ASIIN Seal & European Labels

Accreditation Report

Ba Electrical Engineering
Ba Electrical Engineering (Double Degree)
Ma Electrical Engineering
Ma Electric Transportation Systems

Provided by
Lappeenranta-Lahti University of Technology

Version: 10 October 2024

Table of Content

A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Sähkötekniikan kandidaatin tutkinto-ohjelma	Bachelor's degree programme in Electrical Engineering	ASIIN, EUR-ACE® Label	ASIIN, 30.6.2017-30.9.2023 (extension until 30.9.2024)	TC 02
Bachelor's degree programme in Electrical Engineering, DD	/	ASIIN, EUR-ACE® Label	/	TC 02
Sähkötekniikan diplomi-insinöörin tutkinto-ohjelma	Master's degree programme in Electrical Engineering	ASIIN, EUR-ACE® Label	ASIIN, 30.6.2017-30.9.2023 (extension until 30.9.2024)	TC 02
Master's degree programme in Electric Transportation Systems	/	ASIIN, EUR-ACE® Label	/	TC 02
Date of the contract: 21.03.2023 **Submission of the final version of the self-assessment report:** 11.12.2023 **Date of the onsite visit:** 09.04.2024 **at:** Lappeenranta Campus				
Expert panel: Prof. Dr. Reinhard Moeller, Bergische Universität Wuppertal Prof. Dr. Sigrid Hafner, Fachhochschule Südwestfalen				

[1] ASIIN Seal for degree programmes; EUR-ACE® Label: European Label for Engineering Programmes

[2] TC: Technical Committee for the following subject areas: TC 02 - Electrical Engineering/Information Technology.

Prof. Dr. Reiner Schütt, Fachhochschule Westküste Dr. Kai Kriegel, Siemens AG Anders Nikula, University of Oulu	
Representative of the ASIIN headquarter: Sascha Warnke	
Responsible decision-making committee: Accreditation Commission for Degree Programmes	
Criteria used: European Standards and Guidelines as of May 15, 2015 ASIIN General Criteria, as of December 10, 2015 Subject-Specific Criteria of Technical Committee 02 – Electrical Engineering/Information Technology as of December 9, 2011 EUR-ACE® Framework standards and guidelines, as of March 31, 2015	

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Sähkötekniikan kandidaatin tutkinto-ohjelma	B.Sc. Electrical Engineering	/	6	Full time	/	8 semesters	180 ECTS	2008
B.Sc. Electrical Engineering (Double Degree)	/	/	6	Full time	Hebei University of Technology (HEBUT)	8 semesters	180 ECTS	2021
Sähkötekniikan diplomi-insinöörin tutkinto-ohjelma	M.Sc. Electrical Engineering	/	7	Full time	/	4 semesters	120 ECTS	2008
M.Sc. Electric Transportation Systems	/	/	7	Full time	/	4 semesters	120 ECTS	2022

For the Bachelor's degree programme Electrical Engineering the institution has presented the following profile in the self-assessment report:

"The three-year BSc programme in Electrical Engineering (taught in Finnish) provides students with basic knowledge in general engineering skills, i.e. mathematics, physics and computer science as well as in closely related engineering disciplines: energy technology, mechanics, and sustainability. This is done during the first half of the studies. The subject specific studies include the most relevant electrical engineering related topics, such as electrical circuits, electrical circuit analysis, electromagnetism, electrical power systems, electrical drives, control engineering and electronics to name a few. Additionally, transferable skills are being taught within the engineering courses, and programme also includes internship and language and communication studies. The students must complete their studies with minor studies either in Industrial electronics or Energy economics."

[3] EQF = The European Qualifications Framework for lifelong learning

For the Bachelor's degree programme Electrical Engineering (Double Degree) the institution has presented the following profile in the self-assessment report:

"The double degree programme in Electrical Engineering is targeted mainly to international students and students from a partner university from China's Hebei University of Technology, HEBUT. The three-year BSc programme (taught in English) provides students with the same basic knowledge, skills and competences as the BSc programme taught in Finnish. General studies concentrate in general engineering skills, i.e. mathematics, physics and computer science as well as in closely related engineering disciplines: energy technology, mechanics, and sustainability. The subject specific studies include the most relevant electrical engineering related topics, such as electrical circuits, electrical circuit analysis, electromagnetism, electrical power systems, electrical drives, control engineering and electronics. The programme also includes internship and language and communication studies, which have specific options for different groups of students. In the DD programme, the variety of recommended minor studies include Energy Economics; Sustainability Science; Practical Engineering, Innovation and Entrepreneurship; and, Chinese Business, Culture and Technology; Study Finnish - Live and Work in Finland.

Even though the programme is a DD programme together with HEBUT, students from many nationalities other than Finland and China are also involved. The graduates of the programme can continue their studies at LUT Master Programmes of Electrical Engineering or Electrical Transportation Systems or apply for other international Master level educational institutions."

For the Master's degree programme Electrical Engineering the institution has presented the following profile in the self-assessment report:

"The MSc programme in Electrical Engineering focuses on giving the graduates comprehensive and holistic view of the modern electric and power systems and their technological development. The core studies include amongst other studies applied mathematics, energy efficiency, power electronic converters, and laboratories. Internship is also included in compulsory core studies. Students choose which advanced specialisation studies they want to focus on from a list of specialisation areas: solar economy, control and automation, control and communication, electromechanics, power electronics design and electrical drives. For Finnish speaking students there are two additional specialisation areas: Smart grids and electricity market and Applied electronics. Studies are complemented with a minor, of which Bioenergy technology and Environmental responsibility minors are recommended. The programme gives students good capabilities to work as experts in the field of electrical engineering, be it large corporations, SMEs, governmental institutions, or NGOs. Graduates' positions are typically related to, for ex-

ample, design and production of electric devices, product development, technical sales or production management. The programme also qualifies to doctoral studies in the field of electrical engineering."

For the Master's degree programme Electric Transportation Systems the institution has presented the following profile in the self-assessment report:

"The MSc programme in Electric Transportation Systems has been commenced in 2022 as a response to educate specialists for the growing field of electrifying industry. It focuses on giving the students a deep understanding of electric transportation systems as a whole, including how to apply relevant power electronics and electric drive technology solutions to the development of future zero-emission transportation systems. The programme gives an overview of the technology and business in electric transportation systems. It also focuses on key technologies and skills related to electric transportation, such as electro-mechanical drive trains, power electronics, battery technology and related information technology. Also indirect electrification methods and e-fuel technologies are considered, and environmental impacts of different technology solutions are analysed. Additionally, the students complete their studies with minor studies, of which Circular economy, Mechanical engineering for electrified transportation systems, Industrial engineering and management and Study Finnish – live and work in Finland are recommended. Besides electrical transportation sector graduates of the programme are competent to work as experts also in the fields of power electronics and electrical drives technology. In addition, the programme qualifies to doctoral studies in the field of electrical engineering."

C Expert Report for the ASIIN Seal[4]

1. The Degree Programme: Concept, Content & Implementation

Criterion 1.1 Objectives and Learning Outcomes of a Degree Programme (Intended Qualifications Profile)

Evidence:

- University strategy
- Degree certificates
- Degree regulations
- Learning outcome analysis
- Cooperation agreement between LUT and HEBUT
- University website: https://www.lut.fi
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:

Lappeenranta-Lahti University of Technology (LUT) is a public university serving the two eponymous towns in South Eastern Finland. Lappeenranta campus, where LUT was founded in 1969, has more than 6,500 students enrolled, and at Lahti campus, which was opened in 2019, there are about 1,000 students. The two campuses are about 130 km apart. The university has, according to its strategy 'Trailblazers 2030', put the focus on sustainability, trying to put into focus issues such as carbon-neutrality, combating climate change, and usage of emissions in their teaching and research. The four degree programmes under review here, too, include sustainability in their programme learning outcomes and the contents, thus tying neatly with the general university's mission and vision.

[4] This part of the report applies also for the assessment for the European subject-specific labels. After the conclusion of the procedure, the stated requirements and/or recommendations and the deadlines are equally valid for the ASIIN seal as well as for the sought subject-specific label.

For their assessment of the four study programmes, the auditors refer to the standards and requirements of the Technical Committee 02 – Electrical Engineering/Information Technology as of December 9, 2011 as well as the EUR-ACE® Framework standards and guidelines (2015) for their assessments.

The three-year Bachelor's degree programme Electrical Engineering is taught mainly in Finnish and provides students with basic knowledge in general engineering skills, i.e. mathematics, physics and computer science, as well as in related engineering disciplines, e.g. energy technology, mechanics and sustainability. Furthermore, the programme contains teaching about the most relevant topics of electrical engineering, such as electrical circuits, their analysis, electromagnetism, electrical power systems and drives, as well as control engineering and electronics.

The three-year Bachelor's degree programme Electrical Engineering Double Degree is a relatively recent programme between LUT and the partner Hebei University of Technology (HEBUT) from China, that accepted its first students in 2021. The programme is taught exclusively at LUT campus with professors from HEBUT functioning as guest lecturers on-site. It is taught in English and aimed at international students and those from HEBUT, but local students are enrolled in this programme as well. Generally, the basics of electrical engineering are the same as in the other Bachelor's degree programme. Additionally, a focus is put on internationality with offers called "Chinese Business, Culture and Technology" and "Study Finnish – Live and Work in Finland."

The programme Electrical Engineering is a consecutive Master's degree programme for both Finnish and international Bachelor's degree graduates. The core studies of this programme consist of applied mathematics, energy efficiency, power electronic converters, and laboratory work. There are also specialisation areas to choose from, such as solar economy, control and automation, control and communication, electromechanics, power electronics design, and electrical drives. With a Master's degree in Electrical Engineering the students are expected to work as experts and the field of electrical engineering, e.g. in design and production of electric devices, technical sales or production management.

The last programme under review here is the Master's degree programme Electric Transportation Systems. Opened in 2022, it is the only programme under review that is taught at Lahti campus. The programme is a response to the growing field of the electrifying industry that is demanding more specialists. The programme gives an overview of the technology and business in electric transportation systems, focusing on key technologies and skills related to electric transportation, such as electro-mechanical drive trains, power electronics, battery technology and related information technology.

The assessors find that, generally, the learning outcomes of the four study programmes are well-phrased and concise. They represent the goals of the study programmes and the qualification of the Bachelor's degree programmes are discernible from the Master's degree programmes. All programme learning outcomes can be found in the annex to this report.

The assessors see a problem with the learning outcomes of the two Bachelor's degree programmes Electrical Engineering and Electrical Engineering (Double Degree). While both of them are similar in content and virtually equal in name, the programmes diverge in a point that is crucial for the industry: The Finnish programme lists as a goal that students "will know the phenomena and regulations of electrical safety well enough to apply Electrical Qualification 2 and/or 3 (S2 and/or S3) [and] will be able to perform the essential measurements related to the electrical safety of installations," an issue which is wholly lacking in the Double Degree programme. The Electrical Qualification 2/3 is a necessary certificate to legally perform certain electrical works in Finland according to the Finnish Safety and Chemicals Agency (Tukes). During the audit, the university argues that this portion of the curriculum was given up for the international aspects of the Double Degree programme, the students of which are likely working in fields where these certificates are not necessary. The assessors understand the line of argumentation but inherently, these differences in the learning outcomes of the two programmes pose a challenge. There are students from Finland in the Double Degree programme studying a programme with the same name as their peers in the Finnish programme; and international students have the opportunity to study about living and working in Finland. This leads to the assumption that the contents are overwhelmingly similar, which in turn would mean that the learning outcomes of the two Bachelor's degree programmes should not diverge in this crucial point of national safety regulations.

The assessors argue that the mismatch in the learning outcomes of the two Bachelor's degree programmes is intertwined with the name of the programmes (see criterion 1.2) and the contents of the curriculum (see criterion 1.3). They recommend that the university representatives reflect on how the degree programmes differ in content and prospective work environments for the graduates and construct the learning outcomes accordingly.

As was said before, the learning outcomes of the four programmes align with the university's strategy as well as the general and subject-specific criteria of ASIIN, as well as EUR-ACE. The accuracy and relevance of the learning outcomes is reviewed annually in November as part of the curriculum work. This work includes feedback from and discussions with internal and external stakeholders. Internal stakeholders include heads of the programmes, students; external stakeholders include alumni, research project partners as well as representatives from the industry. During the audit, both students and industrial representatives

mention their involvement in the review and describe the whole curriculum work as a thorough process. The auditors are convinced that the curriculum work is taken seriously by all partners and involves inputs from all relevant stakeholders.

The learning outcomes of all programmes are published in the diploma certificates and on the website of the university. The validity of the learning outcomes in all programmes is promulgated in the degree regulations. The assessors agree that the learning outcomes are anchored in the curriculum in a transparent manner.

Criterion 1.2 Name of the Degree Programme

Evidence:

- Degree regulations
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:
The official names of the study programmes reflect the language in which they are taught, as is stated in the degree regulations. The Ba Electrical Engineering, Double Degree is instructed in English, as is the Ma Electric Transportation Systems. The official name of the Ba Electrical Engineering is Sähkötekniikan kandidaatin tutkinto-ohjelma, representing the language being Finnish. The Ma Electrical Engineering has an official Finnish name next to the English one (Sähkötekniikan diplomi-insinöörin tutkinto-ohjelma). The names and their official English translations (which are used in this report) are used consistently throughout the documentation and on the university's web presence.

Generally, the names of the study programmes reflect their respective contents. The Ba and Ma Electrical Engineering cover a wide array of topics of electrical engineering without any particular specialisation which makes a universal name sensible. The Ma Electric Transportation Systems demonstrates the focus area of the degree programme and is a comprehensible choice.

As was already mentioned in criterion 1.1, the names of the Ba Electrical Engineering and Ba Electrical Engineering, Double Degree suggest that the contents, the learning outcomes, and the professional outlooks of the two study programmes are the same. Since graduates of the Double Degree do not learn about Finnish safety regulations and do not receive necessary certificates, the divergence in the two programmes are so striking that the similar

name of the programmes might lead to the misdirection of prospective students and employers. If the professional outlooks for students of the Ba Electrical Engineering, Double Degree are different – e.g., in that they are more likely to work in international environments – the auditors suggest that the name of the degree programme be changed to accurately reflect the international aspect.

The designation (both in the original language and in English) is used consistently in all relevant documents.

Criterion 1.3 Curriculum

Evidence:

- Learning outcome analyses
- Module descriptions
- Degree regulation
- Statistical data on student mobility
- Workshop reports
- Curriculum analyses
- Evaluations
- Website of the university about student exchange: https://elut.lut.fi/en/completing-studies/internationalisation-and-student-exchange
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:

Content

The Bachelor's degree programmes Ba Electrical Engineering and Ba Electrical Engineering, Double Degree are three-year study programmes with 180 ECTS to acquire. Both programmes consist of general studies, which are basic and foundational courses for electrical engineering. Part of these are introductions to mathematics, physics, and electronics. Further courses are offered in the form of intermediate specialisation studies and minor/multidisciplinary studies. Both programmes include an internship in Finland or abroad, a Bachelor's thesis and a seminar for the thesis, as well as language courses.

For the Ba Electrical Engineering the specialisations comprise further introductory courses in topics of electrical engineering, e.g., electrical power systems, electrical safety, and electrical circuit analysis. There are also three laboratory courses à 4 ECTS. The minor studies consist of courses about either industrial electronics or energy economics, with 20 ECTS being electives. In preparation for the on-site visit the assessors worry that fundamental knowledge of electrical engineering is only poorly reflected in the Bachelor's degree programme, particularly signals and systems. During the audit, the experts are able to assess that Laplace and Fourier transformations are taught throughout other courses, i.e. circuit analysis and control systems. The assessors find the contents of this programme to be fully satisfactory.

The Ba Electrical Engineering, Double Degree has similar basic courses as the other programme. Due to the international aspect of this programme there are some differences with the weighting of some courses. For example, the course "Measurement and Control Systems" is a course of 5 ECTS in the Double Degree programme that corresponds to two courses in the other programme: "Introduction to Measurement and Automation Technology (worth 3 ECTS) and "Introduction to Control Systems" (worth 4 ECTS). The courses of "Basics of Vibration and Wave Motion" and "Electricity and Magnetism", both from the Finnish programme worth 2 ECTS each correspond to the 3 ECTS course "Engineering Physics" in the Double Degree programme. This leads, indubitably to some differences to the contents of the study programmes despite all fundamentals are taught. The lab courses, which accrue 12 ECTS total in the Finnish programme are also shrunken to a single course à 5 ECTS in the international programme. Since the Double Degree programme welcomes students from Finland, China, and other countries abroad, the Double Degree programme has a variety of obligatory language and communication studies for each group. They contain Finnish, Chinese, or a third language, as well as introductions to Finnish or Chinese culture, respectively. Lastly, as electives, the students for the Double Degree programmes may choose between the general topics of Energy Economics, Practical Engineering, Innovation and Entrepreneurship, Sustainable Science, as well as Chinese Business, Culture and Technology. The assessors find that these subjects all feature interesting courses that are reflecting current issues in electrical engineering.

The issue of the two programmes that was already mentioned in earlier criteria is exacerbated when comparing the curricula. Despite the contents of the two programmes being similar, the depth of teaching in the fundamental courses varies greatly. For one, several subjects that are considered foundational in electrical engineering are treated as such in the Finnish Bachelor's programme, but are merged under a more vague title in the Double Degree programme (see above). This means that students of the international programme focus on different themes, that is the international aspects of the programme. As was said

earlier, the learning outcomes of the degree programme do not cover courses on Finnish legislation of electrical safety. During the audit, the programme representatives state that the students learn just as much about electric safety as the national students (except for the certificate) but a whole course of Electrical Safety of 5 ECTS is missing from the programme. Still, the assessors consider the Double Degree programme to be a robust study programme that suffers from its overarching title. They suspect that the university would fare better if they kept both programmes as is, but focus for the Double Degree programme on a title that centres the international aspect of the programme.

The Master's degree programmes Electrical Engineering and Electric Transportation Systems comprise 120 ECTS. The content covers core studies, advanced specialisations, minors and electives as well as language and communication studies. The core studies for both programmes comprise two courses in Applied Mathematics, laboratory courses as well as an internship. The course is finished with an obligatory Master's thesis.

Currently, the Ma Electrical Engineering programme consists of eight specialisations. In the self-assessment report the programme coordinators state that evaluations have shown a high distribution of workload among the advanced specialisations. They have decided to merge some of the specialisations (Electromechanics, Electric Drives and Power Electronics Design) into one called "Electric Drives and Power Electronics". The assessors find that the specialisations in this programme are well thought-out and reflect current issues in the field of electrical engineering.

In the Ma Electric Transportation Systems, there are specialisations all related to the titular subject. Furthermore there are minor studies on circular economy, mechanical engineering, industrial engineering as well as Finnish. The assessors regard the programme to be well constructed and sound. The subjects are all current and related to the issue of electric transportation systems. The assessors find, however, that the subject of grid integration is not sufficiently reflected in the programme, which would be a necessary topic in the near future of electric transportation systems.

Structure of the programmes

Structurally, the four programmes under review here are sound. The two Bachelor's degree programmes of 180 ECTS offer foundational courses about electrical engineering, mathematics, and related subjects in the first year. In later semesters students get the opportunity to choose courses about their topics of interest. Nonetheless, the study programmes are quite dense throughout the whole three years. The programme finishes with an obligatory Bachelor's thesis. The Master's degree programmes, both 120 ECTS, consist of foundational courses as well as specialisations. They also finish with a mandatory thesis.

Overall, the structure of the programmes allows for enough freedom for the students to individually schedule courses. This allows for a more personal approach to the studies which the assessors consider a valuable asset of the study programmes. The students may individualise their schedules before the semester starts. The feasibility of the schedules is then checked by a programme coordinator. During the audit the assessors get to know that the students make use of this individualisation. The students state, however, that the structure of the Bachelor's degree programmes complicate student mobility since there is no dedicated window for exchanges in the programmes. This will be discussed below.

Apart from that, the assessors judge the programmes to be structurally well thought-out.

Student mobility

LUT considers itself an international university, offering many of their courses for many degree programmes, among them the four programmes under review here, in English. 30% of the student body come from abroad, as of 2023. For the academic year starting in 2024, 40% of new students are from abroad. LUT offers exchange programmes with about 200 partners in Europe and several in the Americas and East Asia. The programme coordinators report that students performed their exchange year in, e.g., Norway, Germany, Italy, or Hebei, where recognition of courses was a simple process.

Especially students from the Ba Electrical Engineering (Double Degree) have ample opportunity for international contacts. For one, the study programme has a particularly international student body. The cooperation with HEBUT also means that non-Chinese students may (but are not required to) spend time at the partner university in China. For the other programmes LUT offers exchange programmes with several partners in Europe and beyond.

The overall quota of students going abroad remains, however, notably low. Disregarding the years of the COVID-pandemic, in 2019, none of the students of the Ba Electrical Engineering spent time abroad, and three of the Ma Electrical Engineering did; in 2022 only one student of the latter programme went on a student exchange. Of course, the introduction of the other two degree programmes is too recent to give a robust representation of the exchanges. The reason for these low numbers are not fully understood and the programme coordinators assume that the general interest in exchange programmes appears quite low. They state that the structures of the degree programmes make exchange studies possible but the students disagree during the audit, especially in the Ba Electrical Engineering. They worry that going abroad will throw them behind in their studies since the programme is quite dense and contains a lot of laboratory courses. Moreover, the students report that advertisement of these exchange programmes does not reach them. It needs to be said, however, that the university does market exchange programmes extensively on campus

and via e-mail. All in all, the experts assume that the problems with student mobility do not run deep. They suggest to introduce a mobility window into the programmes and advertise them as such to help the students recognise the opportunity.

Periodic Review of the Curriculum

The programmes are annually reviewed as part of the curriculum work. The curriculum work consists of workshops in which the performance indicators and the feedback from students and other stakeholders is reviewed with academic staff and students. Based on these findings, the staff discusses measure to tackle problems. The results of the workshops (course of action and development targets) are published in workshop reports and communicated to all workshop participants and the head of the department. On request, the proceedings are accessible to other staff and students in the department. Recent findings include the workload in the Ma Electrical Engineering. The workload varies a lot depending on the advances specialisation chosen by the students. Currently, the university reviews the workload distribution of the specialisation areas with the goal to adjust the workload for each area. The programme coordinators are free in how grave the changes are per year but there is a general agreement to keep changes low. Apart from these annual meetings, the people responsible also meet monthly to discuss current events.

The assessors see that the review of the curriculum is deemed an important tasks by all stakeholders involved. They appreciate that the job is taken seriously and that there are transparent results that aim at better programmes. Generally though, the experts come to understand that the communication between programme coordinators, lecturers and specialists appears to be lacking which hampers a smooth reviewing process. This will be discussed in greater detail in criterion 5.

Criterion 1.4 Admission Requirements

Evidence:

- Degree regulations
- Cooperation agreement between LUT and HEBUT
- Websites: https://www.lut.fi/fi; https://opintopolku.fi/konfo/fi/;
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:
At LUT, the university body decides annually on the intake of students. Specific requirements are proposed by the deans of each school and need approval by the vice rector for education. Information about programmes and their admission criteria are published on the national service "Opintopolku" which is maintained by the Finnish National Agency for Education. The admission criteria for international programmes is published on the sister website of "Studyinfo". These webpages are also used by the students to submit applications.

For the two Bachelor's degree programmes the intake quota is 120 (as of 2023). 60 of these are reserved for programmes in English. These quotas are then divided into two forms of admission depending on the course language. The first one for the Finnish programmes is the national matriculation examination grades. To be selected, the applicant must have either a C grade in physics or chemistry and passed an advanced course in mathematics, or must have a C grade in advanced mathematics. If so, the five best grades from the matriculation examination certificate are calculated for the selection. Alternatively, applicants must take an entrance exam based on the secondary school curriculum in mathematics, physics and chemistry. When the course language is English, the first admission also follows the national matriculation examination grades, but also takes into account equivalent certificates, such as the International or European Baccalaureate, as well as SAT results. For other certificates LUT checks its validity for the study programmes selected. Chinese students who apply for the Ba Electrical Engineering, Double Degree are selected by the partner university HEBUT.

The admission requirements for the Bachelor's degree programmes are comprehensible are sensible. They are promulgated in the degree regulations and published on LUT's website as well as the application websites run by the Finnish Ministry. During the audit, the proficiency of English for students from HEBUT was raised several times by programme coordinators, teachers as well as fellow-students. It appears that there is a lack of English fluency from the Chinese students which makes both teaching and socialising among the student body harder. To avoid this the assessors suggest that the partner university HEBUT be notified of this shortcoming so that the admission requirement there is updated.

For the Master's degree programmes, there is recruitment from within LUT and from external applicants. Generally, it is necessary that electrical engineering is featured with at least 40 ECTS in the Bachelor's degree. Quota for the Ma Electrical Engineering is 30 students per year, and for the Ma Electric Transportation Systems it is 45. The assessors do not find any issues with the admission for the Master's degree programmes.

Criterion 1.5 Workload and Credits

Evidence:

- Module descriptions
- Degree regulation
- Analysis of the curricula
- Module descriptions
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:
All programmes at LUT follow the ECTS system. According to the degree regulation one ECTS is stipulated to equal 27 hours of work, be it teaching hours, individual study, as well as examinations and preparations thereof. 60 ECTS are expected to be acquired in one academic year, which, according to the programme coordinators is manageable. The academic year is divided into periods of seven weeks that terminate with an examination week. One semester consists of two periods. Generally, a course can span up to four periods. The module descriptions can be found online for all study programmes under review. In it, student can find the total workload of each course.

For the two Bachelor's degree programmes the total amount of ECTS to acquire amounts to 180; the Master's degree programmes amount to 120 ECTS total. During the audits, the students of the Bachelor's degree programmes describe the workload as dense but not debilitating. Still, the programme coordinators have begun investigating reasons for this alleged high workload and plan to tackle these issues in upcoming curricula.

The workload and crediting of the four study programmes is regularly monitored and analysed. Changes to the programme are made when it becomes evident during analysis that students are struggling. As was said earlier, the Ma Electrical Engineering is currently undergoing change of the specialisation areas to ascertain that each specialisation is equal in workload. The assessors find the monitoring to be proactive and satisfactory.

Criterion 1.6 Didactic and Teaching Methodology

Evidence:

- Statistics on teaching and assessment methods
- Analysis of the curricula
- Module descriptions
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:
LUT tries to align course-specific ILOs with content and assessment methods within each course. When designing a course the lecturers first define the content, ILOs and the work-load (in ECTS) and work from there to plan suitable teaching methods, assessment methods as well as the hours needed for coursework and independent studies. All information is accessible online via the university website.

In their analysis of the teaching methods for the two Bachelor's degree programmes, the programme coordinators state that teaching is based on lectures and exercises, particularly in theory courses. On the other hand, there is also laboratory work, individual and group working and presentations. Generally, the teachers try to strengthen work-life skills of their students, e.g. by project-based or group-based work, information retrieval, and multilingual communication.

The two Master's degree programmes are similar in that the main focus is put on lectures and exercises, as well as laboratory courses, group and project work as well as presentation. In contrast to the Bachelor's degree programmes, the courses contain far more work-oriented practical assignments, e.g. real case-studies from companies. There are also guest lectures from representatives of companies.

Generally, LUT appears to have fully embraced digitalisation, with courses being offered in a hybrid manner to accommodate students from both Lahti and Lappeenranta campuses. Lectures are recorded and published for the students to get access if they missed a lecture or if they want to re-watch them.

Learning activities applied in courses are recorded and reviewed as part of the curriculum work to manage the variety of teaching and assessment methods as needed. The assessors

are shown analyses of evaluations and other statistical data that proves a periodic examination of the teaching methodology.

Final assessment of the experts after the comment of the Higher Education Institution regarding criterion 1:

Regarding the Electrical Qualifications issued by the Finnish Safety and Chemicals Agency (Tukes) the university explains that these qualifications are gained by "an independent and objective assessor after "work experience and additional examination" which exceeds the scope of a Bachelor's degree. In the Finnish Ba Electrical Engineering, the programme coordinators consider the educational requirements for the Electrical Qualification 2 "a selling point of the programme since no other university in Finland provide that. That is why we have also increased the number of laboratories in Finnish BSc programme up to 12 ECTS which is considerably high amount in a university degree." The assessors understand the reasoning and take note that students of the two Bachelor's degree programmes do not graduate with highly different skill sets. Still, the differences in curricula and aims of the study programmes are stark enough to warrant a change in name. The university agrees, scheduling a new name for the coming year.

LUT agrees that, for the Ma Electric Transportation Systems, the topic of grid integration should be included. They want to make it part of the course "Electric Vehicle Charging", which is currently in development.

LUT recognizes the need for a mobility window in the two Bachelor's degree programmes, stating that the issue has already been addressed in the curriculum planning processes.

Regarding the English skills of students, especially from the partner university HEBUT, LUT plans to add a requirement for approved English language tests at the partner university in the revision of the agreement between the two universities. Currently, LUT has introduced a compulsory English course for students admitted to the Ba Electrical Engineering (Double Degree).

The assessors welcome the planned changes to the curricula and admission requirements and consider criterion one to be partially fulfilled.

2. Exams: System, Concept and Organisation

Criterion 2 Exams: System, Concept and Organisation

Evidence:

- Module handbooks
- Degree regulations
- Statistics on teaching and assessment methods
- Analysis of the curricula
- Exemplary examinations
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:

The assessment of the students is done using various methods that include traditional written exams and continuous assessments. Teach teacher has the freedom to choose for their courses the appropriate assessment method for the intended learning outcomes. Examination procedures are promulgated in the LUT degree regulations. Teaching periods are announced every year by the vice rector for education, and examinations are arranged in accordance with the examination schedule. Throughout the year there are seven examination weeks, plus an additional exam week in the summer for students who want or need to retake an exam. Apart from these designated times students can also arrange exams via the tool EXAM all year round. The examination schedules and course specific completion methods and assessment criteria are published on the LUT website. At the beginning of the courses the teachers discuss the methods and dates of the exams with the students, which the students present during the audit can corroborate.

Examination forms in the courses are for the most part written examinations which usually take three hours. They consist of essays, problem-solving or case-based questions as well as calculation problems. Next to handwritten examinations, there are also electronic exams, which are performed in a dedicated controlled room to prevent cheating. Due to the COVID-19 pandemic Moodle exams were tested and introduced into the assessments. Students can partake in these examinations on-line from home. Apart from written exams, other forms of assessments have increased over the past years. They include for example

home assignments, laboratory work, project work, written reports, learning tests, presentations, group work and peer evaluation. In the two Bachelor's degree programmes there are exercises, home assignments, learning tests and quizzes, project work, written reports and laboratory work. However, about 60% of the courses make use of continuous evaluation methods in favour of final assessment. The two Master's degree programmes require more in-depth knowledge so the assessment methods apart from written examinations focus project works and written reports with presentations and peer evaluation as well as simulations. For these programmes, too, there is utilisation of continuous evaluation methods. They make up about 30% of all examinations in the Master's programmes.

Generally, the assessors prove content with variation of the assessment methods. The students are tested on their knowledge but they are actively supported in developing their work-related skills, like communication, group work, and report writing. However, they are concerned about the Moodle exams for two reasons. For one, with students sitting through the examination individually and from home, there always is the opportunity for cheating. The programme coordinators are aware of this problem, stating in the self-assessment report that "it is practically impossible during a Moodle exam to prevent the students from acquiring additional information on-line". They suggest, however, that "teachers are instructed to design the Moodle exams accordingly". According to the experts, this solution is poorly conceived. Taking as an example the Moodle examination for the introductory course "Measurement and Control Systems" in the Ba Electrical Engineering, Double Degree, the tests are allegedly individualised, but the questions appear to be merely randomised in order. This means that students can communicate the solutions to the questions without problem. Furthermore, the problems presented in the exam are judged to be fairly simple by the assessors. In the example provided, one student finished the exam in less than 19 minutes and got 100%. Especially when taking into account the potential for cheating, the questions do not pose any substantial challenge. The exams do not appear to be time-limited, since some students took over three hours for the exams. Lastly, the grading of the online examinations appears to be done automatically. The teachers have to correct spelling differences – e.g., the system is case-sensitive – and contextually correct answers manually. During the inspection of the exam, one assessor found an answer that was marked as incorrect although it should have been accepted. In a nutshell, the assessors are of the opinion that the current Moodle exams are lacking in difficulty, particularly regarding the opportunity for illicit aid and missing time limit. The teachers and programme coordinators should pay attention that the examinations are congruent with EQF6 or EQF 7, respectively. Furthermore, the methods of examination do not compromise a fair, individual assessment.

All four degree programmes terminate with a final thesis. Generally, these theses can be completed in cooperation with industrial partners. The students are supported by a supervisor. For the Ba Electrical Engineering, Double Degree the theses are examined and assessed separately by an examiner from LUT and HEBUT.

LUT has guidelines for procedures to support students with learning disabilities and special needs. Documented learning disability diagnoses will be taken into consideration in examination arrangements. Guidelines and procedures for fostering accessible education and equality are available online. The heads of the programmes evaluate the relevance of the assessment methods for each course as part of the annual curriculum work. Statistics and analyses show that the assessment methods are regularly inspected.

Final assessment of the experts after the comment of the Higher Education Institution regarding criterion 2:

In regard to the Moodle exams the university states that some changes have already been implemented. They now work via the EXAM hall platform or as a paper exam. Further, LUT states that "[i]n the next curriculum work round the head of degree programme of electrical engineering will make a more thorough review on assessment methods used on courses and assure that there will be enough supervised exams in every programme - be they organized digitally in the EXAM rooms or in writing in exam halls during the examination weeks." Lastly, some Moodle exams will remain but teachers are advised on how to make them sufficiently challenging.

The assessors welcome the changes implemented and planned. They are looking forward to the evidences once the programmes are properly restructured. As of now, the assessors consider criterion 2 to be not fulfilled.

3. Resources

Criterion 3.1 Staff and Staff Development

Evidence:

- Staff handbook
- LUT's research portal: https://www.lut.fi/en/research/search-research
- Discussion during the audit
- Self-assessment report

Preliminary assessment and analysis of the experts:

The staff at the Department of Electrical Engineering, where the four study programmes under review here belong to, counts 151 people plus visiting personnel from the partner university in Hebei. In total, there are ten professors and 18 associate professors. Both the faculty and the department are responsible for there being enough personnel to conduct both teaching and research. Generally, over the last years the number of students has increased which led the university to pay closer attention to the workload of teachers and capacity of classrooms. During the audit one teacher concedes that the laboratory courses in the Ba Electrical Engineering have been decreased to accommodate for an influx of students. This means that all students have fewer designated courses in the laboratories, which cannot be the goal of the study programme. The programme coordinators mention, however, that recruitment of further personnel has been planned or completed. Another solution is hiring teaching assistants among the student body who can help with organisational matters. LUT also invites visiting lecturers from other universities or the industry, especially at a Master's degree level.

Virtually all teachers are involved in research by means of, e.g., working on research projects, reporting and publishing research results, supervising theses of doctoral students and research activities of research groups. Research is published in the university's research portal.

All in all, the staff appears well-equipped to teach and research in all four study programmes under review here. For the Ba Electrical Engineering, Double Degree, however, the assessors could not get a full picture of the visiting lecturers from HEBUT since no representative from the partner university participated during the audit. This means that the relevance and significance of the partnership between LUT and HEBUT could not be discussed in detail and only from unilaterally. The assessors regret the absence. As the English fluency of the guest professors is brought up during the audit the assessors want to ascertain that their level of English is sufficient to teach in that language. This is not possible so the assessors can only assume that English fluency might be too low for the demands of a lecturer.

During the audit the assessors get the impression that the teaching staff is quite content with working conditions and the workload at LUT. They discuss with the assessors openly and confirm that they can also speak frankly with the programme coordinators and heads of the faculty. Their ideas are taken into account and they have sufficient freedom in their design of courses and methodology of teaching and assessment.

Criterion 3.2 Student Support and Student Services

Evidence:

- Website of the university: www.lut.fi
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:

The student services at LUT are supposed to help students throughout their study pathway by providing individual and group guidance on issues such as degree structure, study counselling, personal study plans and career advice. Students receive group counselling about the study programmes in a way that is integrated into specific stages of the curricula, as well as at the individual request of students when they need help. In the beginning of the study, all degree programmes offer a course worth one ECTS for student orientation. Furthermore, there are orientation weeks where students learn about the university and their courses. As was said in criterion 1.3, the curricula are designed individually by the students to fit their wants and needs. These plans are revised by counsellors who are also helping with questions and uncertainties.

LUT career services is an offer for students to get information on potential career paths and help with the job search process. Offers include sharing job positions, organising trainings, webinars and workshops about job search and career planning, as well as organising low threshold Career Café discussion opportunities on campuses individually or in groups, networking and recruitment events and offering individual counselling and career guidance.

During the audit the students describe the services at LUT as sufficient for their needs. The atmosphere at the university among the students and with the teachers appears familiar. The assessors find the student services to be smooth and convenient for the students.

Criterion 3.3 Funds and equipment

Evidence:

- Student feedback
- Self-assessment report
- Tour of the facilities
- Discussion during the audit

Preliminary assessment and analysis of the experts:
The department of the study programmes under review here is founded equally in parts by the Finnish Ministry of Education and Culture, and by research funding from the Academy of Finland, the Finnish Funding Agency for Technology and Innovation, the European Commission, and private companies. Lastly, tuition fees for non-European students are another source of funding for the department.

Both campuses, at Lappeenranta and Lahti, feature enough classrooms, laboratories and equipment to perform all necessary teaching and research units. Teaching laboratories at LUT include, at Lappeenranta campus, one for basic electrical engineering, one for more advanced electrical engineering, and electronics laboratory, a power electronics laboratory, an electrical power engineering and a power-to-X laboratory. Some of these facilities have recently been renovated or are currently undergoing renovation. During the audit the assessors get a tour of the facilities of Lappeenranta campus and can confirm that the laboratories are well equipped for teaching the programmes Ba Electrical Engineering, Ma Electrical Engineering and Ba Electrical Engineering, Double Degree. During the audit the assessors cannot visit Lahti campus, where the fourth programme Ma Electric Transportation Systems is taught, however they receive evidences in form of photos and videos that show facilities in good shape. The students from Lahti campus state during the audit that the laboratories in Lahti are pared-down in comparison to Lappeenranta, but they say that the equipment is sufficient. Finally, LUT features the J. Hyneman Center, that features specialized equipment and expertise for project work and practical exercises. In it, students can focus on mechanical prototyping (e.g. laser cutting, milling, wood work and welding), but the facility also offers two dedicated electronics workbenches equipped with multimeters, oscilloscopes, and soldering stations.

One problem which the students of the Ma Electric Transportation Systems programme mention during the audit, is the lack of industry standard software – an issue that is not raised in the other programmes. The assessors see the importance of software in this programme, such as DigsiLENT Power Factory, and suggest to make it accessible to the students in the future.

Final assessment of the experts after the comment of the Higher Education Institution regarding criterion 3:

The university states that, in contrast to the teacher quoted in this report, the number of laboratory courses for the Ba Electrical Engineering have increased in the last couple of years. They explain this comment as a possible miscommunication which the assessors accept.

Regarding the English fluency of teaching staff from HEBUT, LUT states that both teachers present if the academic year of the on-site visit are fluent in English. Since this comment in the report was made due to the absence of either teacher, the assessors want to clarify that this worry remains abstract and is not based on evidence handed in post-hoc by the university. The university states that they have designed a procedure "for possible cases where English fluency of HEBUT teachers is too low for the demands of academic education," which will be added in the agreement between the universities upon the next revision.

Lastly, the assessors raised concern about the usage of software, especially DigsiLENT Power Factory in the Ma Electric Transportation Systems. In their statement, the university states to deliberately teach the principles of modelling with various tools since "no single software is used in all possible jobs that graduates might end up in." The assessors understand this reasoning but want the university to look into the procurement of various software tools, especially since this issue was raised by students during the on-site visit. The assessors welcome the willingness of the university to purchase necessary software.

The assessors consider criterion 3 to be partially fulfilled.

4. Transparency and Documentation

Criterion 4.1 Module Descriptions

Evidence:

- Module descriptions
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:
The module descriptions for all four study programmes under review here are accessible via the university website. As was already mentioned in this report, the module handbooks have slots for all relevant information, such as the name of the course, the responsible persons, the teaching methods, credits and workloads, as well as the ILOs and contents. The prerequisites, and examination requirements are mentioned, and so are the forms of assessment and the recommended literature. The handbooks mention the academic year in which they are valid.

As a preparation to the audit, the assessors look through the handbooks and recognise that for some courses not all information is given. The information missing is not at all systemic or grave, but rather, some information are missing in some courses. As an example, the course "Fundamentals of Energy Economics" in the Ba Electrical Engineering (Double Degree) does not list any literature recommendations on the website, and neither does "Basic Electronics 1".

This is why the auditors suggest that the module handbooks be checked for all information.

Criterion 4.2 Diploma and Diploma Supplement

Evidence:

- Exemplary diploma
- Exemplary diploma supplement
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:
The university confirms that all students receive a diploma supplement in English after graduation. The diploma supplements contain all relevant data, i.e., all the studies included in the degree, completed modules and their number of credits, grades and the total number of ECTS credits in the degree. LUT states that the diploma supplements "compl[y] with the model developed by the European Commission, the Council of Europe and UNESCO and it includes a description of the Finnish education system prepared by the Finnish National Agency for Education and approved by Finland's Ministry of Education and Culture."

The assessors acknowledge that all relevant data is contained in the diploma supplement.

Criterion 4.3 Relevant Rules

Evidence:

- University regulations
- Degree regulations
- Website of the university: https://elut.lut.fi/en/completing-studies/rules-and-regulations
- Self-assessment report

- Discussion during the audit

Preliminary assessment and analysis of the experts:
Relevant rules at LUT are communicated via the university regulations, the code of conduct of the university, and governmental rules are given by the Finnish Ministry's Universities' Act. All relevant rules are published on the university's website. The degree regulations give additional insight on teaching and studying at LUT.

The assessors can confirm that all rules and regulations are transparent. During the audit, both teachers and students are aware of the rules and where to find them.

Final assessment of the experts after the comment of the Higher Education Institution regarding criterion 4:

The university asks for an example of missing content in the module handbooks which has been provided in the report proper. The assessors consider this criterion to be partially fulfilled.

5. Quality management: quality assessment and development

Criterion 5 Quality management: quality assessment and development

Evidence:

- Statistics of curriculum work
- LUT Quality Manual
- Evaluations of surveys
- Analyses of curriculum work
- Self-assessment report
- Discussion during the audit

Preliminary assessment and analysis of the experts:
The quality management system covers the university's core operations, i.e. academic education, scientific research, societal interaction and support services. As was mentioned throughout the report, each programme undergoes a yearly curriculum work in which all levels of the programmes are evaluated and analysed. The curriculum work includes surveying stakeholders, among them students and teachers, as well as evaluating statistical

data of the students (assessment grades, number of graduates etc). The statistical data and their interpretation show that feedback is taken seriously and that the university strives toward a smoother studying process for all people involved. The students, teachers and industry representatives confirm this assumption during the audit saying that they are involved with the curriculum. They specify several instances in which their suggestions were implemented in the past, such as the conceptualisation of the course "Measurement and Control Systems" in the Ba Electrical Engineering. The industry partners state that they have recently suggested the implementation of a course on "Functional Safety and Cyber Security", which the department is now discussing internally.

During the audit the teachers find faults with the communication between the different levels of the faculty, especially during the opening of the Double Degree programme. They state that they wish for more organisational lead and generally more communication. This comes as a surprise to the auditors given the mechanisms in the quality assurance seem to be working well and problems are mentioned quite easily. The assessors follow this suggestion from the teachers and call upon the programme coordinators to facilitate communication throughout the levels of the department to ensure that everybody knows how to work toward the common goals.

Other than that, the assessors can see that the quality assurance is taken seriously and is working well. Changes to the curriculum are published and communicated to the students, who during the audit confirm their taking part in the quality enhancement and their visibility in the changes made. The students say that the improvements come slowly but this is understandable given the size of the programmes.

Final assessment of the experts after the comment of the Higher Education Institution regarding criterion 5:

The university responds to the lack of communication between the different levels of university saying that they began publishing regular news, e.g. on the department level. Moreover, they want to discuss further steps with the teaching staff. The assessors welcome the receptive reply and look forward to the changes once they are implemented. For now, they consider criterion 5 to be not fulfilled.

D Additional Documents

Before preparing their final assessment, the panel ask that the following missing or unclear information be provided together with the comment of the Higher Education Institution on the previous chapters of this report:

„No additional documents needed“

E Comment of the Higher Education Institution (19.08.2024)

The following quotes the comment of the institution:

„LUT Statement on ASIIN Accreditation report draft, Cluster A – Electrical Engineering

We are grateful for the constructive approach and feedback given by the peer review team in evaluating the four programmes in Electrical Engineering. Our comments concerning the evaluation are listed below.

Criterion 1.1 Objectives and Learning Outcomes of a Degree Programme (Intended Qualifications Profile)

Citation from the accreditation report, page 11:

"The Finnish programme lists as a goal that students "will know the phenomena and regulations of electrical safety well enough to apply Electrical Qualification 2 and/or 3 (S2 and/or S3) [and] will be able to perform the essential measurements related to the electrical safety of installations," an issue which is wholly lacking in the Double Degree programme. The Electrical Qualification 2/3 is a necessary certificate to legally perform certain electrical works in Finland according to the Finnish Safety and Chemicals Agency (Tukes)."

There is a misunderstanding in assessors' evaluation. Electrical qualification 2 justifies for working as an electrical work supervisor and supervisor of operations of AC electrical equipment and electrical installations not exceeding 1000 V and DC electrical equipment and electrical installations not exceeding 1500 V. Working as a supervisor for electrical works with higher voltages require electrical qualification 1. Electrical qualification 3 justifies for working as an electrical work supervisor in repairs of electrical equipment intended to be connected with an AC network not exceeding 1000 V or a DC network not exceeding 1500 V.

The competence for electrical qualifications is assessed by SETI Personal and Company Assessment Ltd that is an independent and objective assessor of electrical qualifications according to the Electrical Safety Act, nominated by TUKES. All the mentioned qualifications require 1) proper education (clearly defined requirements for degree and content), 2) work experience and 3) separate electrical safety degree test organized by SETI/TUKES. Thus, a bachelor's programme (nor any other educational degree) does not provide the students

with any certificate of electrical qualification, but it also requires work experience and additional examination. And the final agreement of the adequacy of the studies is made by SETI.
We estimate that less than 10% of the students graduated from the MSc programmes in electrical engineering will ever require and acquire electrical qualification certificates. Also, employers do not expect that graduates of MSc programmes in electrical engineering (not to mention bachelor's) would have electrical qualifications. However, we want to provide the educational requirements (45 ECTS covering content defined by SETI) of electrical qualification 2 for the students of Finnish BSc programme. That is a selling point of the programme since no other university in Finland provide that. That is why we have also increased the number of laboratories in Finnish BSc programme up to 12 ECTS which is considerably high amount in a university degree.
The profile of the students of the international BSc programme differs from the student profile in the Finnish-language programme. Many of international students are expected to study at LUT only the BSc programme and then return to their home country or move to another country for MSc studies. Because of this, there are even fewer students in the international BSc programme than in the Finnish programme who will ever need electrical qualifications. That is why the international BSc programme is designedto provide students with strong basics of electrical engineering knowledge and skills but not to cover the educational requirements of electrical qualifications.

Criterion 1.3 Curriculum

Citation from the accreditation report, page 15:
"Still, the assessors consider the Double Degree programme to be a robust study programme that suffers from its overarching title. They suspect that the university would fare better if they kept both programmes as is, but focus for the Double Degree programme on a title that centres the international aspect of the programme."

The head of the degree programme and the head of the international BSc programme agree with the assessors that the names of the two BSc programmes need to be reconsidered. The renaming is planned for the application round 2025-26.
"

Citation from the accreditation report, page 15:
"The assessors find, however, that the subject of grid integration is not sufficiently reflected in the programme [MSc ETS], which would be a necessary topic in the near future of electric transportation systems."

The subject of grid integration will be included in the course Electric Vehicle Charging planned for the curriculum for academic year 2025-26. The course is provided especially for the MSc programme in Electric Transportation Systems in Lahti. It is a new course and the content of the course is still under development.

Citation from the accreditation report, page 17:
"They suggest to introduce a mobility window into the programmes and advertise them as such to help the students recognise the opportunity."

This comment is valid and room for development has been recognized at LUT. The issue has been already addressed in the curriculum planning of Electrical Engineering programmes. Also, LUT level actions will be executed to include mobility periods to all programmes curricula and communication about mobility possibilities to students will be improved.

Criterion 1.4 Admission requirements

Citation from the accreditation report, page 18:
"During the audit, the proficiency of English for students from HEBUT was raised several times by programme coordinators, teachers as well as fellow-students. It appears that there is a lack of English fluency from the Chinese students which makes both teaching and socialising among the student body harder. To avoid this the assessors suggest that the partner university HEBUT be notified of this shortcoming so that the admission requirement there is updated."

To avoid any future gaps in students' language skills, LUT will require an approved English language test for every HEBUT student starting the international BSc programme. This is in line with the entry requirements for all other LUT English-language BSc programmes. The procedure has been planned in revising the agreement between LUT and HEBUT. To ensure the required language skills of the students admitted to the international BSc programme in 2024, a compulsory English course has been added to their curriculum.

Criterion 2. Exams: System, Concept and Organisation

Citation from the accreditation report, page 22:
"In a nutshell, the assessors are of the opinion that the current Moodle exams are lacking in difficulty, particularly regarding the opportunity for illicit aid and missing time limit. The teachers and programme coordinators should pay attention that the examinations are congruent with EQF6 or EQF 7, respectively."

The problems of the Moodle exams mentioned in the report are noticed at LUT and improvements have been planned. In some courses, exams have already been changed from moodle to EXAM hall or as paper exams for the academic year 2024-2025. In the next curriculum work round the head of degree programme of electrical engineering will make a more thorough review on assessment methods used on courses and assure that there will be enough supervised exams in every programme - be they organized digitally in the EXAM rooms or in writing in exam halls during the examination weeks. The exam of the course "Measurement and Control Systems", mentioned in the report, will be changed to be a supervised written exam for the next implementation in the autumn semester 2024. For the Moodle exams that will stay, teachers, especially new ones, are advised better to make them challenging enough, individual by using question bank, and definitely having proper time limits.

Criterion 3.1 Staff and Staff Development

Citation from the accreditation report, page 23:
"During the audit one teacher concedes that the laboratory courses in the Ba Electrical Engineering have been decreased to accommodate for an influx of students. This means that all students have fewer designated courses in the laboratories, which cannot be the goal of the study programme."

The mentioned comment from a teacher during the audit on-site visit is not true. The number of laboratory courses have not decreased in the Finnish BSc programme in Electrical Engineering – on the contrary, the number has increased after the latest accreditation decision 2017. Some of the starting points in planning the international BSc programme in Electrical Engineering were to provide students with strong enough basic knowledge and skills of electrical engineering. In planning, we reflected our ideas on, for example, ASIIN accreditation criteria and content of other BSc programmes in Electrical Engineering in Finland. We did not see any benefit in making an English copy of the Finnish BSc programme, but we wanted the programmes to be slightly different. Thus, for example, the number of laboratory courses is different in the two programmes. The comment from a teacher can probably be caused by insufficient communication between the management and teachers.

Citation from the accreditation report, page 24:
"For the Ba Electrical Engineering, Double Degree, however, the assessors could not get a full picture of the visiting lecturers from HEBUT since no representative from the partner university participated during the audit. This means that the relevance and significance of the partnership between LUT and HEBUT could not be discussed in detail and only from unilaterally. The assessors regret the absence. As the English fluency of the guest professors

is brought up during the audit the assessors want to ascertain that their level of English is sufficient to teach in that language. This is not possible so the assessors can only assume that English fluency might be too low for the demands of a lecturer."

In the academic year 2023-24, there were only two teachers from HEBUT teaching on Electrical Engineering courses. Both have fluent English skills and we have not noticed any language related problems nor received critical feedback relation to this issue from students. We are very sorry, that the teacher who was present at campus at the time of accreditation on-site visit could not participate in discussions due to scheduled teaching hours. His language skills were presented afterwards with the video recording sent to ASIIN.
To prevent defects in teachers' language skills in future, LUT has designed a procedure for possible cases where English fluency of HEBUT teachers is too low for the demands of academic education. The procedure has been planned in revising the agreement between LUT and HEBUT. It allows LUT to replace a teacher from HEBUT at HEBUT's expense.

Criterion 3.3 Funds and equipment

Citation from the accreditation report, page 26:
"One problem which the students of the Ma Electric Transportation Systems programme mention during the audit, is the lack of industry standard software – an issue that is not raised in the other programmes. The assessors see the importance of software in this programme, such as DigsiLENT Power Factory, and suggest to make it accessible to the students in the future."

Currently, an advanced Matlab+Simulink software package is in use that covers the intended learning outcomes for modelling skills. The main idea is to teach the principles of modelling using different tools, as no single software is used in all possible jobs that graduates might end up in. However, the head of the programme and the professors teaching in the programme will study the various standard software tools in the field that graduates may need in their work. Based on that the decisions will be made on the possible software purchases.

Criterion 4.1 Module Descriptions

Citation from the accreditation report, page 27:
"As a preparation to the audit, the assessors look through the handbooks and recognise that for some courses not all information is given. This is why the auditors suggest that the module handbooks be checked for all information."

All the course descriptions are checked and updated annually by the responsible teacher of the course. The descriptions are checked by the study coordinator before publication in the following year's study guide, and if any deficiencies are found, they are addressed by the study coordinator or head of the degree programme. We appreciate if ASIIN could deliver a list of incomplete course descriptions or at least indicate what type of deficiencies were observed so that the necessary improvements can be made.

Criterion 5: Quality management

Citations from the accreditation report, page 17 and 29:
"Generally though, the experts come to understand that the communication between programme coordinators, lecturers and specialists appears to be lacking which hampers a smooth reviewing process."
"During the audit the teachers find faults with the communication between the different levels of the faculty, especially during the opening of the Double Degree programme."

This comment is a good reminder of the importance of internal communication inside the department, school and whole university. Some actions have already been executed at the school as a new School News format has been designed and published on a regular basis. In the Electrical Engineering department, the same kind of Department News has been introduced recently. In addition, we will discuss with teachers what kind of information they would like to receive and in what format. When designing the communication means, we need to take into account that all teachers at LUT are also researchers who need to focus on their research work as well. Too frequent, detailed and inappropriate communication can be a burden for them.

F Summary: Expert recommendations (20.08.2024)

Taking into account the additional information and the comments given by LUT the peers summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Electrical Engineering	With requirements for one year	30.09.2031	EUR-ACE®	30.09.2030
Ba Electrical Engineering (Double Degree)	With requirements for one year	30.09.2030	EUR-ACE®	30.09.2029
Ma Electrical Engineering	With requirements for one year	30.09.2031	EUR-ACE®	30.09.2030
Ma Electrical Engineering (Double Degree)	With requirements for one year	30.09.2030	EUR-ACE®	30.09.2029

Requirements

For all degree programmes:

A 1. (ASIIN 1.3): The (English) name of courses that have similar content should be the same.

A 2. (ASIIN 2): Make sure that the difficulty of the exams is appropriate for the EQF level and the type of examination.

A 3. (ASIIN 2): Make sure that the methods of examination do not compromise a fair, individual assessment.

A 4. (ASIIN 4.1): The module descriptions should be accessible, in full, to all interested parties.

A 5. (ASIIN 5): The exchange between programme coordinators, lecturers and specialists during programmes revisions and curriculum design should be enhanced.

For the Ba „Electrical Engineering (Double Degree)“

A 6. (ASIIN 1.1 / 1.2 / 1.3): The learning outcomes, the title of the programme, and the curriculum should be harmonised so that the intercultural and international aspect of the programme is more visible.

A 7. (ASIIN 1.4 / 3.1): Make sure that both lecturers and students, especially from the partner university, are sufficiently proficient in English.

For the Ma „Electric Transportation System“

A 8. (ASIIN 1.3): Make sure that the topic of grid integration is sufficiently discussed in the programme.

A 9. (ASIIN 3.3): Make sure that the students can use industry standard software such as DigsiLENT Power Factory.

Recommendations

For all degree programmes

E 1. (ASIIN 1.3): It is recommended to include a mobility window in all programmes and advertise it as such.

E 2. (ASIIN 1.5): It is recommended to introduce part-time study opportunities.

E 3. (ASIIN 3.3): It is recommended to enhance the lab equipment and extend lab capacities.

For the Ba programmes

E 4. (ASIIN 1.5): It is recommended to re-evaluate the workload in the first year.

G Comment of the Technical Committee 02 – Electrical Engineering/Information Technology (28.08.2024)

Assessment and analysis for the award of the ASIIN seal:

The TC members discuss the procedure and agree with the experts' vote without any changes.

Assessment and analysis for the award of the EUR-ACE® Label:

The Technical Committee deems that the intended learning outcomes of the degree programmes do comply with the engineering specific parts of Subject-Specific Criteria of the Technical Committee 02 – Electrical Engineering/Information Technology.

The Technical Committee 02 – Electrical Engineering/Information Technology recommends the award of the seals as follows:

Degree Programme	**ASIIN Seal**	**Maximum duration of accreditation**	**Subject-specific label**	**Maximum duration of accreditation**
Ba Electrical Engineering	With requirements for one year	30.09.2031	EUR-ACE®	30.09.2030
Ba Electrical Engineering (Double Degree)	With requirements for one year	30.09.2030	EUR-ACE®	30.09.2029
Ma Electrical Engineering	With requirements for one year	30.09.2031	EUR-ACE®	30.09.2030
Ma Electrical Engineering (Double Degree)	With requirements for one year	30.09.2030	EUR-ACE®	30.09.2029

Requirements

For all degree programmes:

A 1. (ASIIN 1.3): The (English) name of courses that have similar content should be the same.

A 2. (ASIIN 2): Make sure that the difficulty of the exams is appropriate for the EQF level and the type of examination.

A 3. (ASIIN 2): Make sure that the methods of examination do not compromise a fair, individual assessment.

A 4. (ASIIN 4.1): The module descriptions should be accessible, in full, to all interested parties.

A 5. (ASIIN 5): The exchange between programme coordinators, lecturers and specialists during programmes revisions and curriculum design should be enhanced.

For the Ba „Electrical Engineering (Double Degree)“

A 6. (ASIIN 1.1 / 1.2 / 1.3): The learning outcomes, the title of the programme, and the curriculum should be harmonised so that the intercultural and international aspect of the programme is more visible.

A 7. (ASIIN 1.4 / 3.1): Make sure that both lecturers and students, especially from the partner university, are sufficiently proficient in English.

For the Ma „Electric Transportation System“

A 8. (ASIIN 1.3): Make sure that the topic of grid integration is sufficiently discussed in the programme.

A 9. (ASIIN 3.3): Make sure that the students can use industry standard software such as DigsiLENT Power Factory.

Recommendations

For all degree programmes

E 1. (ASIIN 1.3): It is recommended to include a mobility window in all programmes and advertise it as such.

E 2. (ASIIN 1.5): It is recommended to introduce part-time study opportunities.

E 3. (ASIIN 3.3): It is recommended to enhance the lab equipment and extend lab capacities.

For the Ba programmes

E 4. (ASIIN 1.5): It is recommended to re-evaluate the workload in the first year.

H Decision of the Accreditation Commission (24.09.2024)

Assessment and analysis for the award of the subject-specific ASIIN seal:

The Accreditation Commission discusses the procedure. They agree with the opinion of the expert team and the Technical Committee and follow the requirements and recommendations with minor editorial changes.

Assessment and analysis for the award of the EUR-ACE® Label:

The Accreditation Commission deems that the intended learning outcomes of the degree programmes do comply with the engineering specific parts of Subject-Specific Criteria of the Technical Committee 02 – Electrical Engineering/Information Technology.

The Accreditation Commission decides to award the following seals:

Degree Programme	**ASIIN Seal**	**Maximum duration of accreditation**	**Subject-specific label**	**Maximum duration of accreditation***
Ba Electrical Engineering	With requirements for one year	30.09.2031	EUR-ACE®	30.09.2030
Ba Electrical Engineering (Double Degree)	With requirements for one year	30.09.2030	EUR-ACE®	30.09.2029
Ma Electrical Engineering	With requirements for one year	30.09.2031	EUR-ACE®	30.09.2030
Ma Electrical Engineering (Double Degree)	With requirements for one year	30.09.2030	EUR-ACE®	30.09.2029

*Subject to the approval of the ENAEE Administrative Council

Requirements

For all degree programmes:

A 1. (ASIIN 1.3): Modules with identical content have to have the same title.

A 2. (ASIIN 2): Make sure that the difficulty of the exams is appropriate for the EQF level and the type of examination.

A 3. (ASIIN 2): Make sure that the methods of examination do not compromise a fair, individual assessment.

A 4. (ASIIN 4.1): The module descriptions should be accessible, in full, to all interested parties.

A 5. (ASIIN 5): The exchange between programme coordinators, lecturers and specialists during programmes revisions and curriculum design should be enhanced.

For the Ba „Electrical Engineering (Double Degree)“

A 6. (ASIIN 1.1 / 1.2 / 1.3): The learning outcomes, the title of the programme, and the curriculum should be harmonised so that the intercultural and international aspect of the programme is more visible.

A 7. (ASIIN 1.4 / 3.1): Make sure that both lecturers and students, especially from the partner university, are sufficiently proficient in English.

For the Ma „Electric Transportation System“

A 8. (ASIIN 1.3): Make sure that the topic of grid integration is sufficiently discussed in the programme.

A 9. (ASIIN 3.3): Make sure that the students can use industry standard software such as DigsiLENT Power Factory.

Recommendations

For all degree programmes

E 1. (ASIIN 1.3): It is recommended to include a mobility window in all programmes and advertise it as such.

E 2. (ASIIN 1.5): It is recommended to introduce part-time study opportunities.

E 3. (ASIIN 3.3): It is recommended to enhance the lab equipment and increase lab capacities.

For the Ba programmes

E 4. (ASIIN 1.5): It is recommended to re-evaluate the workload in the first year.

Appendix: Programme Learning Outcomes and Curricula

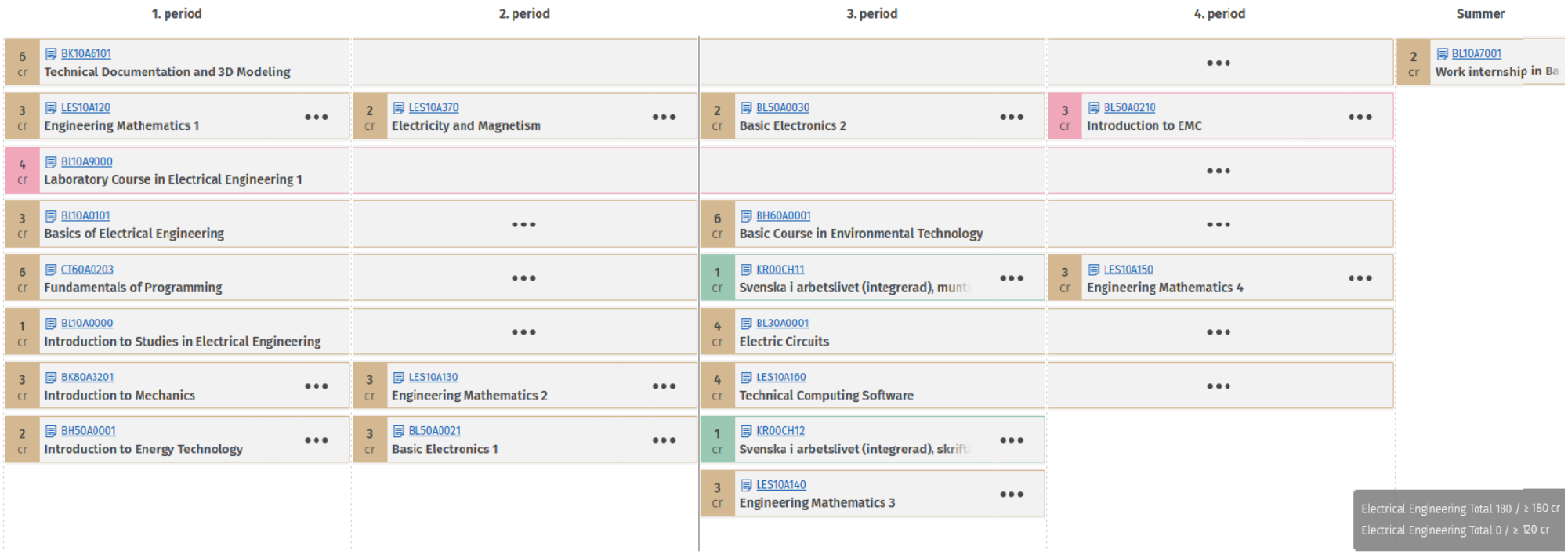
According to the self-assessment report the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Electrical Engineering:

- Students will have basic skills in mathematics and science and be able to solve problems by applying suitable mathematical methods.
- Students will be aware of the essential laws of physics and be able to apply them to various physical processes. Students will understand physical phenomena and be able to solve problems related to them. Students will be able to describe simple dynamics systems using continuous time differential equations and simulate them. Students will be able to use digital solving environments in the practical applications of the methods.
- Students will understand the meaning of the most essential electrical equations and be able to apply them.
- Students will be able to name and describe the most common electrical and electronics applications and operation principles. Students will be able to explain the most essential operation principles of electrical grid.
- Students will understand the principle of feedback control. Students will be able to apply the basic methods of control engineering in devices and machines.
- Students will be able to describe the essential systems of electricity production. Students will be able to explain the operation of the most essential electromagnetic and electromechanical components used in energy conversion, based on the basic equations of electricity. Students will be able to describe the operation and control of the typical electrical motors and converters. Students will understand the meaning of electricity in the energy systems of the societies and be able to propose energy efficient electrical implementations to different energy solutions of the society.
- Students will know the phenomena and regulations of electrical safety well enough to apply Electrical Qualification 2 and/or 3 (S2 and/or S3) if required. Students will be able to describe the essential guidelines and regulations of electrical safety, electrical installations and electromagnetic compatibility, and act according to

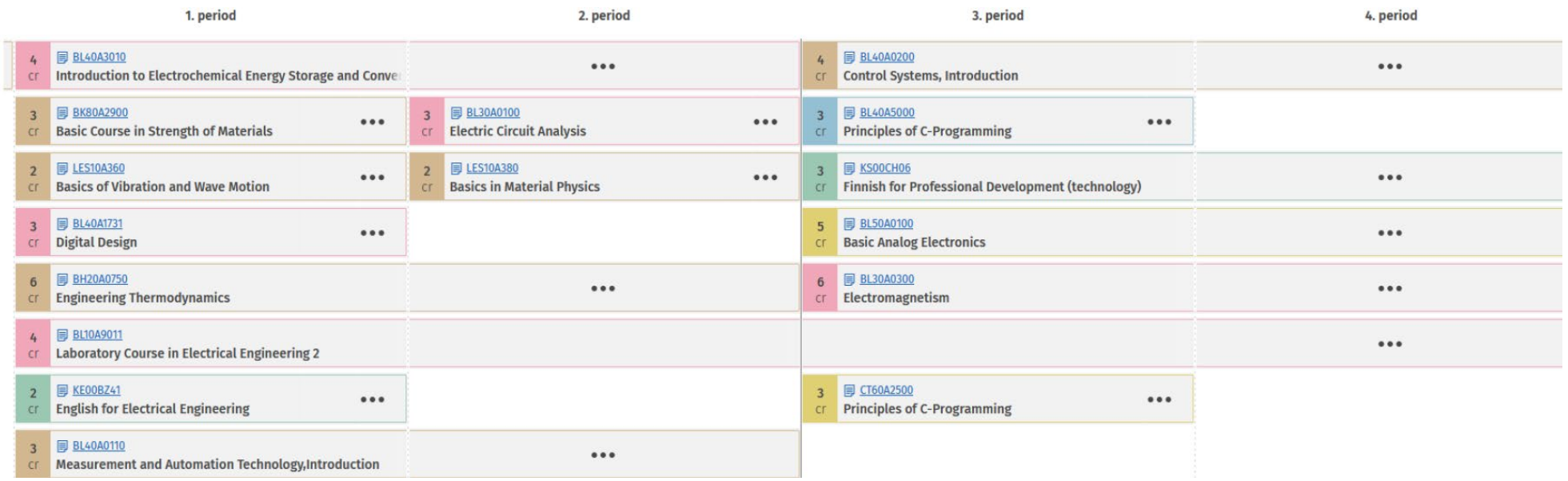
them. Students will be able to operate in case of electrical accident. Students will be able to perform the essential measurements related to the electrical safety of installations.

- Students will be able to use safely and reliably the most common measurement systems of electrical power engineering, power electronics and electronics, and perform calculations and measurements related to electrical circuits and power electronics. Students will be able to design, implement and document measurements and justify technical theorems by means of measurements.
- Students will know the study methods best suited for themselves and apply them. Students will be able to communicate both written and orally, also with foreign language. Students will be able to search and filter information. Students will be able to work as a team member in a project-like working environment. Students will be able to prepare and follow schedules to achieve goals. Students will be able to participate scientific discussion. Students will be able to give and treat peer-feedback.

The following **curriculum** is presented:

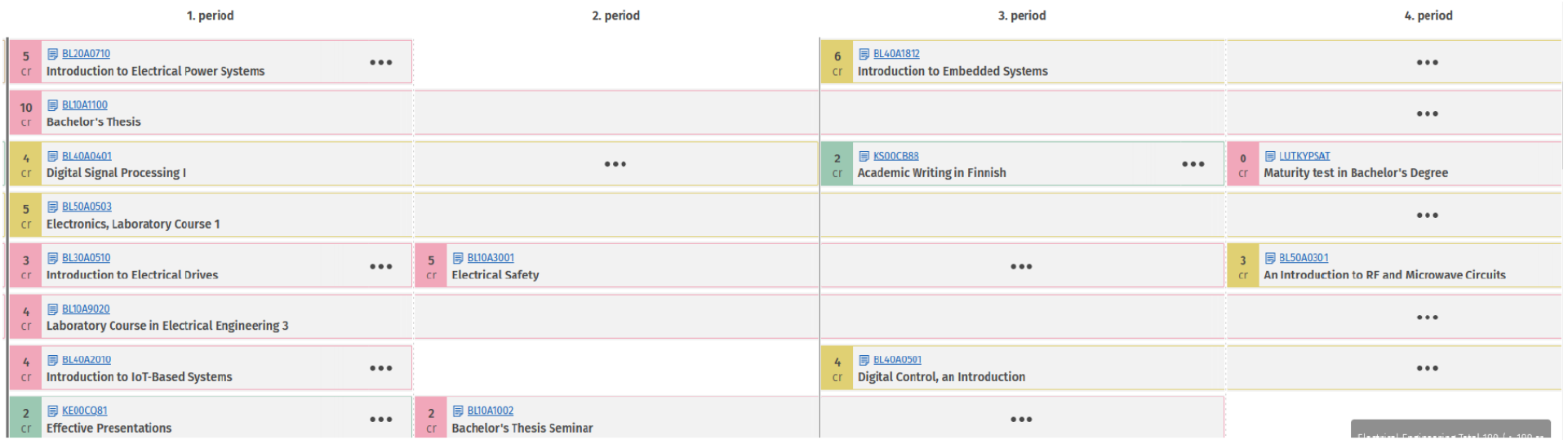

1. period
2. period
3. period
4. period
Summer
6 cr BK10A6101 Technical Documentation and 3D Modeling
3 cr LES10A120 Engineering Mathematics 1
4 cr BL10A9000 Laboratory Course in Electrical Engineering 1
3 cr BL10A0101 Basics of Electrical Engineering
6 cr CT60A0203 Fundamentals of Programming
1 cr BL10A0000 Introduction to Studies in Electrical Engineering
3 cr BK80A3201 Introduction to Mechanics
2 cr BH50A0001 Introduction to Energy Technology
2 cr LES10A370 Electricity and Magnetism
3 cr LES10A130 Engineering Mathematics 2
3 cr BL50A0021 Basic Electronics 1
2 cr BL50A0030 Basic Electronics 2
6 cr BH60A0001 Basic Course in Environmental Technology
1 cr KR00CH11 Svenska i arbetslivet (integrerad), munt
4 cr BL30A0001 Electric Circuits
4 cr LES10A160 Technical Computing Software
1 cr KR00CH12 Svenska i arbetslivet (integrerad), skrift
3 cr LES10A140 Engineering Mathematics 3
3 cr BL50A0210 Introduction to EMC
3 cr LES10A150 Engineering Mathematics 4
2 cr BL10A7001 Work internship in Ba
Electrical Engineering Total 180 / ≥ 180 cr
Electrical Engineering Total 0 / ≥ 120 cr

0 Appendix: Programme Learning Outcomes and Curricula



1. period	2. period	3. period	4. period
4 cr BL40A3010 Introduction to Electrochemical Energy Storage and Conve	•••	4 cr BL40A0200 Control Systems, Introduction	•••
3 cr BK80A2900 Basic Course in Strength of Materials •••	3 cr BL30A0100 Electric Circuit Analysis •••	3 cr BL40A5000 Principles of C-Programming •••	
2 cr LES10A360 Basics of Vibration and Wave Motion •••	2 cr LES10A380 Basics in Material Physics •••	3 cr KS00CH06 Finnish for Professional Development (technology)	•••
3 cr BL40A1731 Digital Design •••		5 cr BL50A0100 Basic Analog Electronics	•••
6 cr BH20A0750 Engineering Thermodynamics	•••	6 cr BL30A0300 Electromagnetism	•••
4 cr BL10A9011 Laboratory Course in Electrical Engineering 2			•••
2 cr KE00BZ41 English for Electrical Engineering •••		3 cr CT60A2500 Principles of C-Programming •••	
3 cr BL40A0110 Measurement and Automation Technology,Introduction	•••		

0 Appendix: Programme Learning Outcomes and Curricula



According to the self-assessment report the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Electrical Engineering (Double Degree):

• apply the mathematical and scientific foundations of technology in problem solving,

• apply key laws of physics to model different physical processes, understand physical phenomena and solve tasks related to these phenomena,

• describe simple dynamical systems with time-continuous differential equations and simulate them as well as use digital solution environments in practical applications of methods,

• understand the importance of the fundamental principles of electrical engineering and be able to use them when solving related tasks,

• name and describe the most common electrical engineering and electronics applications and operating principles,

• explain the main operating principles of electricity networks,

• describe the principles of feedback in system control, apply basic methods of control technology to devices based on physical phenomena,

• describe the main electricity generation systems, explain the operation of the most important components of electromagnetic and electromechanical energy conversion based on the fundamental principles of electrical engineering,

• describe the principles of operation and control of typical electric motors and frequency converters, understands the role of electricity in the energy systems of societies and present energy efficient electrotechnical solutions for society,

• programme effectively in Python, C and Matlab environments and understand the importance of the Internet of Things to electrical engineering,

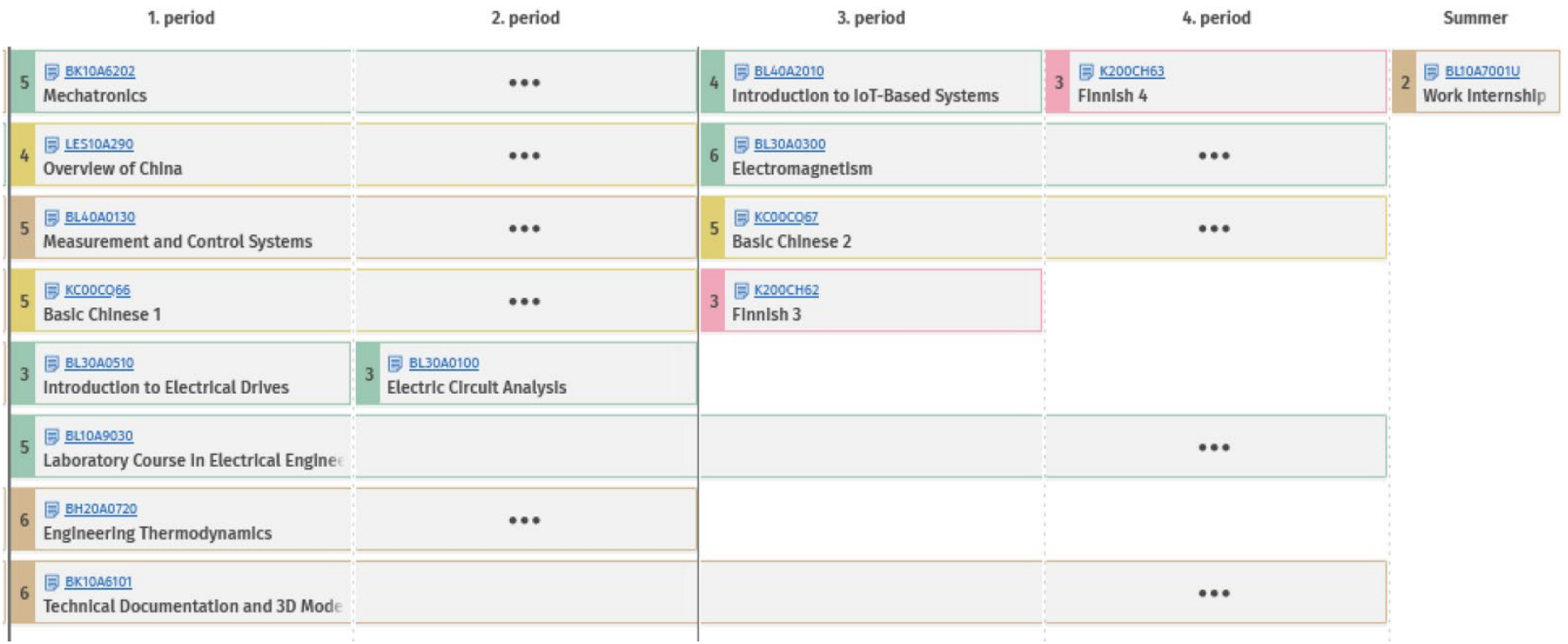
• safely and reliably use the most common measurement systems for electrical power technology, power electronics and electrical devices,

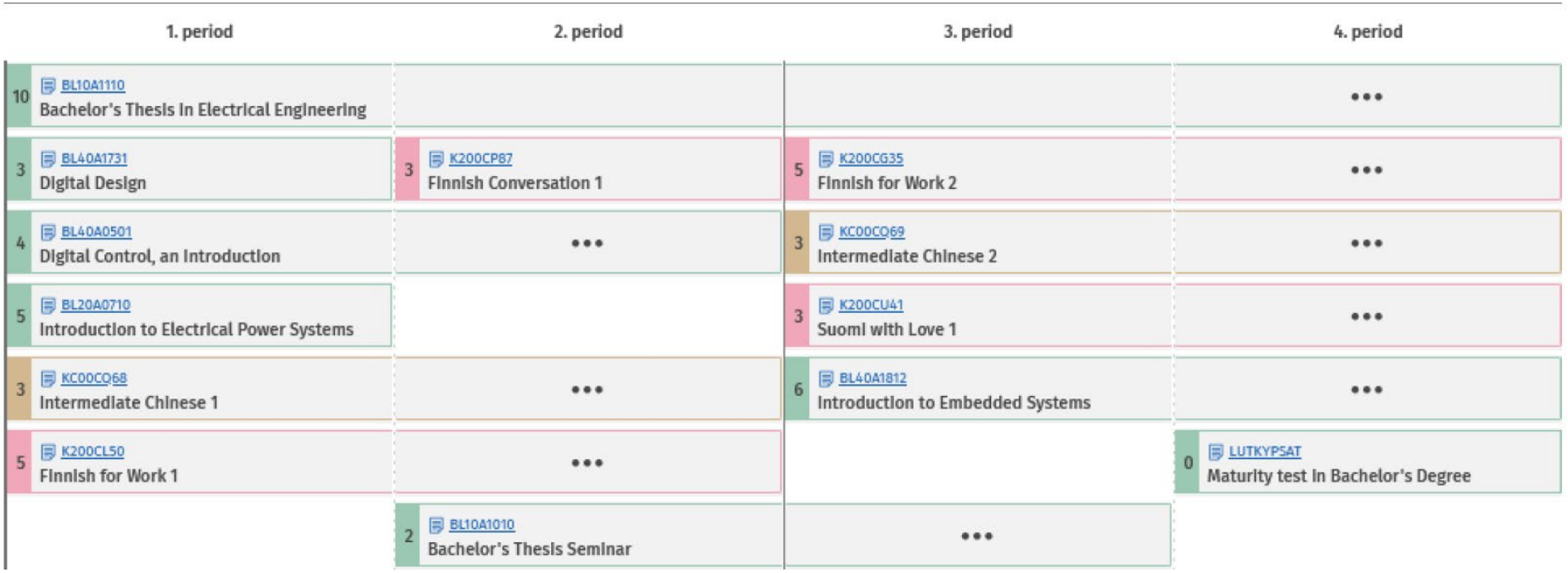
• make calculations and measurements related to electronic circuits and power electronics as well as plan, implement and document measurements and substantiate technical claims with the help of measurements,

• study effectively and communicate orally and in writing, work as a team member in a project-like work environment, create schedules to achieve goals and follow them, participate in scientific discussion, give and process peer feedback.

The following **curriculum** is presented:

1. period		2. period		3. period		4. period	
3	LES10A200 Engineering Mathematics I	3	LES10A210 Engineering Mathematics II	3	BL50A0021 Basic Electronics 1	3	LES10A230 Engineering Mathematics IV
5	K200BX70 Finnish Culture and Language 1	•••		3	BL40A5000 Principles of C-Programming	3	BL50A0210 Introduction to EMC
3	BL10A0101 Basics of Electrical Engineering	•••		5	BH50A0220 Energy Systems	•••	
1	LES10A000 Introduction to B.Sc. Studies	•••		6	BH60A0001 Basic Course in Environmental Technology	•••	
3	LES10A020 Engineering Physics	•••		2	BL50A0030 Basic Electronics 2	•••	
5	BK10A5800 Engineering Mechanics 1	•••		3	LES10A220 Engineering Mathematics III		
6	CT60A0250 Fundamentals of Programming for Internatic	•••		4	BL30A0001 Electric Circuits	•••	
				4	LES10A260 Technical Computing Software	•••	


1. period
2. period
3. period
4. period
Summer
5 BK10A6202 Mechatronics
4 LES10A290 Overview of China
5 BL40A0130 Measurement and Control Systems
5 KC00CQ66 Basic Chinese 1
3 BL30A0510 Introduction to Electrical Drives
5 BL10A9030 Laboratory Course in Electrical Engine
6 BH20A0720 Engineering Thermodynamics
6 BK10A6101 Technical Documentation and 3D Mode
3 BL30A0100 Electric Circuit Analysis
4 BL40A2010 Introduction to IoT-Based Systems
6 BL30A0300 Electromagnetism
5 KC00CQ67 Basic Chinese 2
3 K200CH62 Finnish 3
3 K200CH63 Finnish 4
2 BL10A7001U Work Internship


1. period
2. period
3. period
4. period
10 BL10A1110 Bachelor's Thesis In Electrical Engineering
3 BL40A1731 Digital Design
4 BL40A0501 Digital Control, an Introduction
5 BL20A0710 Introduction to Electrical Power Systems
3 KC00CQ68 Intermediate Chinese 1
5 K200CL50 Finnish for Work 1
3 K200CP87 Finnish Conversation 1
2 BL10A1010 Bachelor's Thesis Seminar
5 K200CG35 Finnish for Work 2
3 KC00CQ69 Intermediate Chinese 2
3 K200CU41 Suomi with Love 1
6 BL40A1812 Introduction to Embedded Systems
0 LUTKYPSAT Maturity test in Bachelor's Degree

According to the self-assessment report the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Electrical Engineering:

• is able to work independently and scientifically, acquire information and formulate solutions to complex problems and tasks.

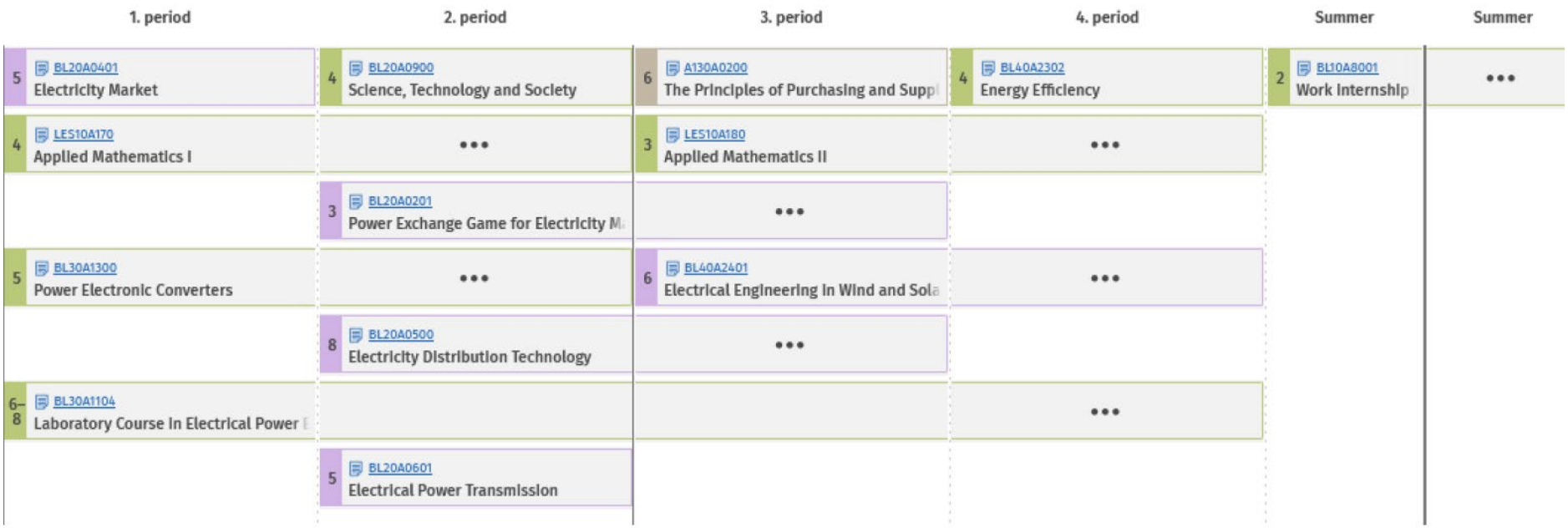
• has an ability to work as a member of team, is able to organise, carry out and lead projects and has the required communication skills.

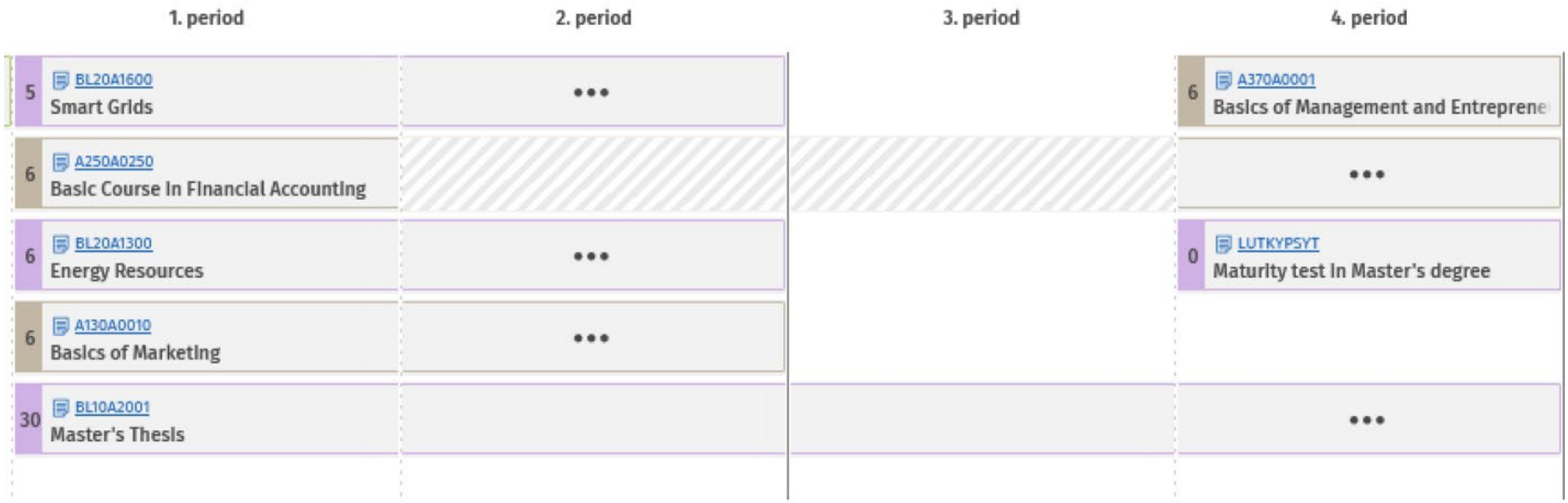
• is aware of ethical aspects of the field and its effects on society, and is capable of critically assessing the future prospects of the field.

• is able to apply the essential theories of electrical engineering to practical electrotechnical and electronics applications.

• is able to apply his/her knowledge in product development, research and marketing as well as in management of these.

The following **curriculum** is presented:


1. period
2. period
3. period
4. period
Summer
Summer
5 BL20A0401 Electricity Market
4 BL20A0900 Science, Technology and Society
6 A130A0200 The Principles of Purchasing and Supp
4 BL40A2302 Energy Efficiency
2 BL10A8001 Work Internship
4 LES10A170 Applied Mathematics I
3 LES10A180 Applied Mathematics II
3 BL20A0201 Power Exchange Game for Electricity M
5 BL30A1300 Power Electronic Converters
6 BL40A2401 Electrical Engineering in Wind and Sola
8 BL20A0500 Electricity Distribution Technology
6–8 BL30A1104 Laboratory Course in Electrical Power
5 BL20A0601 Electrical Power Transmission


1. period
2. period
3. period
4. period
5
BL20A1600
Smart Grids
6
A370A0001
Basics of Management and Entrepren
6
A250A0250
Basic Course in Financial Accounting
6
BL20A1300
Energy Resources
0
LUTKYPSYT
Maturity test in Master's degree
6
A130A0010
Basics of Marketing
30
BL10A2001
Master's Thesis

According to the self-assessment report the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master degree programme Electric Transportation Systems:

• is able to work independently and scientifically, acquire information and provide solutions to complex problems and tasks.

• has an ability to work as a member of a team, is able to organize, carry out and lead projects and has the required communication skills.

• is aware of the ethical aspects of the field and its effects on society and is capable of critically assessing the future prospects of the field.

• has a profound understanding of electrical transportation systems as a whole, and he/she is able to apply appropriate technology solutions for the development of future electric transportation systems.

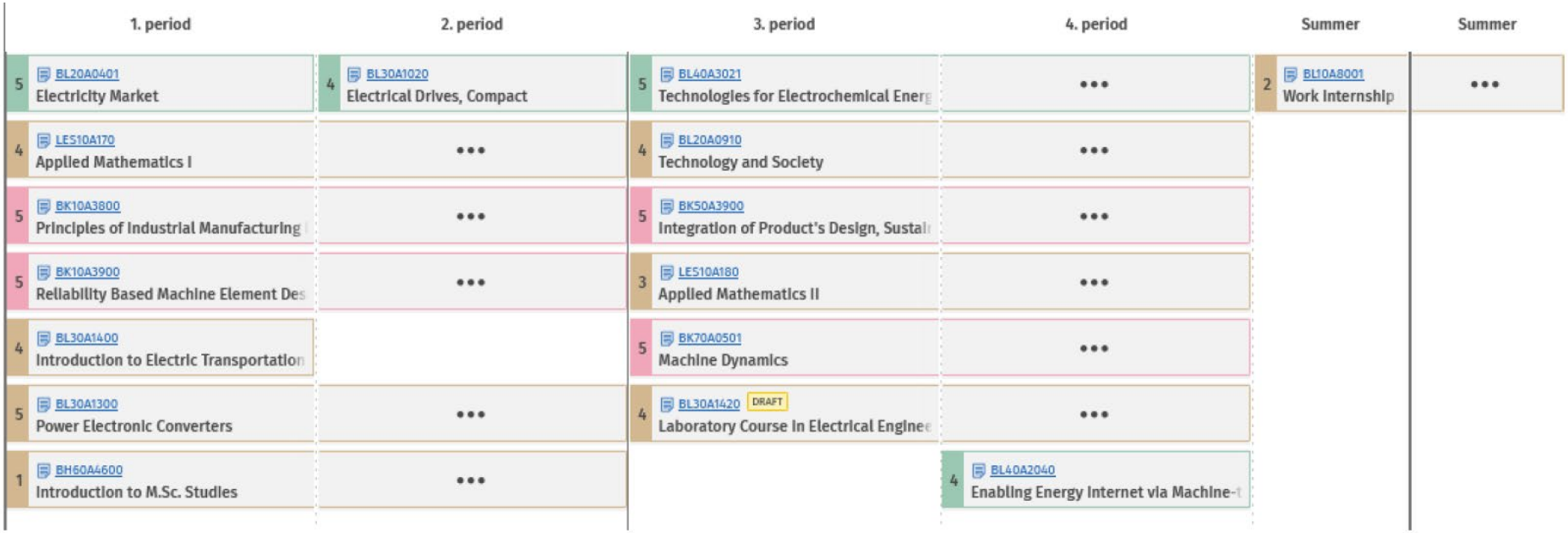
• is able to describe and analyze the role and influence of electric vehicles in the energy system, as well as power and energy transmission of electrical vehicles all the way from the grid to the drivetrain.

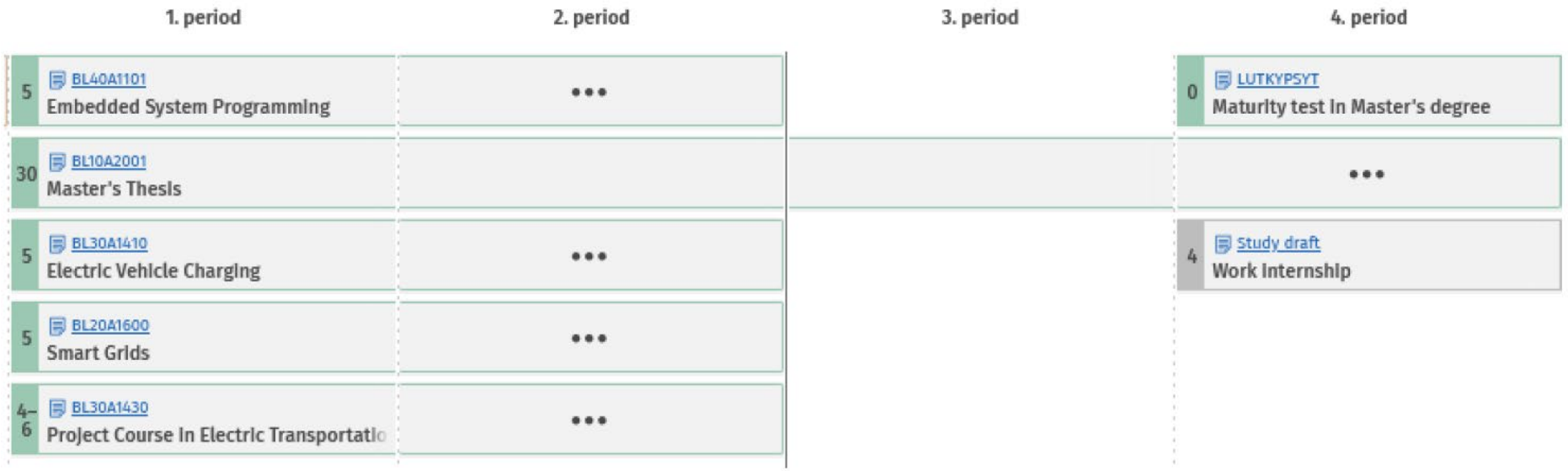
• is able to compare different energy storage options and choose a suitable one for different applications.

• is able to describe information technologies related to transportation systems and apply them, for example, to develop flexible charging systems.

• is able to apply his/her knowledge in product development, research and marketing as well as in management of these.

The following **curriculum** is presented:


1. period
2. period
3. period
4. period
Summer
Summer
5 BL20A0401 Electricity Market
4 BL30A1020 Electrical Drives, Compact
5 BL40A3021 Technologies for Electrochemical Ener
2 BL10A8001 Work Internship
4 LE510A170 Applied Mathematics I
4 BL20A0910 Technology and Society
5 BK10A3800 Principles of Industrial Manufacturing
5 BK50A3900 Integration of Product's Design, Sustai
5 BK10A3900 Reliability Based Machine Element Des
3 LE510A180 Applied Mathematics II
4 BL30A1400 Introduction to Electric Transportation
5 BK70A0501 Machine Dynamics
5 BL30A1300 Power Electronic Converters
4 BL30A1420 DRAFT Laboratory Course in Electrical Engine
1 BH60A4600 Introduction to M.Sc. Studies
4 BL40A2040 Enabling Energy Internet via Machine-t


1. period
2. period
3. period
4. period
5
BL40A1101
Embedded System Programming
•••
0
LUTKYPSYT
Maturity test in Master's degree
30
BL10A2001
Master's Thesis
•••
5
BL30A1410
Electric Vehicle Charging
•••
4
Study draft
Work Internship
5
BL20A1600
Smart Grids
•••
4–6
BL30A1430
Project Course in Electric Transportatio
•••