



KTH Electrical Engineering

Electric Power Systems Lab

## EG201X DEGREE PROJECT IN ELECTRIC POWER SYSTEMS

13 March 2013

# Syllabus

The latest news of the course can be found on the course web page on KTH social, which is most easily found at <https://www.kth.se/social/course/EG201X/>. Additional guidelines concerning master thesis degree projects at the School of Electrical Engineering can also be found at [http://www.kth.se/ees/utbildning/thesisproject?l=en\\_UK](http://www.kth.se/ees/utbildning/thesisproject?l=en_UK). It is also possible to contact the involved teachers:

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## Objectives

The aim of the course is to develop the student's ability to independently carry out and report a project within the area of electric power systems.

Upon completion of this course, the student shall be able to

- apply relevant knowledge and skills, within the area, to a given problem,
- within given constraints, even with limited information, independently analyse and discuss complex inquiries/problems and handle larger problems on the advanced level within the area,

- reflect on, evaluate, and critically assess one's own and others' scientific results,
- document and present one's work with strict requirements on structure, format, and language usage,
- identify one's need for further knowledge and continuously develop one's own knowledge by using different sources of information.

## Course Registration

You may not start your master thesis project unless you have been registered in the course. In order to be registered, you must fill out an application form (which is available on the course web page). The form is filled out by you and your examiner and should then be submitted to the course admin assistant, who will arrange the registration with the student office.

Please notice that the application form must be submitted at least 10 working days before you want to start the project. Only official KTH study periods count as work days in this context; hence, if you want to start your project on 1 August, you will have to submit your application at the end of the spring term.<sup>1</sup>

In order to submit an application for a master thesis project, the student must have a suitable project and fulfil the requirements of that project. There should also be a written project description, which has been approved by the examiner, which needs to be handed in together with the application form.

### ***Finding a project***

Before you can start your master thesis work you need an appropriate project, which can be found in three ways:

- The Electric Power Systems Lab put available projects on the course web pages.
- The student can contact a company or an authority within the field of electric power systems.
- Student can formulate their own projects.

In the two latter alternatives it is important to remember that the project proposal must be approved by a examiner at Electric Power Systems. Only projects where the student applies relevant knowledge within the field are accepted. (A project that is not suitable as master thesis in electric power systems may however still be appropriate at some other department of KTH.)

In those cases when there are several applicants for the same project, the examiner and the intended supervisor will select which student that is given the project. The selection will normally be based on grades and personal interviews.

When a student has been given a project, the examiner will appoint a supervisor from KTH. For master thesis projects that are carried out externally there may also be one or more supervisors from the company or organisation where the work is done.

### ***Requirements***

Master thesis applications will only be accepted by the School of Electrical Engineering if the student has progressed sufficiently in the education. The requirements may vary depending on your type of studies. Please refer to the EE school web site for details.

Depending on which project the student intends to work with, there might be further requirements on specific courses that student must have passed, and there may also be requirements on the grade of specific courses. These requirements are decided by the examiner; hence, although you have found a project yourself, you might not be accepted for that project if the examiner thinks that you do not have sufficient background knowledge.

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1. The dates of the KTH academic year can be found on KTH Startpage → Student → Time tables.

Finally, there may be requirements that the project should be finished within a certain time. Normally the master thesis work should be performed in 20 weeks, but there is some flexibility in case the students need to take a break or to carry out the work on part time due to other courses, work or for private reasons. However, there can sometimes be an absolute requirement from KTH or the company where the thesis work is done, that the project must be presented at a certain date. A student who does not think that he or she can fulfil such a requirement should of course choose another project.

### ***Project description***

It is important that there is a project description in order to make sure that all parties (student, supervisors and examiner) agree on the topic and scope of the master thesis. The project description should be two or three pages and must include the following points:

- **Background.** This section provides a general background for the project. The background should for example explain why this project is interesting, who has initiated the project and how will the results of the project be used.
- **Problem definition.** Here it is stated what the objectives of the project are, i.e., which engineering and scientific challenges will be studied. It should be clear which problems that are expected to be solved within the master thesis work and if there are any further questions that will be addressed only if time allows.
- **Time plan.** The time plan should divide the project in smaller tasks, where it is stated for each task what should be done and the estimated time to complete the task. If possible, it should also be stated which method that will be used to solve the task.

It is not always possible to predict what needs to be done in a project as large as a master thesis. If necessary, it is always possible to modify for example the problem definition or the time plan. Smaller changes can be made after consultations between student and supervisors, whereas in case of larger changes, the examiner should be contacted.

In order to be seated at the electric power systems department your supervisor needs to book you a seat. When your seat is booked you have the commitment to use your work space. To efficiently allocate the given facilities, let your supervisor know when you not need your seat such that it can be booked by other people.

## **Learning Activities**

A master thesis work means that the student carries out a larger project within the field of electric power systems. Although the idea is that you should apply the engineering skills that you have acquired during your basic education, the master thesis is also a part of that education, and it is not expected that you already have learned everything you need to know. The most important learning activity is of course the individual project work, which will be supported by one or more supervisors. In addition to that, there are some presentations and smaller exercises that are mandatory.

### ***Supervision***

You will have one or more supervisors for your project. It is however important to remember that the student should work independently and that the role of the supervisors is to provide advice and support. You can in other words not expect that the supervisor will always give detailed instructions on how to solve your problems.

You can expect to meet your KTH supervisor and discuss your work in average one hour per week. External supervisors may be prepared to put more or less time on supervision, depending on the nature of the project. Thus, as the time for supervision in most cases is limited, it is important to use these occasions as efficiently as possible. It is important that you are well prepared before each occasion, for example by writing a list of questions that you are looking for an answer

to.

It is up to the student and the supervisors to agree on exactly how the supervision is to be organised. It is natural that students who perform their work at KTH meet their supervisors regularly to follow up on the project. Master thesis workers who carry out their projects outside KTH will probably have a closer cooperation with the external supervisors, but it is still important to keep in touch with the KTH supervisor, as it is KTH that sets the grade when all is said and done.

### **Status reporting**

To hand in status reports to your supervisor every second week is recommended. If your supervisor does not give you any other instructions you email the reports to your supervisor. If you have more than one supervisor, do not forget to email them all. These status reports are discussed with your supervisor in the meetings that you hold. A good status report will not only keep your supervisor updated but also help keep you on track with your project. For more information check out: <http://www.kth.se/en/ees/utbildning/thesisproject/examensarbete-ee-1.3316>

A template is provided on the course web page on KTH social. However in general, a status report is about one page long and includes the following:

- **Basic information:** Name and date the report. State which weeks the status report is for and be sure to include the project title. Write down the starting and ending date of the project
- **Completed tasks:** List the tasks that you finished in bullet points.
- **To do:** List the next tasks that you will take on. Try to estimate how long each task will take.
- **Changes in time plan:** Here you communicate if there have been any adjustments of the time plan
- **Issues comments:** Clarify any need for guidance or help. Write down your list of questions that you want to discuss with your supervisor and need guidance for.

### **Exercises**

These exercises should be performed during the first weeks of the master degree project and upon completion send to the course admin assistant. The instructions for the exercises are found on the course web page. In each exercise, the student will write a short report. After submitting the report to the KTH supervisor, the student should get some feedback. This can be done in a telephone meeting or a direct meeting with the supervisor. If possible, several students can meet in a seminar and have a group discussion of the exercise together with a KTH teacher.

The exercises cover the following topics:

- **Reflection and critical assessment.** As stated in the course objectives above, students should learn to reflect on, evaluate and critically analyse their own work as well as the work of others. In this exercise, you will be given instructions on how to make a critical review of a master thesis. You will then practice this on an already published master thesis.
- **Citation.** The objective of this exercise is to teach you how to manage citations and references in a master thesis.
- **Presentation techniques.** You will give several oral presentations during your master degree project. In this exercise, you will be given some advice on how to create a good presentation. You will compare three different ways to present the background and objectives of a master degree project.
- **Evaluation of final presentation.** In this exercise, you will attend at least two final presentations of other master degree projects, and write a small evaluation of the presentation and the following discussion. Bring the opponent form to the presentations you attend. This form should be signed by the responsible supervisor at the presentation. The opponent form you can find on the course web page.

### ***Start-up presentation***

The student, supervisors and the examiner should be taking part in the start-up presentation. If possible, it is advantageous if several students can have their start-up meetings at the same occasion, in order to learn from each other. In some cases, it might also be interesting to invite other parties to the presentation.

The presentation itself is quite short (around five minutes) and the aim is that you should present the background and the objectives of the project. Hence, the start-up presentation should be a draft version of the first few slides of your final presentation. After the presentation, there should be a short discussion, where you get some feedback on your objectives as well as a possibility to discuss ideas on how to proceed with the work.

Before the start-up presentation, you should submit a draft version of the Introduction chapter of your master thesis. Thus, an appropriate time for the start-up presentation is about one or two weeks after that you started the project.

### ***Mid presentation***

As for the start-up presentation, this presentation involves primarily the student, the supervisors and the examiner, but it is also possible to invite others. The purpose of the mid presentation is that the student gives a preliminary version of the final presentation, partly to get an opportunity to practice and partly to allow the examiner to review the work. If anything is unclear then the presentation is paused and it discussed if there is a need for the student to change anything.

Before the mid presentation, you should submit a draft version of the technical report. It is acceptable if some sections of the report are missing, as long as there is a short summary of the content of the missing section. Thus, an appropriate time for the mid presentation is when there is between two and eight weeks of work left in the project.

## **Examination**

The examination of a master degree project is divided in three parts: a technical report, an oral presentation and critical review. Further details about these parts as well as a description of how the grades are set are given below.

It must be emphasised that the examination of a master degree project is performed by the KTH examiner! Hence, in order to complete the course, it is not sufficient that for example an external supervisor is pleased with the performed work, if the requirements described below are not fulfilled.

### **Technical Report**

The technical report (commonly referred to as a “master thesis”) is the primary way to show what has been accomplished in a master thesis work. In addition to being a part of the examination, the thesis is also the most important way to communicate the results of a project.

Instructions for thesis writing in electric power systems are found on the course web page. It can also be useful to browse through other technical reports to get an idea about what is expected. Many reports from master thesis works in electric power systems are available online at [www.eps.ee.kth.se](http://www.eps.ee.kth.se).<sup>2</sup> Your supervisor can recommend inspiring reports and maybe lend you a printed copy.

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2. Choose the heading “Research” in the right column and then the subheading “Publications”. Choose “Master Thesis” in the field “Type”. The search can also be restricted by year, author or report title if necessary.

The technical report can be written in Swedish or English. The language is in many cases stated already in the project description. If there are no specific requirements then the student may freely choose between Swedish and English.

Nowadays, master theses from the Electric Power Systems Lab are only published electronically. Your supervisor will assist you with creating the cover for the pdf version of the thesis. In some cases, when the report is performed at an external organisation or if the project is part of a larger KTH research program, the thesis will also be made available in print.

## Final Presentation

Besides the technical report, the degree project should also be presented orally at a seminar at KTH. The student can give the final presentation when the examiner has assessed that the technical report is completed. A few paper copies of the technical report (either the final or a preliminary version) should be distributed for the audience.

The presentation should be about 30 minutes long. The final presentation opens with the student's presentation, which should be uninterrupted by the audience (unless there is any short questions of practical nature, for example if a figure caption is hard to read). After the presentation it is time for any opponents to discuss the work. Then the examiner asks his or her questions, and finally the audience is welcome to ask questions or give comments upon the work. The presentation itself should be about 30 minutes long, and another 30 minutes will be used for questions and discussion.

Further instructions for a good presentation are given in the exercise on presentation techniques (see *Learning Activities* above).

## Critical Review

Each master thesis worker should at some time review another master thesis. The objective of this task is to show that the student fulfils the course objective to be able to reflect on, evaluate, and critically assess others' scientific results. This means that the student who performs the critical review (the opponent) should read the technical report of the other student (the respondent) and attend the final seminar of the respondent (either in person or by telephone). In exceptional cases, the opponent can submit only a written critical review. Further instructions for constructive critical review are given in the exercise on reflection (see *Learning Activities* above).

Bring your opponent form to the final seminar. The opponent form should be signed by the responsible supervisor at the presentation. When you have all signatures on your opponent form you should hand it in to the course admin assistant. This is important since attending two final presentations and performing the critical review are requirements to pass the course.

Please note that the requirement to pass is that one should have performed a critical review of another master thesis work, but not that some other student has critically reviewed your own work.

## Grading

The master thesis work is graded on a scale A–F based on the students performance within six different aspects of the degree project. For each aspect the examiner gives a review. The grading matrix in the table below shows which reviews that are necessary to receive a certain grade. Please note that in order to get a certain grade, the student must have received the stated or a better review for each of the aspects. This means that only students who have received the reviews *Good planning*, *Excellent initiative*, *Contents above expectation*, *Good report*, *Good final presentation* and *Good critical review* can receive the grade A. A student who receives the reviews *Delayed planning*, *Good initiative*,

*Contents above expectation, Good report, Good final presentation and Good critical review* will receive the grade C, although the students for some aspects fulfils the requirements for a higher grade.

**Grading matrix**

Planning	Initiative	Content	Report	Final presentation	Critical review	Grade
Good	Excellent	Above expectation	Good	Good	Good	A
Good	Good	As expected	Good	Good	Good	B
Delayed	Good	As expected	Some flaws	Some flaws	Some flaws	C
Delayed	Low	As expected	Some flaws	Some flaws	Some flaws	D
Delayed	Low	Below expectation	Serious flaws	Some flaws	Some flaws	E
Delayed	Low	Below expectation	Serious flaws	Some flaws	Failed	Fx
Insufficient	Insufficient	Insufficient	Inferior	Inferior	Failed	F

More details about what is evaluated for the different aspects and what is meant by the reviews in the grading matrix are given below.

### **Planning**

In the beginning of a master thesis project, the student and the supervisors (both external and KTH supervisors) agree on a time plan for the project, and the student is then expected to follow this plan. If necessary the plan can be modified in agreement between the student and the supervisor.

The following criteria are used to evaluate the student's planning:

- **Good.** The student can plan and mostly carry out the project within agreed time frames. All larger changes of the time plan must be reported in advance to the supervisor.
- **Delayed.** The student can plan the work, but has difficulties to carry out the project within agreed time frames. It has occurred that changes of the time plan has been reported to the supervisor at a later time.
- **Insufficient.** The student can either not plan the work or has not respected agreed time frames.

### **Initiative**

An important part of the master thesis work is to learn to work independently. This means that the student should be able to show initiative and solve the problem without detailed instructions from the supervisor. To achieve this, the student must be able to learn new methods, adapt old methods to new problems, collect data, discuss with experts in the field, etc. The supervisor can provide advice to the student where to find the knowledge necessary to solve the task. In some cases it might be the supervisor who is the best source of knowledge for the student! A student who asks technical questions on a high level to the supervisor may thus be showing good initiative.

The following criteria are used to evaluate the student's initiative:

- **Excellent.** The student can independently identify one's own need for new knowledge and acquire this knowledge.
- **Good.** The student can acquire new knowledge from different sources.
- **Low.** The student does not search for new knowledge, but can acquire new knowledge after detailed instructions from a supervisor.
- **Insufficient.** Lacks the ability or desire to acquire new knowledge.

## Contents

The contents of the master thesis refers to the ability of the student to manage the engineering and scientific problems that are part of the project, for example problem definition, modelling, analysis, development and evaluation. The review of the contents is based on what the student has achieved in comparison to the questions raised in the project description. However, sometimes it can turn out that a problem is far more complex when what was predicted in the project description. In those case the student can after agreement with the supervisor choose a simplified solution methodology or remove the problem from the project.

The following criteria are used to evaluate the contents of the master thesis:

- **Above expectation.** The student has solved the basic problems and also addressed further questions or managed challenges that were not foreseen in the project description.
- **As expected.** The student has solved the basic problems. Challenges that were not foreseen in the project have, after consultation between the student and the supervisor, been either considered superficially or neglected entirely.
- **Below expectation.** The student has not been able to or have run out of time to solve the basic problems, even though they have not been more difficult than foreseen in the project description.
- **Insufficient.** Significant lack of engineering-related or scientific skills or lack of methodology despite request from supervisor.

## Report

The review of the report is depending both on how well the student describes the work performed and the conclusions, as well as language and format. Good language means that the report does not contain language errors that makes the reading difficult, i.e., occasional spelling errors or grammatical errors are acceptable. Format refers to the rules for report described under the heading *Technical Report* above.

The following criteria are used to evaluate the report:

- **Good.** The report is well-written, i.e., the presentations of the background, methods and models as well as results are easy to follow. Moreover, the conclusions must be clearly supported by results from the report. Finally, good language is necessary and the instructions for structure and format must have been followed correctly.
- **Some flaws.** The report as a whole gives the reader a good understanding of the work that has been done, although some parts of the report does not fulfil the requirements for a good report.
- **Serious flaws.** The report as a whole gives the reader an understanding of the work that has been done, but there are such flaws in detail level, argument, structure or something else, that a reader without very good prior knowledge will have difficulties in understanding the contents of the report.
- **Inferior.** The student has not corrected important flaws in the report in spite of requests from the supervisor.

## Final presentation

As a part of the master thesis, the students should present their results orally at a seminar and be able to participate in a discussion about the work performed, covering topics such as methodology, conclusions and need for future work in the field.

The following criteria are used to evaluate the participation in the seminar:

- **Good.** A good presentation means that the audience get a good understanding of the work performed and that the student can discuss methods and results with the audience.
- **Some flaws.** The presentation gives the audience an overall understanding of the



work performed although some details are unclear or the student has difficulties discussing methods and results with the audience.

- **Inferior.** Lacks ability to orally present or discuss the results of the master thesis.

### ***Critical review***

The critical review can either be written or oral. A student that fails the critical review can make another attempt by reviewing another master thesis.

The following criteria are used to evaluate the critical review:

- **Good.** The student has provided such critique that is useful to improve the reviewed master thesis.
- **Some flaws.** The student has provided reasonable critique, but the focus is on less important details and the critique does not add very much to the reviewed master thesis.
- **Failed.** The student has not made any effort to study another master thesis and provides none or only trivial critique.

## **Schedule**

There are no scheduled activities in this course. The presentations and mandatory exercises can be performed at any time during the autumn and spring term. However, students cannot expect that it is possible to schedule an activity outside the terms (for example during the summer).

If there is a possibility, it is encouraged if student activities can be coordinated so that students can interact with each other during presentations and exercises. The KTH supervisors can help you finding these possibilities.

## **Course evaluation**

There are two course evaluations. The first evaluation is to improve the four mandatory exercises that need to be completed in the beginning of the course. This evaluation will be sent to you a month after you started your project so that you still have the exercises fresh in your mind and can give feedback on how to improve them. The second evaluation you receive once having finished the course. The purpose with this evaluation is to get your feedback on what can be improved in the course for the coming students. We like to see this course as a dynamic course and we are therefore open for suggestions of changes. Some of the feedback from previous evaluations of the course and the course modifications they implied are posted on the course web page. Of course all feedback is made anonymous before being public. If it is comments that you do not want to be public please state this in the evaluation. Both of the evaluations will be sent to you via email.