Programme syllabus

Master's Programme, Electric Power Engineering, 120 credits
Masterprogram, elkraftteknik
120.0 credits

Valid for students admitted to the education from autumn 20 (HT - Autumn term; VT - Spring term).

This is a translation of the Swedish, legally binding, programme syllabus.

Programme objectives

The Master’s programme in Electric Power Engineering covers courses in Electric Power Engineering including systems and components where electricity is principally used to transfer energy. The programme is concerned with understanding, modelling and analysing a wide range of topics related to design, operation, and control of individual power system components as well as power system in its entirety. After successful completion of the programme, participants shall be able to pursue a professional career in industry as well as an academic research career.

Knowledge and understanding

For the Master’s degree, the student shall

• demonstrate knowledge and understanding in the field of Electric Power Engineering, including both broad knowledge of this field and a considerable degree of specialised knowledge in one of the above mentioned subject areas as well as insight into current research and development issues, and

• demonstrate specialised methodological knowledge in the field of Electric Power Engineering

Skills and abilities

For the Master’s degree, the student shall

• demonstrate the ability to critically and systematically integrate knowledge and analyse, assess and deal with complex phenomena, issues and situations even with limited information

• demonstrate the ability to identify and formulate issues critically, autonomously and creatively as well as to plan and, using appropriate methods, undertake advanced tasks within predetermined time frames and thereby contribute to the creation of knowledge as well as the ability to evaluate this work
• demonstrate the ability to orally and in writing clearly report and discuss his or her conclusions and the knowledge and arguments on which they are based in dialogue with different audiences, and

• demonstrate the skills required for participation in research and development work or autonomous employment in some other qualified capacity.

Ability to make judgements and adopt a standpoint

For the Master’s degree, the student shall

• demonstrate the ability to make assessments in the field of Electric Power Engineering, informed by relevant disciplinary, social and ethical issues and also to demonstrate awareness of ethical aspects of research and development work

• demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used, and

• demonstrate the ability to identify the personal need for further knowledge and take responsibility for his or her ongoing learning.

Extent and content of the programme

The programme consists of 120 credits, corresponding to two years of full-time studies, and the courses are at the second cycle level. The language of instruction throughout the programme is English.

Main areas of the programme
The student freely chooses within the framework of the programme and thereby creates his own profile within electric power, for example within:

• Electric power system, focusing on the power system's dynamics, stability and control, as well as electricity markets and their design.

• Information and control systems, with focus on automation, control and monitoring of electric power systems.

• Electrotechnical design, focusing on the physical and technical bases for the design and maintenance of low and high voltage components, equipment and systems.

• Electric energy conversion with focus on electric machines and power electronics.

• Management, a broad base of electric power courses are read and supplemented by optional courses in economics, innovation and management.

Eligibility and selection

Admission requires the fulfillment of basic eligibility and the following requirements for special eligibility:
previous education must consist of courses in electrical engineering including three phase electrical circuits and/or electrical machines, equivalent to 60 ECTS,
- previous education must consist of courses in mathematics (calculus, algebra, probability theory, basic control theory) equivalent to at least 30 ECTS.

Recommended entry requirements are courses in optimization, numerical analysis and thermodynamics and statistical physics.

The number of places in the masters programme is limited. The selection process is based on the following selection criteria: University, previous studies (for instance GPA, grades in specific subjects and English), motivation for the studies (for instance letter of motivation, references, thesis proposal and relevant work experience). The evaluation scale is 1-75.

**Implementation of the education**

**Structure of the education**

Each academic year consists of two semesters which are 20 weeks each, and each semester is further divided into two study periods.

The programme comprises two years of full-time studies (120 higher education credits) including a half-year degree project (30 higher education credits).

**Courses**

The programme is course-based. Lists of courses are included in appendix 1.

**Grading system**

Courses in the first and the second cycle are graded on a scale from A to F. A-E are passing grades, A is the highest grade. The grades pass (P) and fail (F) are used for courses under certain circumstances.

Grading scale is found in the course syllabus.

**Conditions for participation in the programme**

Participation requires admission to courses within the programme and course registration.

For further studies, special admission requirements for the course are to be fulfilled. Special admission requirements are listed in the respective course syllabus.

**Degree project**

The degree project is the final part of the education and comprises 30 higher education credits. The project work may begin when special admission requirements for the course are fulfilled.

The degree project should be performed within the area of technology for which the degree is being prepared.
Degree

The degree is called "Teknologie masterexamen", English translation "Degree of Master of Science (120 credits)". The main subject for the degree will be stated in the degree certificate.

Appendix 1 - Course list
Appendix 2 - Programme syllabus descriptions
Appendix 1: Course list

Master's Programme, Electric Power Engineering, 120 credits (TELPM), Programme syllabus for studies starting in autumn 2020

General courses

Year 1

Mandatory courses (7.5 Credits)

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>AK2030</td>
<td>Theory and Methodology of Science (Natural and Technological Science)</td>
<td>4.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EH2220</td>
<td>The Sustainable Electric Power Engineer</td>
<td>3.0 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>

Conditionally elective courses

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits</th>
<th>Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG2100</td>
<td>Power System Analysis</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EG2110</td>
<td>Power System Stability and Control</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EG2200</td>
<td>Power Generation Operation and Planning</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EG2210</td>
<td>Electricity Market Analysis</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EG2220</td>
<td>Power Generation, Environment and Markets</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EH2741</td>
<td>Communication and Control in Electric Power Systems</td>
<td>6.0 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EH2745</td>
<td>Computer Applications in Power Systems</td>
<td>4.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EI2430</td>
<td>High-voltage Engineering</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
</tbody>
</table>
EI2433  Electrotechnical Modelling  Conditionally elective advanced course  7.5 hp  Second cycle
EI2436  Power Grid Technology and Substation Design  Conditionally elective basic course  6.0 hp  Second cycle
EI2440  Electrotechnical Design  Conditionally elective advanced course  7.5 hp  Second cycle
EI2452  Reliability Evaluation of Electrical Power Systems  Conditionally elective advanced course  7.5 hp  Second cycle
EI2455  Smart Electrical Networks and Systems  Conditionally elective advanced course  7.5 hp  Second cycle
EI2460  Batteries for Energy Storage in Electrical Systems  Conditionally elective advanced course  6.0 hp  Second cycle
EJ2201  Electrical Machines and Drives  Conditionally elective basic course  6.0 hp  Second cycle
EJ2230  Control in Electrical Energy Conversion  Conditionally elective advanced course  6.0 hp  Second cycle
EJ2301  Power Electronics  Conditionally elective basic course  6.0 hp  Second cycle
EJ2311  Modulation of Power Electronic Converters  Conditionally elective advanced course  6.0 hp  Second cycle
EJ2420  Seminars in Electrical Machines and Power Electronics  Conditionally elective advanced course  1.5 hp  Second cycle
EJ2440  Electric Transportation  Conditionally elective advanced course  6.0 hp  Second cycle
EL2450  Hybrid and Embedded Control Systems  Conditionally elective advanced course  7.5 hp  Second cycle
EL2520  Control Theory and Practice, Advanced Course  Conditionally elective advanced course  7.5 hp  Second cycle
EL2700  Model Predictive Control  Conditionally elective advanced course  7.5 hp  Second cycle
EL2820  Modelling of Dynamical Systems  Conditionally elective advanced course  7.5 hp  Second cycle

**Supplementary information**

The program consists of compulsory courses, two groups of conditionally elective courses (where a number of hp must be read from each group), a degree project and completely optional courses.

- **Mandatory courses.** All courses must be read for a degree. For students who follow the program for less than two years, for example due to studies abroad, the course EH2220 is replaced with EH2221.
- **Conditionally Elective Basic Courses.** At least 24 credits must be read for the degree. It is free to read the courses year 1, or year 2, if the course's special eligibility requirements are met. Note, however, that the conditionally elective basic courses often constitutes eligibility requirements for the conditionally elective advanced courses.

- **Conditionally elective advanced courses.** At least 22.5 credits must be read for the degree. It is free to read the courses year 1, or year 2, if the course's special eligibility requirements are met.

- **Elective courses, of which the following courses are recommended**

  EP2120, Internetworking  
  EP2500, Networked Systems Security  
  EP2510, Advanced Networked Systems Security  
  SF2812, Applied Linear Optimization  
  SF2822, Applied Nonlinear Optimization  
  EH2770, IT-Management med Enterprise Architecture I  
  EH2030, Business Development and Quality Management  
  MJ2411, Renewable Energy Technology  
  MJ2410, Energy Management  
  ME2719 Entrepreneurship and Innovation  
  ME2831 Entrepreneurial Leadership in Practice  
  DD2425, Robotics and Autonomous Systems  
  DD2421, Machine Learning  
  IK2218, Protocols and Principles of the Internet

**Year 2**

**Mandatory courses (12.0 Credits)**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EH2220</td>
<td>The Sustainable Electric Power Engineer</td>
<td>3.0 hp   Second cycle</td>
</tr>
<tr>
<td>EI2525</td>
<td>Electric Power Engineering Project</td>
<td>9.0 hp   Second cycle</td>
</tr>
</tbody>
</table>

**Conditionally elective courses**

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course name</th>
<th>Credits Edu. level</th>
</tr>
</thead>
<tbody>
<tr>
<td>EG2340</td>
<td>Wind Power Systems</td>
<td>7.5 hp   Second cycle</td>
</tr>
<tr>
<td>EG2420</td>
<td>Monte Carlo Simulation Theory and Project</td>
<td>7.5 hp   Second cycle</td>
</tr>
<tr>
<td>EH2720</td>
<td>Management of Projects</td>
<td>7.5 hp   Second cycle</td>
</tr>
<tr>
<td>EI2402</td>
<td>Electromagnetic compatibility</td>
<td>7.5 hp   Second cycle</td>
</tr>
<tr>
<td></td>
<td>Classical Electrodynamics</td>
<td></td>
</tr>
</tbody>
</table>
EI2405 Conditionally elective advanced course 7.5 hp Second cycle
EI2439 Power System Protection Conditionally elective advanced course 6.0 hp Second cycle
Seminar Course in Electrotechnical Design and High Voltage Equipment Conditionally elective advanced course 1.5 hp Second cycle
EI2490 Conditionally elective advanced course 7.5 hp Second cycle
EJ2222 Design of Electrical Machines Conditionally elective advanced course 7.5 hp Second cycle
EJ2420 Seminars in Electrical Machines and Power Electronics Conditionally elective advanced course 1.5 hp Second cycle
EL2620 Nonlinear Control Conditionally elective advanced course 7.5 hp Second cycle

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  EP2500, Networked Systems Security
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  SF2822, Applied Nonlinear Optimization
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  EH2030, Business Development and Quality Management
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  MJ2410, Energy Management
  ME2719 Entrepreneurship and Innovation
  ME2831 Entrepreneurial Leadership in Practice
  DD2425, Robotics and Autonomous Systems
  DD2421, Machine Learning
  IK2218, Protocols and Principles of the Internet
Appendix 2: Specialisations

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This programme has no specialisations.