Programme syllabus

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

Valid for students admitted to the education from autumn 15 (HT - Autumn term; VT - Spring term).

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

Programme objectives

This programme covers all major fields 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.

The programme includes the following subject areas:

1. Electric Power Systems focusing on power system dynamics, stability and control, as well as on electricity markets

2. Information and Control Systems focusing on automation, operation, and control of electric power systems

3. Electrotechnical Design focusing on the physical and technical fundamentals for design and maintenance of low and high voltage components, equipment and systems,

4. Electrical Energy conversion focusing on electrical machines and power electronics.

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 lasts for two academic years (120 ECTS) on the advanced level (second cycle). The language of instruction throughout the programme is English.

**Eligibility and selection**

**Basic admission requirements**

Basic eligibility to be accepted to the master’s programme requires a completed Bachelor's degree, corresponding to a Swedish Bachelor's degree (180 ECTS), or equivalent academic qualifications from an internationally recognized university. Students should have in addition, good knowledge in English, oral and written, is required. Applicants must provide proof of their proficiency in English.

**Specific admission requirements**
Specific eligibility to the programme requires:

- electrical engineering (including three phase electrical circuits and/or machines) equivalent to 60 ECTS,
- mathematics (calculus, numerical methods, algebra, probability theory, basic control theory) equivalent to at least 30 ECTS.

The specific eligibility requirements can be judged as not being fulfilled if:

1. the GPA converted to a percentage grade is less than 75%,
2. the degree awarding institution is not considered to meet acceptable quality standards by the authorities of the country in which the institution is located,
3. the degree does not qualify for admission to equivalent Master level in the country where the degree is awarded.

Selection process

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

The Academic year starts at the end of August/beginning of September and ends at the end of May/beginning of June. The year is divided into two semesters, one in the autumn and one in the spring. Each of the semesters has two study periods. The study periods are about 7 weeks long and end in an exam period. In addition to the four exam periods at the end of the study periods there are three more exam periods, one after Christmas, one after May and one before the start of the Academic year.

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.

All courses are graded on a scale from A to F. A-E are passing grades, A is the highest grade.

Conditions for participation in the programme
Each student is responsible for registering for the term at the beginning of each term. This is done via the ”personal menu” on KTH’s website. There is a limited time window for doing this. Term registration indicates that the student is active and opens the system so that results may also be reported.

Signing up for courses is done via https://www.universityadmissions.se. The system there for choosing courses is open from 1-15 November and 1-15 May, unless other information is posted.

**Conditions for being promoted to the next level.**

In order to be registered for elective courses in the third semester, the student must have completed at least 45 higher education credits of course work.

**Recognition of previous academic studies**

Under certain circumstances, and in agreement with the programme director, credits for previous studies can be received according to the local policy of KTH.

**Studies abroad**

The latter part of the study program, and/or the Master’s thesis may be performed at another university outside Sweden in accordance with KTH guidelines for student exchange.

**Degree project**

The aim of the Degree project is to develop the student’s ability to independently carry out and report a work effort within the area of Electric Power Engineering.

The final degree project is worth 30 ECTS, and corresponds to five months of full-time study. It may be carried out either at KTH or in industry or in combination. The project is summarised in a written report, and orally presented at a seminar. The project work can begin if

- the student has an agreement with one of the examiners involved in the programme,
- the student has obtained 60 ECTS at least 22.5 ECTS of which are advanced electric power engineering courses,
- the student has completed the courses relevant to the project subject.

**Degree**

Students who have successfully completed a two-year Master's programme (120 ECTS) will be awarded a "Teknologe masterexamen", translated into English as "Master of Science (120 credits)".

To be awarded the above Master’s degree, students must obtain 120 ECTS and meet the following degree requirements:
- "Basic courses in electric power engineering" corresponding to at least 24 ECTS have been successfully completed,

- "Advanced courses in electric power engineering" corresponding to at least 22.5 ECTS have been successfully completed,

- "Project courses in electric power engineering" corresponding to at least 9 ECTS have been successfully completed,

- "Complementary courses in electric power engineering" corresponding to exactly 10.5 ECTS have been successfully completed, and

- the final degree project (30 ECTS) has been successfully completed.

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 2015

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>EG2120</td>
<td>FACTS and HVDC in Electric Power Systems</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>EG2311</td>
<td>Power System Research Project, part 1</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>EG2410</td>
<td>Hybrid System Modelling and Simulation</td>
<td>7.5 hp</td>
<td>Second cycle</td>
</tr>
<tr>
<td>Code</td>
<td>Course</td>
<td>Type</td>
<td>Credits</td>
</tr>
<tr>
<td>--------</td>
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<td>-------------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>EH2741</td>
<td>Communication and Control in Electric Power Systems</td>
<td>Conditionally elective basic course</td>
<td>6.0</td>
</tr>
<tr>
<td>EH2745</td>
<td>Computer Applications in Power Systems</td>
<td>Conditionally elective advanced course</td>
<td>4.5</td>
</tr>
<tr>
<td>EI2430</td>
<td>High-voltage Engineering</td>
<td>Conditionally elective advanced course</td>
<td>7.5</td>
</tr>
<tr>
<td>EI2433</td>
<td>Electrotechnical Modelling</td>
<td>Conditionally elective advanced course</td>
<td>7.5</td>
</tr>
<tr>
<td>EI2436</td>
<td>Power Grid Technology and Substation Design</td>
<td>Conditionally elective basic course</td>
<td>6.0</td>
</tr>
<tr>
<td>EI2440</td>
<td>Electrotechnical Design</td>
<td>Conditionally elective advanced course</td>
<td>7.5</td>
</tr>
<tr>
<td>EI2452</td>
<td>Reliability Evaluation of Electrical Power Systems</td>
<td>Conditionally elective advanced course</td>
<td>7.5</td>
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<tr>
<td>EI2455</td>
<td>Smart Electrical Networks and Systems</td>
<td>Conditionally elective advanced course</td>
<td>7.5</td>
</tr>
<tr>
<td>EI2490</td>
<td>Seminar Course in Electrotechnical Design and High Voltage Equipment</td>
<td>Conditionally elective advanced course</td>
<td>1.5</td>
</tr>
<tr>
<td>EJ2201</td>
<td>Electrical Machines and Drives</td>
<td>Conditionally elective basic course</td>
<td>6.0</td>
</tr>
<tr>
<td>EJ2230</td>
<td>Control in Electrical Energy Conversion</td>
<td>Conditionally elective advanced course</td>
<td>6.0</td>
</tr>
<tr>
<td>EJ2301</td>
<td>Power Electronics</td>
<td>Conditionally elective basic course</td>
<td>6.0</td>
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<tr>
<td>EJ2311</td>
<td>Modulation of Power Electronic Converters</td>
<td>Conditionally elective advanced course</td>
<td>6.0</td>
</tr>
<tr>
<td>EJ2420</td>
<td>Seminars in Electrical Machines and Power Electronics</td>
<td>Conditionally elective advanced course</td>
<td>1.5</td>
</tr>
<tr>
<td>EJ2440</td>
<td>Electric Transportation</td>
<td>Conditionally elective advanced course</td>
<td>6.0</td>
</tr>
<tr>
<td>EL1820</td>
<td>Modelling of Dynamical Systems</td>
<td>Conditionally elective advanced course</td>
<td>6.0</td>
</tr>
<tr>
<td>EL2450</td>
<td>Hybrid and Embedded Control Systems</td>
<td>Conditionally elective advanced course</td>
<td>7.5</td>
</tr>
<tr>
<td>EL2520</td>
<td>Control Theory and Practice, Advanced Course</td>
<td>Conditionally elective advanced course</td>
<td>7.5</td>
</tr>
</tbody>
</table>

**Supplementary information**

The program consists of five blocks of courses and a thesis project. The blocks are: Compulsory courses, three groups of Conditionally Elective courses, from each such group of courses have a minimum number of credits should be consulted to get your degree, and finally a block of Freely Elective courses.

1. Compulsory Courses: EH2220, AK2030, all courses must be passed to certify for the degree.
2. Basic Power Engineering (Conditionally Elective - group 1): EG2100, EG2200, EH2741, EI2436,
EJ2301 EJ2201. Of these, at least 24 credits must be passed for to certify for the degree. It is free to take
the courses either year 1 or year 2. However, please note that these are often the entry requirements for
courses in Conditionally Elective - of group 2.
3. Advanced Power Engineering (Conditionally Elective - group 2): EG2110, EG2120, EG2210, EG2220,
EG2311, EG2312, EG2340, EG2420, EH2745, EI2402, EI2405, EI2437, EI2439, EI2430, EI2433,
EI2440, EI2452, EI2455, EI2490, EJ2222, EJ2230, EJ2311, EJ2420, EJ2440, EL1820, EL2520, EL2620,
EL2450, EP2500, IK2218. Of these, at least 22.5 credits must be passed to certify for the degree. It is free
to read the courses either year 1 or 2, so long as the necessary prerequisites are met.
4. Project courses in Power Engineering (Conditionally Elective - group 3): EH2751, EI2520, EJ2120,
EG2330, of which at least 9 credits must be passed to certify for the degree.
5. Freely elective courses, of which are a few recommendations: EQ2870, EP2510, SF2812, SF2822,
EH2770, EH2030, ME2043, EL1150, MJ2411, MJ2410, DD2431, DD2425.
Changes may occur.

Year 2

Mandatory courses (3.0 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</td>
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</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>EG2312</td>
<td>Power System Research Project, part 2</td>
<td>7.5 hp</td>
</tr>
<tr>
<td>EG2330</td>
<td>Power System Design, Project Course</td>
<td>9.0 hp</td>
</tr>
<tr>
<td>EG2340</td>
<td>Wind Power Systems</td>
<td>7.5 hp</td>
</tr>
<tr>
<td>EG2420</td>
<td>Monte Carlo Simulation Theory and Project</td>
<td>7.5 hp</td>
</tr>
<tr>
<td>EH2751</td>
<td>Communication and Control in Power Systems - Project Course</td>
<td>9.0 hp</td>
</tr>
<tr>
<td>EI2402</td>
<td>Electromagnetic compatibility</td>
<td>7.5 hp</td>
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<tr>
<td>EI2405</td>
<td>Classical Electrodynamics</td>
<td>7.5 hp</td>
</tr>
<tr>
<td>EI2433</td>
<td>Electrotechnical Modelling</td>
<td>7.5 hp</td>
</tr>
<tr>
<td>EI2439</td>
<td>Power System Protection</td>
<td>6.0 hp</td>
</tr>
<tr>
<td>EI2490</td>
<td>Seminar Course in Electrotechnical Design and High Voltage Equipment</td>
<td>1.5 hp</td>
</tr>
</tbody>
</table>
EI2520  Electromagnetic Engineering, Project Course
Conditionally elective project course                       9.0 hp  Second cycle

EJ2120  Electrical Energy Conversion - Project Course
Conditionally elective project course                     9.0 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

EL2700  Model Predictive Control
7.5 hp  Second cycle

EL2820  Modelling of Dynamical Systems
7.5 hp  Second cycle

IK2218  Protocols and Principles of the Internet
Conditionally elective advanced course                   6.0 hp  Second cycle

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Changes may occur.
Appendix 2: Specialisations

Master's Programme, Electric Power Engineering, 120 credits (TELPM), Programme syllabus for studies starting in autumn 2015

This programme has no specialisations.