UiT The Arctic University of Norway

Program description
Electrical Engineering - Master

120 Credits/Campus Narvik

Based on the document “Vilkår for bruk av tilleggsbetegnelsen Sivilingeniør (siv.ing.)” approved by The Norwegian Association of Higher Education Institutions spring 2016

The programme description has been approved by the board of Faculty of Engineering Science and Technology on 01.12.2017

Study programme name	Bokmål: Elektroteknikk, sivilingeniør - master Nynorsk: Elektroteknikk, sivilingeniør - master Engelsk: Electrical Engineering - Master
Degree obtained	Master I Teknologi, Elektroteknikk Master of Science in Electrical Engineering
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 Engineering program with minimum 25 credits in mathematics, 5 credits in statistics and 7,5 credits in physics* on a higher level. *Some of the courses in the bachelor program have a certain amount of physics included that can be accepted. The candidate should have basic knowledge in power electronics and electrical machines. Basic knowledge of power systems is also an advantage.
The study programme's Learning Outcome	After completing the study program the candidate has the following learning outcome: **Knowledge:** • has basic knowledge about economics and innovation, with special focus on creating an enterprise, developing concepts and protection of rights. • knows the principles of electric power system and understands the limitations and bottlenecks in such a system. Key topics are renewable energy, stability of power systems and operation and control of power systems. • has a thorough knowledge of electrical machines, their dynamics and choice of suitable converter types for motor drives. The candidate also knows about available measurement sensors and how these could be integrated in an advanced control system. • has basic knowledge of computer architecture and programming.

	Skills: • can use linear algebra and numerical methods as mathematical tools for analyzing physical processes and technical solutions. • can combine power electronics, control engineering and electrical systems into advanced electric motor drives. • can perform basic simulations and analyzes of power systems, in regards to load flow, stability, operating conditions or economic considerations. • can use computers, microcontrollers or other types of microelectronics in order to control and monitor mechatronic systems. • completes the study program through performing a larger diploma work of a six-month duration. **General competence:** • gains insight into new and innovative technologies and will be able to put these into a society perspective. • gains insight into various aspects of future network systems, energy solutions and climate challenges. • is able to combine energy systems with signal transfer and ICT solutions in an overall system with high flexibility.
Academic content and discription of the study programme	The program is aimed at automated industrial processes, with the use of computer aided advanced control systems and inverter technologies. In addition, there is an emphasis on a basic understanding of the properties and limitations of power systems, as well as the potential of small-scale renewable energy sources. The study also focuses on applied mathematics, economics and business development. The program covers the following disciplines: - Linear Algebra and Numerical Analysis - Control Engineering - Instrumentation and Measurement - Signal Transmission - Computer Programming - Programmable Controllers - Electrical Machines and Power Electronics

- Basic Power System Theory

- Renewable Energy Sources

- Power System Operation and Stability

- Final thesis

See additional information in the different course descriptions.

The program is uniform, except for 5 ECTS of electives, and does not include different modules, and all teaching is on campus. Mandatory tasks are described in the different course descriptions. The program can be done part-time over four years.

It will be possible to take part of the studies abroad, provided that external courses are similar in content and scope to those specified in the study plan.

Table: programme structure

Semester	10 ECTS	10 ECTS	10 ECTS	
1	MAT-3800 Linear algebra 2 MAT-3801 Numerical Methods	ELE-3606 Control Engineering	ELE-3600 Power System Fundamen-tals	HMS-0501 Safety in the laboratory, workshop and on sea and land expeditions (0 ECTS) Online and HMS-0502 First aid in the laboratory, workshop and on sea and land expeditions (0 ECTS) Compulsory attendance
2	ELE-3611 Programming	ELE-3612 Instrumentation & measuring systems	TEK-3501 Innovation and economics	
	ELE-3609 Signal Distribution and Transmission	ELE-3607 El Machines and Power Electronics 1	ELE-3610 Power System Stability	

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<tr><td>3</td><td>ELE-3608 El Machines and Power Electronics 2</td><td>ELE-3601 Renewable energy - generation and conversion</td><td>ELE-3602Power System Operation and Control</td></tr>
<tr><td></td><td>TEK-3500 Innovation and management</td><td>ELE-3603 Fundamentals of Programmable Controllers</td><td>Electives

ELE-3604 Distributed Generation and Micro Grids: Concepts and Roles

Or

ELE-3605 Electrical Engineering Project</td></tr>
<tr><td>4</td><td colspan="3">ELE-3900 Diploma Thesis - M-EL</td></tr>
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<tr><td>Learning activites, examination and assessment</td><td>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 assignment and project solution. The different 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, currently Canvas). 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 used mainly, but "flipped classroom" is included in some subjects.

In a traditional lecture model, teachers will lecture in scheduled hours. However, a part of the hourly scheduled hours will be hours of 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 plus any scientific assistants will be present.</td></tr>
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	The student's learning is obtained through lecture preparation and processing, voluntary assignments, mandatory work, assignment evaluation, collaboration with other students in groups; laboratory exercises (many of which are mandatory) and a significant amount of self-study. Flipped classroom is intended to move the lecture out of the classroom, and turn it into a preparatory part for which the student is responsible. Preparation consists of the student using textbook, notes and links to the relevant material. The scheduled lectures are used for review of specific topics, and mainly for work with tasks similar to those mentioned above. The flipped classroom model can be run as a "hybrid model", where parts of the topic are run in a lecture model, and other parts in a flipped classroom model. Mandatory safety training in health, security and environment (HSE) All students must complete mandatory safety training before they are allowed access and given permission to work in laboratories, workshops and the like. This also goes for participation in fieldwork/research cruises and similar. Please contact your immediate supervisor for list of mandatory courses.
The study programme's relevance	The program is suitable for candidates who want to work with industrial electrical engineering, automation, power grid operation and utilizing renewable energy sources. The program also provides a basis for working with project management and marketing, or teaching in technical subjects at Bachelor's level. The program also qualifies for doctoral studies in related fields.
Work scope	In order to achieve the defined learning outcome, the students should expect a weekly study workload of 40 hours, including lectures, lab preparation and self-study. The annual work scope of full-time students should be at least 1500 hours.
For master's theses/independent work in master's degrees	The 30 ECTS final master thesis (diploma) can be carried out in close collaboration with industry partners and/or on the basis of existing research and development projects. The work is usually performed individually. Regular status meetings will be held

	through the entire project period. The diploma will be evaluated solely on the basis of a final written report.
Language of instruction and examination	English
Internationalisation	The education is based on research, which in many cases is related to international research projects. Several diploma projects are closely connected to such projects.
Student exchange	It is possible to study the parts of the master's program at other universities. An individual plan must then be drawn up in consultation with the study coordinator.
Administrative responsibility and academic responsibility	Institute of Electrical Engineering – Faculty of Engineering Science and Technology.
Quality assurance	By the end of each course, the students are offered a QuestBack survey with an electronic questionnaire. Various forms of alternative evaluations are offered, including reference groups.