

The transfer system is designed for bachelor's students that are willing to change their current degree programme or to move to other higher education institution. This is a common practice to be found in Finland and every university may have their own system designed for student transfer. The university of Oulu runs a transfer application procedure twice a year. The accreditation team could find all the needed information on the official university website and do not find drawbacks regarding this procedure.

Based on the team's assessment, the Bachelor's degree programme meets Standard 6.

Based on the team's assessment, the Master's degree programme meets Standard 6.

Standard 7 Students are informed of regulations and guidelines that concern recognition of prior learning, progress of studies and graduation.

The University of Oulu considers that in addition to the traditional way, learning outcomes can also be achieved, in other domestic or foreign higher education institutions. The university has a very clear set of rules under which the candidate can apply for recognition. The accreditation team was introduced with the existing policies for such processes. Students can apply for the recognition of prior skills in the Peppi system.

The accreditation team was informed that every Oulu student receives a university email and connections to the inner systems (Moodle, Peppi etc.). Students will receive all the needed information through the official university email or they can find it on the university website. An important role is played by the teachers and student tutors as contributors to better communication in reaching students. During the first months, a successful integration process is a must for a faster and quality-based understanding of the university environment for newcomers.

The tutor teachers also play a major role in monitoring student progress and study results. If there is a need, the tutor might suggest making changes in the personal study plan or if needed move the issue to the central level of the university. This form of communication is essential for students who might be falling behind the process and might end up dropping out.

The accreditation team found that the university collects data regarding the graduation processes. It seems that only 20% of all bachelor's degree students finish their studies on time, while near

52% finish on time or a year later. For master's studies the picture is similar as only 38% of students finish their studies on time. The university is fully aware of this situation and there are running discussions with the industry sectors due to student employment being the biggest reason for high numbers of dropouts and late graduations from the degree programmes.

Once the student has completed all the required studies, they can apply for the degree in the Peppi system's Graduation Service. The Academic Affairs Service Team handles the applications and prepares degree certificates for the graduates. Starting from August 2022, graduates from the University of Oulu have received the degree certificates in electronic format.

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Based on the team's assessment, the Bachelor's degree programme meets Standard 7.

Based on the team's assessment, the Master's degree programme meets Standard 7.

Strengths, good practice and areas for further development regarding section 2.1: planning of the programme.

The team notes the following strengths and good practice in this section:

- Society has a huge need for graduates from the degree programmes, which are important contributors to further development of the strong ICT industry in the northern regions of Finland.
- In the development of the degree programmes there is extensive cooperation with relevant stakeholders. Students, industry, and society at large are consulted to ensure that the degree programmes are kept relevant and well-functioning.

The team sees the following as areas for further development in this section:

- For the bachelor's degree programme, long graduation times and high drop-out rates are a concern, that should be investigated further. Implementing successful measures would mean more satisfied students and higher graduate output, hence strengthening the societal impact of the degree programmes.
- As the national qualification framework as well as the EUR-ACE standard require the bachelor's programmes to be considered as an independent programme, it could be beneficial if this aspect of the programme were more clearly emphasized in planning, implementation, and evaluation of the degree programme.

2.2 Implementation of teaching and learning

Standard 8 The teaching and learning process, including the assessment of students, enables students to demonstrate that they have achieved the intended course and programme level learning outcomes. Students have an active role in co-creating the learning process and the assessment of students reflects this approach

The findings and assessment concerning the implementation of teaching and learning is based on the following sources of evidence: the self-assessment report, curricula of the degree programmes on the university website, interviews, teaching and learning demos (presentations) made by the teachings staff, a facilities tour (laboratory demos) as well as samples available in the evidence room.

From the demos that were given and the laboratory demonstrations, the accreditation team got a clear impression that these sample courses use contemporary teaching and learning methods, provide feedback during the course for students, and use appropriate and varied student assessment methods.

The course "Calculus 1", which is quite representative of the (many) mathematics courses serves as an example. The course uses blended learning with course material in Moodle. Regarding teaching methods there are 28 hours of lectures, 22 hours of group work, and students are expected to put down 85 hours of self-study. The course is completed (scale 1-5/FAIL) with mid-term exams or a final exam. When completed with mid-term exams, exercise assignments are part of the continuous assessment.

Electronics, communication, and computer science courses typically also use programming or simulation exercises, laboratory work/exercises or projects (individual or in groups). In general, most courses have more than one assessment elements, and provide some feedback during the course duration.

In general, quality assurance at the organizational level as well as individual teachers seem to encourage and want student feed-back on individual courses as well as on the degree programmes. The students confirmed that they have many opportunities to give feedback and that they mainly use this opportunity when something is not working well or when something is working particularly well. The student conveyed satisfaction with their ability to give feedback and partake in the development of courses and degree programmes. The Electrical Engineering Guild was identified as particularly important in this regard. Together with other student guilds in the faculty, this guild organizes a yearly educational seminar with participants from industry, teaching staff and the student body.

To facilitate the student's individual learning process, every student must make a personal study plan (PSP) in the Peppi system. A designated teacher tutor guides the student in the development of this plan, which is initially made in the first semester and then revised during the remaining study years. Students and tutors can monitor study progress from the PSP and use this as a tool to monitor study progress and implement correcting measures when that is necessary.

In the bachelor's programme, the making of the PSP is part of the compulsory 3 ECTS course "Orientation to Electronics and Communications Engineering", which has the following learning outcomes that the student should achieve:

1. Recognizes the university's study system and can utilize study-related services.
2. Can use the information and computer systems needed at the beginning of studies.
3. Recognizes his/her role and responsibilities regarding university studies and can study independently in university.
4. Can make short and long-time study plans and follow the realization of the plans.
5. Has made an acceptable personal study plan.
6. Has been actively acquainted with the activities of Fab Lab.

Completion of the course, which use a PASS/FAIL assessment scale, requires "the preparation and approval of a personal study plan, time management and follow-up assignment, study skills and career planning assignment, the return of orientation essays and participation in at least half of the given supervision." This course seems very appropriate for facilitating a successful transition from upper secondary school to university studies.

During the site visit, the interviewed students were quite satisfied with the courses and the degree programmes under review. Most courses were considered to be up to date, while a few courses were described as "old" and in need of improvement. In the student's own opinion, they believe that they will be well prepared for the industry, and that the relevant companies really value their studies.

Bachelor's degree programme

Knowledge and understanding

- knowledge and understanding of mathematics, computing and other basic sciences underlying their engineering specialisation, at a level necessary to achieve the other programme learning outcomes;
- knowledge and understanding of engineering fundamentals underlying their specialisation, at a level necessary to achieve the other programme learning outcomes, including some awareness at the forefront;
- knowledge and understanding of applicable materials, equipment and tools, engineering technologies and processes, and of their limitations, in their specialisation
- knowledge and understanding of applicable techniques and methods of analysis, design and investigation, and of their limitations, in their specialisation;

The three years of the curriculum build the necessary foundation in mathematics (seven mandatory courses, totalling 35 ECTS) and computer science (programming and internet, 10 ECTS), while at the same time introducing courses in electronics and communications engineering (i.e., intermediate studies and a supplementary/optional study module). In the first year, these core subject courses are "Introduction to Electronics" (5 ECTS), "Electronic Measurement Principles" (5 ECTS), and "Digital Techniques 1" (5 ECTS). From the second year, the subject courses take over with more than ten courses, which introduces the students to a wide field, ranging from materials in electronics to computer and communication systems. There are no pure natural science courses, as it has been decided to build the relevant physics knowledge into subject courses such as "Electromagnetics Engineering" and "Optical Systems".

The self-assessment report stresses the importance of teaching students the necessary skills for use of equipment and tools. As an example, simulations tools for electronic devices are introduced already in circuit theory courses (second year) and further used and expanded on in subsequent courses on electronics design. This is also reflected in the assessment method of "Circuit Theory 1", where the simulation exercise must be passed.

Towards the end of the degree programme, the courses are more system oriented, integrating knowledge and skills from the more fundamental courses. One example is Electronic System Design, which has "The aim of the course is to expand the knowledge of electronics design from the design of individual blocks to the design of complete devices and systems" as one of the learning outcomes.

Taken together, the curriculum covers the relevant engineering fundamentals and there are basic courses in all specialization areas. These basic courses introduce the main concepts and limitation of technologies in their subject matter.

Engineering practice: analysis, problem-solving, design, practice

Analysis

- ability to analyse complex engineering products, processes and systems, and to correctly interpret the outcomes of such analyses, by being able to select and having the practical skills to apply relevant established analytical, computational and experimental techniques and methods

The bachelor's degree programme demonstrates strength in incorporating various tools and practices to facilitate teaching and learning, particularly in relation to engineering practice. Bridging the gap between theory and practice is essential in the field of engineering, and the bachelor's degree programme has effectively integrated this aspect into their curriculum.

During the initial years of the programme, students are equipped with a strong foundation in mathematical tools (e.g., "Calculus I & II", "Matrix Algebra", "Probability and Mathematical Statistics", "Differential Equations"), basic and intermediate field studies (e.g., "Introduction to Electronics", "Circuit Theory 1 &2", "Signal analysis", "Telecommunication Engineering") complemented by laboratory courses (e.g., Electrical Measurement Principles, Laboratory Exercises on Analogue Electronics) that provide hands-on experience to reinforce theoretical concepts. Many courses within the program include practical assignments, laboratory work, simulation tasks, and measurements. Collaborative lab work in groups or pairs is a common practice, enabling students to enhance their communication skills and learn from one another.

Problem-solving

- ability to identify, formulate and solve complex engineering problems, by being able to select and having the practical skills to apply relevant established analytical, computational and experimental techniques and methods

The bachelor's thesis holds significant importance, accounting for 8 ECTS within the total degree requirements of 120 credits. The thesis work is conducted individually, offering students the

opportunity to choose between a literature research-based thesis or a thesis that incorporates practical implementation. This allows students to explore and showcase their expertise in their chosen area of study.

By integrating practical components, collaborative work, and individual thesis projects, the bachelor's degree programme effectively bridge the gap between theory and practice, enabling students to develop a well-rounded skill set and prepare them for real-world engineering challenges.

Bachelor's degree programme contains several courses that are highly important and relevant to develop problem-solving skills. There are courses that uses problem-based learning and examples. Relevant computational, analytical, and experimental techniques are introduced in courses based on the descriptions in the Peppi system.

As an example, it was pointed out in the site-visit that the problems and questions in the courses are formulated in a way that they cannot be answered by artificial intelligent tools like ChatGPT.

Design

- ability to develop and design complex products (devices, artefacts, etc.), processes and systems to meet established requirements that can include societal, health and safety, environmental, economic and industrial constraints, by being able to select and having the practical skills to apply relevant design methodologies
- practical skills for realising complex engineering designs
- ability to use the awareness of the forefront of their engineering specialisation in design and development

During the site visit and based on the bachelor's programme curriculum, the accreditation team found that students are encouraged to do a lot of practical design-based work during their studies. For instance, in courses like "Circuit Theory 1-2", "Digital Filters", "Introduction to Microfabrication Techniques", "Telecommunication engineering" etc. It depends on which specialization they choose, but for instance, after choosing electronics students will have to work in workshops which are provided with all the usual high-level equipment: many 3D printers, soldering stations etc. Students have to use software programs to design their own circuits and then move on to manufacturing them on-site. This allows students to fully understand the manufacturing processes that are common in most electronic-based companies. During the site visit the experts were presented with a few examples of final bachelor's projects and they were more often than not applied science based in order to develop the practical skills needed for the industry labour market.

Practice

- ability to apply norms of engineering practice in their engineering specialisation;
- ability to consult and apply codes of practice and safety regulations in their engineering specialisation

The bachelor's degree programme curriculum is designed so that the first years begin with basic programming and math courses in order for students to gain knowledge that can then be implemented in more specific courses later on. For instance, during the first years, students have courses like "Calculus 1", "Calculus 2", "Elementary Programming", "Matrix Algebra" etc. After choosing one concrete specialization, students are taught very specific courses for each specialization like "Electronical system design", "Artificial intelligence", "Introduction to biomedical engineering" etc. Looking at some specialization courses like "Electronics", it seems that the teaching strategy follows the same system. Students start with the basic required curriculums and move on with more specific ones until reaching practical work. For instance, in telecommunication engineering courses students are introduced to simulation tools and hardware technology used in telecommunication, and then move on to practical training on the topic they choose to dive into.

Investigations and information retrieval

- ability to conduct searches of literature, to consult and to critically use scientific databases and other appropriate sources of information, and to carry out simulation and analysis, in order to pursue detailed investigations and research of technical issues
- ability and practical skills to design and conduct experimental investigations, interpret data and draw conclusions
- ability to work in a laboratory/workshop setting

As part of Basic Studies all students must take a 1 ECTS course "Information Skills", which has the following learning outcomes:

- can search scientific information,
- can use the most important databases of their discipline,
- knows how to evaluate search results and information sources,

is familiar with good scientific referencing practices and reference management software -knows how to create a research data management plan for their bachelor's thesis.

This provides the students with a good foundation and the skills are used and further developed during the bachelor's thesis project.

The ability and practical skills to design and conduct experimental investigation are developed in many courses according to curriculum analysis conducted by the degree programme. During the site visit the accreditation team was given as an example a presentation of the course Electrical Measurement Principles, as well as a demonstration of equipment and learning activities in the laboratory. The overall impression of the course and the supervision of students were excellent.

As a summary, this part of the reference learning outcomes is very well covered by the degree programme.

Multidisciplinary competences

- awareness of the wider multidisciplinary context of engineering
- awareness of societal, health and safety, environmental, economic and industrial implications of engineering practice and recognition of the constraints that they pose
- awareness of economic, organisational and managerial issues (such as project management, risk and change management) in the industrial and business context
- ability to gather and interpret relevant data and handle complexity to inform judgements that include reflection on relevant social and ethical issues;
- ability to manage complex technical or professional activities or projects, taking responsibility for decision making
- ability to recognise the need for and to engage in independent life-long learning
- ability to follow developments in science and technology

Multidisciplinary competences in the bachelor's programme are somewhat shown in courses such as "Orientation to Electronics and Communications Engineering", "Calculus I & II", "Elementary Programming", "Information Skills", "Professional Communication for Technology (ECE)", "Artificial Intelligence", "Basics of Human Computer Interaction" and various language course options. Based on interviews and programme info the teaching methods vary between different courses. Fully online courses are the result of the COVID-19 pandemic, but students have requested for them also after COVID restrictions have been lifted. Some courses have hybrid implementation combining live lectures, which are recorded for later use, self-study materials online, weekly exercises and written exams. There are also wider assignments and project work where students need to apply knowledge from different fields. In the bachelor's phase the project work is scoped to be a bit narrower than in the master's phase.

The bachelor's degree programme seems to offer a rather good understanding of the related fields of electronics and communications engineering to the students. For example, students are provided courses from the fields of computer science, biomedical engineering, information processing science and product management.

However, there seems to be limited communication and collaboration with non-technical programmes and fields, such as education, psychology and medicine. There are some courses available in entrepreneurship and business management. However, based on interviews, the deeper collaboration with these subjects, for example in project or coursework seem to be largely lacking from the curriculum. In the interviews there seem to be no examples of collaboration with other faculties' students.

The University of Oulu is a multidisciplinary university with many faculties and degree programmes. It could be a great opportunity for students and the university to show in practice what it is like to work in a multidisciplinary environment and multidisciplinary teams by exposing them to non-technical approaches to challenges.

Communication and team-working

- ability to communicate effectively information, ideas, problems and solutions with the engineering community
- ability to communicate effectively information, ideas, problems and solutions with the society at large;
- ability to function effectively in a national and an international context;
- ability to function effectively as an individual and as a member of a team;
- ability to cooperate effectively with engineers and non-engineers.

The University of Oulu provides courses related to communications and team-working, e.g., "Professional Communication for Technology", "Basics of Human Computer Interaction", "Seminar for Bachelor's degree" and second language skills in both oral and written skills. These courses have project work and reports that are done in a group or collaboration with other students. They also combine written reports and oral presentations into group work.

As theses commonly do, the bachelor's degree thesis emphasizes academic written communication skills. Various courses provide opportunities for working as a multidisciplinary team. Bachelor's degree's project work is rather limited as students are still going on with their basic courses and do not have enough knowledge to handle more complex projects and subjects. Also, there is little need for communication with non-technical students. Surprisingly, the "Project management" course does not include collaboration with other students.

Typically, the projects in the bachelor's degree programme do not involve external stakeholders or any multidisciplinary aspect. It seems that project work in the bachelor's phase is done mostly in engineering student teams. To be able to succeed in working life, skills related to working in multidisciplinary teams and communicating with non-technical experts is a highly appreciated and needed skill.

Master's degree programme

Knowledge and understanding

- in-depth knowledge and understanding of mathematics, computing and sciences underlying their engineering specialisation, at a level necessary to achieve the other programme learning outcomes
- in-depth knowledge and understanding of engineering disciplines underlying their specialisation, at a level necessary to achieve the other programme learning outcomes;
- critical awareness of the forefront of their specialisation
- comprehensive knowledge and understanding of applicable materials, equipment and tools, engineering technologies and processes, and of their limitations;

- comprehensive knowledge and understanding of applicable techniques and methods of analysis, design and investigation and of their limitations;

The majority of master's degree programme students originate from university's own bachelor's programme, and the degree programme relies heavily on their foundational knowledge. However, the programme acknowledges the importance of accommodating international students and takes this into consideration during the selection process. Stakeholders' inputs are valued in the development of the curriculum. Additionally, the degree programme has a high-quality and high rate of student employment, as demonstrated during a site visit that included stakeholder interviews.

The master's programme consists of five specializations, each requiring the selection of a 30 to 40 ECTC module. These specializations offer advanced-level courses that delve deep into their respective subjects, providing extensive knowledge and understanding. While the mathematical and fundamental physics concepts are primarily covered in bachelor's courses, they are applied in specific fields through these advanced courses. Moreover, certain courses within the degree programme focus on enhancing mathematical skills within the field.

Engineering practice: analysis, problem-solving, design, practice

Analysis

- ability to analyse new and complex engineering products, processes and systems within broader or multidisciplinary contexts, and to critically interpret the outcomes
- of such analyses, by being able to select and apply the most appropriate and relevant, established or new and innovative, analytical, computational and experimental methods and tools,

Relevant computational, analytical, and experimental techniques are introduced in courses based on the descriptions in the Peppi system. As an example, it was pointed on the site-visit that the problems and questions in the courses are formulated in a way that they cannot be answered by artificial intelligent tools like ChatGPT.

In addition, the master's thesis has significant role in the programme 30 ECTS (25%). The thesis work is conducted individually, typically done in a company or a research group. This allows students to explore and showcase their expertise in their chosen area of study.

Problem-solving

- ability to identify, formulate and solve unfamiliar complex engineering problems in new and emerging areas of their specialisation. The problems can be incompletely defined, have competing specifications and may involve considerations from outside their field of study and have non-technical – societal, health and safety, environmental, economic and industrial - constraints.

The master's degree programme is oriented toward applied science practical work. There are many specializations in the master's programme starting from traditional electronics and

telecommunication and moving on to materials science and photonics measurement technology. Master's students have to end their studies by providing a mid-term project in courses like "Wireless measurement project", "Telecommunication engineering project", "Embedded system project" and a final master's project "Master's thesis in Electronics and Communication Technology" during which they show the skills they've learned working with software programs and hardware technology. A lot of final theses are done in collaboration with industrial partners, and thus they are very applicable in the real world.

Design

- ability to conceptualise engineering products, processes and systems;
- ability to design and develop new and complex products (devices, artefacts, etc.), processes and systems, with incompletely defined and/or competing specifications that require integration of knowledge from different fields and non-technical - societal, health and safety, environmental, economic and industrial commercial – constraints;
- ability to design using knowledge and understanding at the forefront of their engineering specialisation.

Each specialization aims to equip students with up-to-date knowledge on technological advancements. For instance, in the Electronics Design specialization, students explore integrated circuit design with a focus on analog and mixed-signal circuits ("Electronics Design II"), digital circuits ("Digital Techniques 3"), optical circuits ("Optoelectronics"), and high-frequency circuits ("Radio Engineering 1"). Additionally, courses like "Electronic System Design" and "Embedded Systems Project" educate students on the device level aspects of the field.

Overall, the master's degree education is research-based, with teachers often being active researchers in their respective fields.

Practise

- ability to select and practical skills to apply the most appropriate and relevant, established or new and innovative, analytical, computational and experimental methods and computer tools in problem solving.
- ability to select and practical skills to apply the most appropriate and relevant design methodologies or to use creativity to develop new and original design methodologies.
- practical skills, including the use of computer tools to realise complex engineering designs.

The practical project courses, mandatory internship, and master's thesis within the masters programme provide students with valuable opportunities to apply engineering practices in real-world settings. These components bridge the gap between theoretical knowledge and practical application. Through these experiences, students gain hands-on experience and develop a deeper understanding of how their specialized field operates in real environments.

A careful analysis of the courses reveals that they incorporate relevant tools specific to each specialization area. These tools enable students to acquire practical skills and knowledge that are essential for their chosen field. The courses are primarily instructed by researchers who possess expertise in the respective domains, ensuring that students receive up-to-date and industry-relevant instruction.

Moreover, the courses within the degree programme demonstrate a focus on relevant modeling and simulation tools, as well as measurement and fabrication techniques. These components enable students to gain practical proficiency in utilizing these tools, which are crucial in their specialization areas. Each specialization within the programme includes at least one course dedicated to teaching these practical skills, enhancing students' overall understanding and competence in their chosen field.

In some courses ideas are collected from the researchers by the teachers and implemented in study courses. This is to ensure that most relevant and newest research is a part of the studies.

Investigations and information retrieval

- ability to identify, locate and obtain required data;
- ability to conduct searches of literature, to consult and critically use databases and other sources of information, to carry out simulation in order to pursue detailed investigations and research of complex technical issues;
- practical skills, including the use of computer tools, for designing and conducting complex investigations;
- advanced laboratory/workshop skills and ability to design and conduct experimental investigations, critically evaluate data and draw conclusions;
- ability to investigate in a creative way the application of new and emerging technologies at the forefront of their engineering specialisation

Based on the master's theses available to the accreditation team there is clear evidence that master's students are encouraged to do research-based theses as their final projects. Theoretical background is build based on accumulated article analysis, which is the important skill of being able to define which literature is valuable for one's studies. These skills of being able to filter valid data are taught in practically all master's subjects such as "Power electronics", "Radio engineering 1", "Energy Harvesting Technology" etc. The experiments vary but might be carried out using simulations before moving on to real life experiments. The received experimental results are also compared with other results published in the articles.

Multidisciplinary competences

- critical awareness of the wider multidisciplinary context of engineering and of knowledge issues at the interface between different fields.
- knowledge and understanding of the non-technical – societal, health and safety, environmental, economic and industrial - implications of engineering practice;

- critical awareness of economic, organisational and managerial issues (such as project management, risk and change management)
- ability to apply norms of engineering practice
- ability to consult and apply codes of practice and safety regulations;
- ability to integrate knowledge and handle complexity, to formulate judgements with incomplete or limited information, that include reflecting on social and ethical responsibilities linked to the application of their knowledge and judgement to deliver sustainable solutions for society, the economy and environment;
- ability to manage complex technical or professional activities or projects that can require new strategic approaches, taking responsibility for decision making.
- ability to engage in independent life-long learning;
- ability to undertake further study autonomously.

Both the mandatory internship and master's thesis in the master's degree programme facilitate close engagement with working life, exposing students to a broader multidisciplinary context within their field of study. Through these experiences, students gain valuable insights into how engineering practices impact the goals and objectives of companies and other relevant entities (e.g., research centres, universities).

Moreover, the degree programme emphasizes the importance of companies as integral components. Active regional co-operation further enhances students' understanding of the interplay between engineering, industry, and the broader community. This collaborative approach helps students grasp the wider implications and influences of engineering beyond the academic realm, providing them with a holistic perspective on their field of study.

Overall, the mandatory internship and master's thesis components create an immersive learning environment that fosters practical knowledge, encourages multidisciplinary engagement, and promotes a comprehensive understanding of the societal and industrial impact of engineering.

The degree programme students can include optional studies in project management and other industrial engineering courses that support the studies and future career into their study plan.

Communication and team-working

- ability to use diverse methods to communicate clearly and unambiguously their conclusions, and the knowledge and rationale underpinning these, to specialist and non-specialist audiences in national and international contexts;
- ability to function effectively in national and international contexts, as a member or leader of a team, that may be composed of different disciplines and levels, and that may use virtual communication tools.

In Finland basic language studies and communication skills related to those are usually done in the bachelor's degree phase of the studies. Then in the master's degree phase it is assumed that

students have those skills and competencies concerning how well they present themselves in oral and written form. However, the university provides a Finnish language course "Survival Finnish" to foreign students to understand common Finnish phrases and everyday life expressions.

Due to the nature of studies many of the master's phase courses are carried out by face-to-face implementation. Teachers emphasized during interviews that hybrid teaching methods are also implemented very often and even requested by students.

The university and degree programme support exchange studies to acquire skills that are needed for working in international business. They offer students possibilities to go abroad as exchange students but also to study in other Finnish universities. The university also actively supports exchange students coming to Finland either to do the whole degree in Finland or part of it. 22% of the students at the University of Oulu are either exchange students or international students.

As almost all master's degree programme courses are taught in English, they strongly support the integration of international students.

Based on the team's assessment, the Bachelor's degree programme meets Standard 8.

Based on the team's assessment, the Master's degree programme meets Standard 8.

Strengths, good practice and areas for further development regarding section 2.2: implementation of teaching and learning

The team notes the following strengths and good practice in this section:

- The degree programmes have developed a very strong strategy regarding the study courses. All programme students start from fundamentals like maths, algebra, physics and these courses from the first years allow students to prepare properly for the further specialization courses.
- The study contents of both degree programmes are in general highly relevant to the industry partners and society at a large. Master's theses are often implemented in close cooperation with the industry.
- Many basic courses in the bachelor's degree programme use very modern teaching and learning methods as well as learning environments.
- The advanced parts of the master's degree programme are strongly connected with research groups and this functions well in practise, not only on paper.

The team sees the following as areas for further development in this section:

- Master's degree programme courses seem to rely more often on traditional teaching and learning methods compared to bachelor's degree programme courses. Teaching and learning methods of master's degree programme courses should be analysed and improvements systematically implemented.
- For communication and team-working the university emphasizes collaboration with stakeholders and between degree students. However, there are no examples in the curricula where multidisciplinary teamwork would be required in any of the courses. Combining cooperation with students from different departments would make the transformation to the working world easier.

2.3 Resources

Standard 9 The academic staff are sufficient in number and qualification to enable students to achieve the programme learning outcomes. There are arrangements in place to keep the pedagogical and professional competence of the academic staff up to date.

The electronics and communications engineering courses are given by teaching staff from the five research units at the faculty that cover the fields. Other courses are given by teachers from relevant research units, for instance "Applied and Computational Mathematics" and the Language and Communications Unit. This ensures a strong research foundation for all courses in the degree programmes, most importantly in the electronics and telecommunication courses where the university has comprehensive research activity of high quality and close cooperation with the relevant industry.

From the self-assessment report the accreditation team got the following overview of all teachers and their pedagogical competences:

TABLE 4. All teachers of the degree programmes, along with their pedagogical studies.

Title	Number of teachers	% pedagocical studies
Professor	11	27%
Associate professor	4	50%
Assistant professor	5	60%
University lecturer	8	75%
University teacher	2	50%
Senior research fellow	12	50%
Postdoctoral researcher	18	28%
Doctoral researcher	23	4%
Project / Research manager	4	25%
Project researcher	6	17%
TOTAL	**91**	**31%**

From the information provided in the self-assessment report and its appendices with complementary information, the number of teachers and their qualifications are adequate for the two programmes under review.

At the university there is a strong emphasis on research and the self-assessment report states that *"most of the teaching staff maintain their professional competence by participating in research in their field"*.

The university offers two levels of pedagogical studies, the basic university pedagogics program (25 ECTS) and a 35 ECTS extension in teacher's pedagogics. However, as explained in the self-assessment report, not all teachers have taken the pedagogical studies at any level. Making sure that

all teaching staff in permanent positions have at least the university pedagogics program would improve the level of pedagogical competence.

The university also offers shorter courses in university pedagogy, which allows teachers to maintain and develop their teaching competences.

During the site visit, the accreditation team learned that recruiting Finnish capable teachers might be a challenge in the future. The interviewed teachers stated that they have enough time to provide high quality teaching but could benefit from more resources being available for the development of courses.

All professorships are filled by open application, while lower teaching position sometimes are appointed internally if a highly suitable candidate is available. The recruitment policy and processes described in the university's Quality Handbook are well aligned with good international practice.

From the interview with the management, it was clear that research competence and research contributions have been and still are regarded higher than pedagogical competence and teaching contributions. The tenure system has reinforced this imbalance. The university leaders are aware of the problem and in progress of implementing measures to strengthen the appreciation of teaching within the university culture.

Based on the team's assessment, the Bachelor's degree programme meets Standard 9.

Based on the team's assessment, the Master's degree programme meets Standard 9.

Standard 10 An effective team of technical and administrative staff supports the programme. There are arrangements in place to keep the competence of the support staff up to date.

The university has centralised technical and supportive administrative staff, handling tasks like admission, ICT, HR, financial, legal and communication. Each study programme has an education designer who works closely with the programme director and the teacher tutors, supporting the development of the programme and guiding students. At the faculty there is additional support staff with specialised competences like communication and digital pedagogy, which support programme management and teachers. At laboratories like FabLab and at the research units, there are technical staff who take care of the equipment and guides teachers and students in the use of the facilities.

Regarding competence development the university offers an extensive selection of staff training courses available in the staff training portal.

Based on the team's assessment, the Bachelor's degree programme meets Standard 10.

Based on the team's assessment, the Master's degree programme meets Standard 10.

Standard 11 The students are provided adequate and accessible support services to enable the achievement of the programme learning outcomes.

In the self-assessment report and during the site visit, the accreditation team was presented with a number of university services provided for students. The provided support services at Oulu

University start from an early stage during the admission process, after which current students are provided with psychological, administrative, and tutoring services. Additionally, career planning support is offered at the end of the student's studies. The university provides all the needed contacts on its official website.

New incoming students are provided with student and teacher tutors who contribute to a better understanding of the university's ecosystem. Both student and teacher tutors undergo training organized by the Academic Affairs Service teams before becoming tutors. During the site visit the students stated that they can come directly to their teacher tutor with any questions, and they will then try and solve it together. If a situation is more complicated the tutor redirects the question to the service offices, and they answer it. The students, if need be, can reach out directly to the Academic Affairs Service team members. As the bachelor's degree programme has a very flexible curriculum choice so the teacher tutor's job is to make sure that the curricular choices are relevant for the student and that all the technical details are followed.

The Career Center constantly organizes training for improving specific skills required for the labour market. It constantly provides support for students searching for an internship or a job position in a company.

A crucial role is played by the university psychologist. Especially after the COVID-19 pandemic, mental health issues have become a very broadly discussed topic worldwide. So, it is no surprise that psychological support is among the top-required university services by students. At Oulu University it is no different. During the site visit the administration members and students stated that psychological services are crucial for the university community. Yet, both agree that the queue for the services is too long and can take up to 6 months of waiting. It was explained to be a national problem, but the accreditation team recommends the university contribute as much as possible to lower the level of the existing queue problem.

Based on the team's assessment, the Bachelor's degree programme meets Standard 11.

Based on the team's assessment, the Master's degree programme meets Standard 11.

Standard 12 The classrooms, computing facilities, software, laboratories, workshops, libraries and associated equipment and services are sufficient and accessible to enable students to achieve the programme learning outcomes.

The accreditation team was introduced in the self-assessment report and during the site visit to the infrastructure used to reach the learning outcomes. Most of the lectures are provided in a classroom equipped with all the necessary technology: wireless internet access, smart boards, cameras (for giving access to the ones who attend the classes remotely) etc. Computer classes are also equipped with all the needed equipment for working with software programs and doing lab work. Some classrooms are open for students to work individually if needed. During the site visit, the teachers said that software programs are also available for students working remotely on their personal computers with student licenses. In the university halls, there were boxes where students could borrow a laptop if needed. It seems that the university is equipped with all the needed technology. In addition, it is very important that there is clear evidence that the university supports students that come from different financial backgrounds and allow them to achieve the same level of study outcomes.

During the observation of some laboratories during hardware lab work, the accreditation team members could not find any major drawbacks. It seems that the laboratory teachers are constantly keeping track of potential new equipment to be bought if needed for coursework. The amount of lab equipment is relevant, as there needs to be enough for every student to get a personal feel for the equipment, and the design of the sitting positions in the laboratories constantly motivates them to work together in solving occurring issues.

The accreditation team had a tour of the university's library. No major drawback could be found there. All the needed literature could be found. The library staff annually ask the teachers if there is a need to add some new literature. In the library, there are working spaces for students. If needed, students can enter the library through a different entrance any time they want. In the university halls, there is also clear evidence of many working spaces for students. In general, the university provides all the needed equipment and space for students working either in classrooms or during their individual working hours.

Based on the team's assessment, the Bachelor's degree programme meets Standard 12.

Based on the team's assessment, the Master's degree programme meets Standard 12.

Standard 13 The HEI and the programme have external partnerships that are adequate to the achievement of the programme learning outcomes.

The Faculty of Electronics and Communications Engineering has several external partnerships that make contribution to teaching and learning. Oulu seems to be very special area that gathers students to the University of Oulu from the whole northern part of Finland. The stakeholders have high demands for the professionals educated at the University of Oulu. The stakeholders and the university have made clear effort to establish a continuous collaboration network to the Oulu area. Interviewed external stakeholders with collaborations were Business Oulu, Bittium, Tactotek, Sensing solutions VTT, and Nordic Semiconductor. The faculty also has a joint professorship with VTT. These industrial partners seem to be aware of the degree programme modules taught at the university. The degree programme curricula comply well with the needs of the industrial partners.

When it comes to university collaboration, the University of Oulu has announced the opening of a joint master's degree programme with Vaasa University. The programme is entitled Sustainable and Autonomous Systems. Internationally the University of Oulu has a double-degree programme with the University of Peradeniya in Sri Lanka in the field of wireless communication engineering. In the programme, students spend the first year in their home university and the second year at the host university. A similar programme has also existed with Asia Institute of Technology, but it has been cancelled due to the fact there has not been any exchange of students between the universities.

The degree programmes have an Erasmus agreement with around 50 universities in Europe and more than a hundred globally. Still, the number of exchange students that go abroad from Oulu is very low.

As found in the interviews, the industrial partners are aware of the degree programme modules that are taught in the university. They said that the degree programme curricula do comply well with their needs in the industry. The industry partners encourage students to finish their studies on time and even give bonuses for them to graduate. There are visiting lecturers from some industry partners on the courses.

Based on the team's assessment, the Bachelor's degree programme meets Standard 13.

Based on the team's assessment, the Master's degree programme meets Standard 13.

Standard 14 The financial resources are sufficient to implement the learning process as planned and to further develop it.

The degree programmes are mainly funded by basic university funding from the Ministry of Education and Culture, which are distributed to the faculty based on a slightly different model with indicators based on education and research. The faculty then distributes the funding to the research units, which take part in the teaching of the education programmes.

According to the self-assessment report, the degree programmes under review got approximately € 1.16 million in 2022, which was distributed to the research units based on results as follows:

- 62% is allocated to the pure teaching (lectures, exercises, assignments)
- 10% to minor supervision and coordination tasks (entrance examination, internships, theses)
- 12% to annual strategic teaching tasks
- 11% to the administrative costs of the degree program (person in charge of the degree program, coordinators of international programs, tutor teachers, resource managers of the teaching in research units, members of the degree program committee)
- and the remaining 5% to rental costs.

In addition to the basic funding, there are financial contributions from external projects related to education. From the interview with management, we learned that the faculty is inclined to use surplus from research activities to support education activities.

Neither from the self-assessment report nor the interviews did the accreditation team observe any complaints related to the financial resources. The funding of the programmes follows the national funding model quite closely. The accreditation team considers the financial resources to be on par with the funding of similar degree programmes at other Finnish universities.

Based on the team's assessment, the Bachelor's degree programme meets Standard 14.

Based on the team's assessment, the Master's degree programme meets Standard 14.

Strengths, good practice and areas for further development regarding section 2.3: resources

The team notes the following strengths and good practice in this section:

- The tutoring system where every new student gets a student tutor, and a teacher tutor is well designed and seems to be well functioning.
- Each degree programme has its own Education Designer who helps in the development and operation of the programme.
- The faculty shows willingness to use surplus from research activities to support education activities. Teaching and learning is emphasized in internal funding allocation.

- Business and industry parties are pretty well connected by both degree programmes. They employ students during their studies and also encourage students to graduate on time. The industry also provides visiting lecturers for university courses.

The team sees the following as areas for further development in this section:

- The availability of psychological support services for students should be improved.
- The number of students participating to exchange programs is low. The university should study ways to enable, support, and encourage student to take study exchange abroad via its exchange programs.
- The encouragement to pursue international studies should be emphasised to the students in order to give them the proper knowledge about working in international environment. There is a need to establish more cooperation with universities abroad.

2.4 Quality management

Standard 15 The quality management procedures of the programme are consistent with the quality policy of the higher education institution.

The university's quality system and the principles for its development are described in detail in the Quality Handbook, which was included and referred to in the self-assessment material. The university has defined its quality policy as follows:

- Quality management is an elemental part of the university's operating culture.
- Operation is improved through analyses based on feedback, evaluations and indicator data.
- The quality system produces reliable information on the effectiveness, productivity and fluency of operation.
- Action is taken based on the set objectives and monitoring results.
- Quality management encompasses all functions and actors in the university community.
- The quality system offers tools for improving education, research and other activities and supports the spreading of good practices.
- The procedures, service processes and systems of the service and administration tasks are shared and jointly agreed.

The university has Quality Specialist maintaining the Quality management guidelines. The quality assurance system of the university was audited in the autumn of 2017. Finnish Education Evaluation Centre (FINEEC) was responsible for the auditing, which was conducted in English. The university's quality system was found to comply with the national criteria for quality management in universities and be in line with the European principles and recommendations. As a token of this, the Finnish Education Evaluation Centre granted the University of Oulu a quality label valid until 28 February 2024.

The quality assurance system consists of the following procedures that the university uses to maintain and develop the quality of its activities and operations:

- Process descriptions

- The targets agreed in the target and performance negotiations
- Up-to-date guidelines
- University regulations, Competence in contracts resolution
- Relevant information about the operations and activities is available (e.g. feedback systems, statistics)
- Methods and policies to step in when deviations are perceived.
- Culture and modus operandi of continuous improvement.

The Vice Rector for Education is responsible for the education at the university, its productivity and quality assurance, as well as other tasks that are specified in the Education Regulations of the university. The Education Council represents the different sciences at the university and supports the rectors in education. The Education Management Group consists of the education deans responsible on the management and development of the education.

The education of the faculty is led by the dean of education and all the degree programmes have directors. The teaching at the faculty is organized by the research units. At the faculty level there is the Education Committee which consists of all education dean, the degree programme directors, study support personnel and student representatives. The Degree Programme Committee consists of the director, the representatives of research unit, study support personnel and student representatives. As a summary, the university has responsible actors and bodies for quality assurance on all the relevant levels, including the degree programmes under review.

Based on the self-assessment materials, interviews as well as teaching and learning demos the degree programmes under review follow the institutional quality policy in its operations and make regular adjustment to the degree programme structure, contents as well as daily operations around the programmes. There is a programme director in overall charge of the degree programmes, and the teachers met during site visit are committed to the quality work. The same applies to the support and administrative staff interviewed. A feedback information and relevant study data is collected and used as supposed to analyze and enhance the degree programmes' functioning.

Based on the team's assessment, the Bachelor's degree programme meets Standard 15.

Based on the team's assessment, the Master's degree programme meets Standard 15.

Standard 16 The organisation and decision-making processes of the programme are fit for effective management.

The education actors, roles and responsibilities, as well as procedures, are clearly described in the university's Quality Handbook. The organisation and decision-making process at the university of Oulu is quite similar with practice at many other universities. Especially universities which, like the University of Oulu, are organized into faculties and where staff and financial resources are handled at the research unit or department level.

It might be that the role of the Programme Director could be clarified and possibly strengthened regarding resource allocation for teaching activities and development, and the capacity of relevant support services.

Overall, the management of the degree programmes is considered to be adequate and well-functioning.

Based on the team's assessment, the Bachelor's degree programme meets Standard 16.

Based on the team's assessment, the Master's degree programme meets Standard 16.

Standard 17 The programme reviews and develops the programme aims, curriculum, teaching and learning process, resources and partnerships and quality management in a systematic and regular manner, taking into account analysis of results of student admissions, students' study progress, achieved learning levels, student, graduate and employer feedback and graduate's employment data.

Quality management is seen as a priority at the University of Oulu, as evident from the Quality Handbook, which outlines the process and responsibilities. There is a dedicated chapter on education quality management. Data is collected from various sources and subject to discussions, although the extent to which thorough analysis guides these discussions and the resulting actions may not be entirely clear. Nevertheless, the self-assessment report and its appendices provide clear evidence of the university and faculty's commitment to quality management. This also applies to the degree programme level in the case of the degree programmes under review.

The student admission results are analyzed after each application round and at the degree programme level. In addition, efforts are made to assess marketing effects as well. To monitor students' study progress, teaching tutors closely follow their progress. The university and the degree programmes also pay attention to graduation times, analyzing graduation data, and personal study plans to identify any reasons for delays.

After completing their degrees, students participate in self-assessment through questionnaires. The national bachelor's degree questionnaire allows students to evaluate their learning levels, and the results were made available to the accreditation team as a part of the self-assessment material. Additionally, graduated master's students take part in the graduate survey managed by the trade union for academic engineers and architects in Finland (Tekniikan akateemiset TEK in Finnish). The university uses these results in developing its degree programmes.

The degree programmes take responsibility for evaluating the feedback received and consider it when making justified changes and developing courses and programs. Recognizing the need for improvement, the feedback system has undergone changes. However, students may not perceive the value in providing feedback. Feedback on master's theses is collected from the organizations where the theses are conducted, which is often in companies since master's theses in engineering in Finland are typically completed in such environments. This feedback gives important information about the programmes' relevance.

Overall, the management of the degree programmes under review emphasizes the importance of monitoring student progress, encouraging self-assessment, and taking student feedback into account. By continuously improving and adapting based on these factors, the degree programme staff aim to provide a high-quality educational experience.

Based on the team's assessment, the Bachelor's degree programme meets Standard 17.

Based on the team's assessment, the Master's degree programme meets Standard 17.

Standard 18 The programme provides public, up to date information about its objectives, teaching and learning process, resources, quality management procedures and results.

The electronics and communications engineering degree programmes provide public and up to date information about their objectives, teaching and learning process on their website. Interviewed students confirmed that they have received and found the information they need on the university website. The university uses Moodle software also for communicating the information about the courses and resources to students. Curricula are usually updated by the beginning of the semester.

Generic information about the curricula, facilities and university administration are shared in public. Student application and selection results are provided in the national Studyinfo (Opintopolku in Finnish) website.

The university of Oulu uses Finnish in most of their communication and website, but they also provide almost the similar information in English too.

Based on the team's assessment, the Bachelor's degree programme meets Standard 18.

Based on the team's assessment, the Master's degree programme meets Standard 18.

Strengths, good practice and areas for further development regarding section 2.4: quality management

The team notes the following strengths and good practice in this section:

- The education actors, roles and responsibilities, as well as procedures, are clearly described in the university's Quality Handbook.

The team sees the following as areas for further development in this section:

- The role of the Programme Director should be clarified and possibly strengthened regarding resource allocation for teaching activities and development, and the capacity of relevant support services.

Overall evaluation of the degree programmes

3.1 Bachelor's degree programme

Upon reviewing the programme the team highlights the following key strengths and good practice:

- Society has a huge need of graduates from the degree programmes, which are important contributors to further development of the strong ICT industry in the northern regions of Finland.
- In the development of the degree programme there is extensive cooperation with relevant stakeholders. Students, industry, and society at large are consulted to ensure that the degree programmes are kept relevant and well-functioning.
- The tutoring system where every new student gets a student tutor, and a teacher tutor is well designed and seems to be well functioning. The system covers both bachelor's level and master's level students. Some of the teaching staff members have a remarkable time allocated for the teacher tutor activities.
- The study contents of the bachelor's degree programme are highly relevant for the industry and society at a large. Many basic courses in bachelor's degree programme use very modern teaching and learning methods as well as learning environments.
- The faculty shows willingness to use surplus from research activities to support education activities. Teaching and learning is emphasized in internal funding allocation.

The team sees the following as main areas for further development of the programme:

- As the national qualification framework as well as the EUR-ACE standard require the bachelor's programmes to be considered as an independent programme, it could be beneficial if this aspect of the programme were more clearly emphasized in planning, implementation, and evaluation of the degree programme under review. As the degree programme management states that compliance with the national qualification framework is not systematically assessed, this would be one essential topic to work on in the future.
- For the bachelor's degree programme, long graduation time and high drop-out rates are a concern, which should be investigated further. Implementing successful measures would mean more satisfied students and higher graduate output, hence strengthening the societal impact of the programme. The degree programme has already made some adjustments for enhancing the progress of studies, but there is need to work even harder on this topic. In addition, it would be necessary to create a widely shared understanding on the reasons behind the drip-out phenomena between the degree programme staff, students as well as key stakeholders and establish a joint plan for the improvements.
- For communication and team-working the university emphasizes the collaboration with stakeholders and between degree students. However, there are no examples in curriculum where multidisciplinary teamwork would be required in any of the courses. Combining cooperation with students from different departments would make the transformation to the working world easier.

The team recommends that the degree programme is accredited without reservation.

3.2 Master's programme

Upon reviewing the programme the team highlights the following key strengths and good practice:

- Society has a huge need of graduates from the degree programmes, which are important contributors to further development of the strong ICT industry in the northern regions of Finland.
- In the development of the degree programme there is extensive cooperation with relevant stakeholders. Students, industry, and society at large are consulted to ensure that the degree programmes are kept relevant and well-functioning.
- The tutoring system where every new student gets a student tutor, and a teacher tutor is well designed and seems to be well functioning. The system covers both bachelor's level and master's level students. Some of the teaching staff members have a remarkable time allocated for the teacher tutor activities.
- Study contents of the master's degree programme are in general highly relevant to the industry partners and society at a large. Master's theses are often implemented in close cooperation with the industry.
- The faculty shows willingness to use surplus from research activities to support education activities. Teaching and learning is emphasized in internal funding allocation.

The team sees the following as main areas for further development of the programme:

- Master's degree programme courses seem to rely more often to the traditional teaching and learning methods compared to bachelor's degree programme courses. Teaching and learning methods of master's degree programme courses should be analyzed and improvements systematically implemented.
- For communication and team-working the university emphasizes the collaboration with stakeholders and between degree students. However, there are no examples in curriculum where multidisciplinary teamwork would be required in any of the courses. Combining cooperation with students from different departments would make the transformation to the working world easier.

The team recommends that the degree programme is accredited without reservation.

4

Decisions of the FINEEC Committee for Engineering Education

In its meeting on 8 September 2023 the FINEEC Committee for Engineering Education decided, based on the proposals and report of the accreditation team, that the Bachelor's degree programme in Electronics and Communications Engineering and Master's degree programme in Electronics and Communications Engineering are both accredited without reservation.

The accreditation of the master's degree programme covers the following parts of the programme entity:

- The degree programme conducted in Finnish and English. Admission where students get two study rights at once, along a secondary level education entry qualification. In addition, there is a separate admission for applicants, who wish to join the programme having a bachelor's degree earned in the other degree programmes.
- Degree programmes conducted in English: Electronics and Wireless Communication. Separate admissions along a bachelor's degree entry level qualification. The degree programmes follow the same curricula as the similar spezializations of the degree programme conducted in Finnish and English.

The accreditations are valid until 8 September 2029.

Engineering programme accreditation is a degree programme specific evaluation that can lead to the European EUR-ACE® Label. The accreditation aims to support the enhancement of quality in engineering degree programmes and increase the international comparability and recognition of engineering degrees within Europe. The accreditation is voluntary for Finnish higher education institutions and degree programmes. This report presents the process and results of the accreditations of the degree programmes in Electronics and Communications Engineering at the University of Oulu in Finland. FINEEC has carried out engineering degree programme accreditations since 2014 at the Finnish universities of applied sciences. FINEEC is authorized by ENAEE to award the EUR-ACE labels to the 4-year degree programmes of 240 ECTS. To extend its mandate to the 3-year and 2-year degree programmes, FINEEC carries out pilot accreditations in 2022–2023. These accreditations are part of this piloting phase.

The Finnish Education Evaluation Centre (FINEEC) is an independent agency responsible for the evaluation of education. It operates as a separate unit within the Finnish National Agency for Education. It implements system and thematic evaluations, learning outcome evaluations and field-specific evaluations. Moreover, FINEEC supports providers of education and training and higher education institutions in matters related to evaluation and quality assurance, as well as advances the evaluation of education.

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