UiT The Arctic University of Norway

Program description
Electrical Engineering - Master

120 ECTS/Campus Narvik

Based on the document “Vilkår for bruk av tilleggsbetegnelsen Sivilingeniør (siv.ing.)” approved by The Norwegian Association of Higher Education Institutions spring 2023.

The programme description has been approved by the board of Faculty of Engineering Science and Technology on 16.05.2024

Valid from the academic year 2025/2026

Study programme name	English: Electrical Engineering - Master Bokmål: Elektroteknikk, sivilingeniør - master Nynorsk: Elektroteknikk, sivilingeniør - master
Degree obtained	Master of Science in Electrical Engineering Master i Teknologi, Elektroteknikk
Target group	The Master Program in Electrical Engineering is suitable for students with an interest in power systems and electric energy sources, energy storage and conversion, as well as advanced electric motor drives.
Admission requirements, required prerequisite, recommended prerequisite knowledge	A relevant undergraduate Bachelor degree in Engineering programme in power electronics, electrical machines or power systems. In addition, the following requirements must be met: • minimum 25 ECTS in mathematics (equivalent to Mathematical Methods 1, 2 og 3) • 5 ECTS in statistics • 7,5 ECTS i physics on a higher level is required. The requirement for physics can be covered by 7.5 ECTS in physics, building physics, fluid mechanics, thermodynamics and/or mechanics of materials.
Certificate of good conduct	Not required
Suitability assessment	Not required
The study programme's Learning Outcome	After completing the study program, the candidate has the following learning outcome: **Knowledge:** • has knowledge of the principles of electromagnetism and its application in electrical engineering. • knows the principles of electric power system. • has a knowledge of energy conversion using power electronics. and applications to electrical machines and power supplies. • has knowledge of measurement sensors, signal processing, and how these could be integrated in an advanced control system. • has basic knowledge of computer architecture and programming.

- has basic knowledge about economics and innovation, with special focus on idea development.
- has a deep understanding in one or more of the following topics:
    - operation and control of power systems
    - integration of renewable energy and smart grids.
    - stability of power systems
    - thorough knowledge of electrical machines, their dynamics and choice of suitable power electronic converter types for motor drives.
    - programmable controllers and logic systems
    - design and production electronic solutions

Skills:

- can use linear algebra and numerical methods as mathematical
  tools for analysing physical processes and technical solutions.
- can combine power electronics, control engineering and electrical
  systems into advanced electric motor drives.
- can perform simulations and analysis of electric power systems.
- can analyse electromagnetic fields in electric systems.
- can complete and document a larger independent research work in the form of a master thesis.
- can perform one or more of the following skills:
    - stability analysis of power systems
    - integration of distributed renewable energy into the grid
    - can design and prototype electric circuits.
    - can use programmable microelectronics in order to control and monitor mechatronics, electric systems, electric devices, and industrial processes.

General competence:

- gains insight into new and innovative technologies and will be able to put these into an interdisciplinary society and ethical perspective.
- gains insight into various aspects of future network systems, energy solutions and sustainability challenges.
- can disseminate knowledge in oral and written form to professionals and non-specialists.
- is able to see the combination of physical energy systems and software in cyber-physical systems and mechatronics.

Academic content and description of the study programme	The master's program covers essential and advanced skills within electric energy conversion, electric drives, control methods and power systems for electrical engineers working with the technology for the future. These technologies are critical for the electrification and digitalisation of our society, an important element towards a sustainable future. Important applications are renewable energy generation, energy storage, energy distribution, and electric transport including electric vehicles, ships, and aircrafts. Advanced skills are supported by fundamental knowledge given within electromagnetism, power electronics, programming, power systems, control engineering, measurement system, signal transmission and mathematics. The student can choose to specialise by their choice of electric courses, or exchange to another institution provided that external courses are similar in content and scope to those specified in this program description. See additional information and an overview of mandatory tasks in the individual course descriptions. The program can be done part-time over three or four years. The Master in Electrical Engineering is founded on the "conditions for use of the protected title Sivilingeniør" according to "Nasjonale retningslinjer for ingeniørutdanning" by "Universitets- og høgskolerådet".

Table 1: programme structure 2-year full time

Semester	5 ECTS	5 ECTS	5 ECTS	5 ECTS	5 ECTS	5 ECTS
1	MAT-3800 Linear algebra 2	MAT-3801 Numerical Methods	ELE-36xx Linear systems and control	ELE-36xx Nonlinear systems and control	ELE-3600 Power System Fundamentals	
2	ELE-3611 Programming	ELE-3612 Instrumentation and measuring systems	ELE-3607 Power Electronics	ELE-3613 Electromagnetic analysis in engineering	ELE-3609/ STE-3603 Signal Distribution and Transmission	TEK-3501 Innovation and economics
3	Choose at least 25 ECTS of elective courses Pre-approved elective courses: ELE-3610: Power System Stability (5 ECTS) ELE-3601: Renewable Energy Generation and Conversion (5 ECTS) ELE-3602: Power System Operation and Control (5 ECTS) ELE-3603: Programmable circuits (5 ECTS) ELE-3604: Distributed Power Generation into an Electric Power Network (5 ECTS) ELE-3605: Electrical Circuit Design and Prototyping (5 ECTS) ELE-3608: Advanced Electric Drives (5 ECTS) ELE-3614: Advanced PLC programming (5 ECTS)					ELE-3615 Scientific Writing

4	ELE-3900 Master Thesis – M-EL

In the 3rd semester the student must choose at least 25 ECTS of elective courses, or exchange to another institution with a similar field of study. Electives outside the provided list of pre-approved subjects must have relevance for the master's programme and have to be approved by the academic program director.

Elective courses define minimum number of students for the course to be run. This will be informed during presentation of electives before students makes their choices.

The master thesis will begin in the 3rd semester by the selection of topic, information about expectations, requirements, and completion of a pre-project. The work on the thesis itself is designated to the 4th semester.

Table 2: programme structure 3-year part time.

Semester	**5 ECTS**	**5 ECTS**	**5 ECTS**	**5 ECTS**	**5 ECTS**	**5 ECTS**
1	MAT-3800 Linear algebra 2	MAT-3801 Numerical Methods	ELE-36xx Linear systems and control	ELE-36xx Nonlinear systems and control	ELE-3600 Power System Fundamentals	
2	ELE-3611 Programming		ELE-3607 Power Electronics	ELE-3613 Electromagnetic analysis in engineering		
3	Elective subjects (selection of at least 15 ECTS): Pre-approved elective courses: ELE-3610: Power System Stability (5 ECTS) ELE-3602: Power System Operation and Control (5 ECTS) ELE-3603: Programmable circuits (5 ECTS) ELE-3604: Distributed Power Generation into an Electric Power Network (5 ECTS) ELE-3608: Advanced Electric Drives (5 ECTS) ELE-3614: Advanced PLC programming (5 ECTS)					
4		ELE-3612 Instrumentation and measuring systems			ELE-3609/ STE-3603 Signal Distribution and Transmission	TEK-3501 Innovation and economics
5	Elective subjects (selection of at least 10 ECTS): Pre-approved elective courses: ELE-3610: Power System Stability (5 ECTS) ELE-3601: Renewable Energy Generation and Conversion (5 ECTS) ELE-3602: Power System Operation and Control (5 ECTS) ELE-3603: Programmable circuits (5 ECTS) ELE-3604: Distributed Power Generation into an Electric Power Network (5 ECTS) ELE-3605: Electrical Circuit Design and Prototyping (5 ECTS) ELE-3608: Advanced Electric Drives (5 ECTS) ELE-3614: Advanced PLC programming (5 ECTS)					ELE-3615 Scientific Writing
6	ELE-3900 Master Thesis – M-EL					

The first semester is a full-time semester, so also the last 6th semester. However, the 6th semester is a master thesis course and it is possible to do the master thesis in cooperation with industry. Elective courses define minimum number of students for the course to be run. This will be

informed during presentation of electives before students makes their choices. Electives outside the provided list of pre-approved subjects must have relevance for the master's programme and have to be approved by the academic program director.

Table 3: programme structure 4 year part time

Semester	5 ECTS	5 ECTS	5 ECTS	5 ECTS	5 ECTS	5 ECTS
1	MAT-3800 Linear algebra 2	MAT-3801 Numerical Methods	ELE-36xx Linear systems and control			
2	ELE-3611 Programming		ELE-3607 Power Electronics	ELE-3613 Electromagnetic analysis in engineering		
3			ELE-36xx Nonlinear systems and control		ELE-3600 Power System Fundamentals	
4		ELE-3612 Instrumentation and measuring systems			ELE-3609/ STE-3603 Signal Distribution and Transmission	TEK-3501 Innovation and economics
5	Elective subjects (selection of at least 15 ECTS): • ELE-3610: Power System Stability (5 ECTS) • ELE-3602: Power System Operation and Control (5 ECTS) • ELE-3603: Programmable circuits (5 ECTS) • ELE-3604: Distributed Power Generation into an Electric Power Network (5 ECTS) • ELE-3608: Advanced Electric Drives (5 ECTS) • ELE-3614: Advanced PLC programming (5 ECTS)					
6	Internship in a company / exchange?					
7	Elective subjects (selection of at least 10 ECTS): • ELE-3610: Power System Stability (5 ECTS) • ELE-3601: Renewable Energy Generation and Conversion (5 ECTS) • ELE-3602: Power System Operation and Control (5 ECTS) • ELE-3603: Programmable circuits (5 ECTS) • ELE-3604: Distributed Power Generation into an Electric Power Network (5 ECTS) • ELE-3605: Electrical Circuit Design and Prototyping (5 ECTS) • ELE-3608: Advanced Electric Drives (5 ECTS) • ELE-3614: Advanced PLC programming (5 ECTS)					ELE-3615 Scientific Writing
8	ELE-3900 Master Thesis – M-EL					

Note that the 8th semester is a full-time master thesis course and it is possible to do the master thesis in cooperation with industry. Elective courses define minimum number of students for the course to be run. This will be informed during presentation of electives before students makes their

choices. Electives outside the provided list of pre-approved subjects must have relevance for the master's programme and have to be approved by the academic program director.	
Learning activities, examination and assessment	Most courses are based on lectures, self-study and assignments or small projects, individually or in groups. Each 5 ECTS course usually includes 40 lectures, plus supervision time. The handouts can be voluntary or mandatory. Mandatory lab exercises are included in some topics. Scientific theory, application and analysis is emphasized in assignments and projects. The individual course descriptions provide additional information. The study offers a learning foundation where digital tools and online support resources are widely used. Learning resources of each subject are available in an LMS (Learning Management System). Most of the subject information is gathered there, such as lecture notes, assignments, tests, links, deadlines, etc., and it is also a platform for the main communication with lecturers and fellow students. Teaching can take place in different ways depending on the topic. Traditional lecture model is primarily used, while some courses has implemented projects, "flipped classroom" and other types of active teaching methods. In a traditional lecture model, teachers will lecture in scheduled hours. However, a part of the scheduled hours will be hours of self-study, where students can work with lab assignments, tasks that are included in work requirements or tasks that are part of an assessment. The lecturer and any scientific assistants will be available.
The study programme's relevance	With a master's degree in electrical engineering, you can work within all types of use and control of electricity, including development, design and construction, research, environmental surveillance, data technology, electrical supply and instrumentation. With a growing focus on the development of sustainable and renewable energy production, electric energy will play a key role in many new energy-intensive areas of our society. We see it in transport, on land, sea and in the air as an exciting development area. The electrical engineer will play a central role in the renewable energy community of the future.
Work scope	The annual scope of work should be 1500 work hours. In order to achieve the learning objectives, the students are expected to work 40 hours per week in full time studies, including lectures, lab exercises and self-study.
For master's theses/independent work in master's degrees	The master thesis cover the entire final semester and has a scope of 30 ECTS. The work will be evaluated based on the written report with grades A – F. The thesis should be written and submitted individually, but it is possible to cooperate with other students working on difference aspects of the same problem.

Language of instruction and examination	English
Internationalisation	The study program is open to international students, and the teaching and examination language is English. The department is participating in international research projects, which influences on subject contents and diploma projects.
Student exchange	It is possible to study parts of the master program at other universities. An individual plan must in this case be made in accordance with the academic programme director.
Supervised professional training	Supervised professional training in the industry is encouraged, but not required for completing the programme.
Administrative responsibility and academic responsibility	Academic programme director: Bjarte Hoff Head of Department of Electrical Engineering: Arild Steen Faculty of Engineering Science and Technology, Dean Bjørn Reidar Sørensen.
Quality assurance	Annual subject evaluation reports and study program evaluation reports. Periodic evaluation of the study program every six years
Other regulations