



# SF280X Degree Project in Optimization and Systems Theory, Second Cycle 30.0 credits

Examensarbete inom optimeringslära och systemteori, avancerad nivå

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

If the course is discontinued, students may request to be examined during the following two academic years

## Establishment

Course syllabus for SF280X valid from Autumn 2015

## Grading scale

P, F

## Education cycle

Second cycle

## Main field of study

Mathematics

## Specific prerequisites

For students in Master's programme at least 60 credits must be completed before the degree project starts. For students within the Master's part of five-year degree (civilingenjör) at least 240 credits must be completed, and no more than 2 courses may be incomplete in the Bachelor part of the degree. It is the responsibility of the examiner to make sure that

the student has an appropriate specialization and that the student has completed sufficient parts of the studies before the degree project is started. Exemption can, after assessment, be granted by the director of first and second cycle education. The degree project should normally be carried out during the last semester.

### **Specific requirements:**

The specific requirements for starting a degree project in Optimization and systems theory is typically considered to be fulfilled if the student has passed at least three of the following six courses: SF2812 Applied linear optimization, SF2822 Applied nonlinear optimization, SF2832 Mathematical systems theory, SF2842 Geometric control theory, SF2852 Optimal control theory, SF2863 Systems engineering.

Dependent on the subject of the particular project, alternative requirements may be applied.

## **Language of instruction**

The language of instruction is specified in the course offering information in the course catalogue.

## **Intended learning outcomes**

The overall objective of the degree project work is that the student, after completion of the project, has knowledge of and is able to apply theory, models, and methods from optimization and systems theory to independently analyse and solve advanced problems from industry or academia, and also to, in a professional way, present and defend the work orally as well as in writing.

More precisely, the student should:

1. show knowledge of the disciplinary foundation of the chosen subject area and best practice, advanced understanding in current research and development and advanced method knowledge,
2. demonstrate the ability to search, collect and integrate knowledge critically and systematically with an overall view of the subject. Identify the need for additional knowledge,
3. demonstrate the ability to identify, analyse, assess and handle complex phenomena, issues and situations also with limited information,
4. demonstrate the ability to plan and with adequate methods carry out qualified assignments within given time frames and to evaluate this work,
5. demonstrate the ability to develop and evaluate products, processes, systems, methods or technical solutions with regards to human needs and the aims of the society for economically, socially and ecologically sustainable development,
6. demonstrate the ability to orally and in writing in dialogue with different groups clearly explain and discuss the conclusions and the underlying arguments,
7. demonstrate the ability to make assessments considering relevant scientific, social and ethical aspects,
8. show the skill required to participate in research and development projects, or to work independently in similar qualified activities.

## Course contents

The degree project, which should deal with a relevant problem in Optimization and systems theory, consists of an individual assignment with a topic that is accepted by the examiner. It should normally constitute a specialisation within the chosen field of technology and be at the level of second-cycle studies. The emphasis is placed on analysis and modelling, not programming and implementation. The extent of the project should correspond to at least 20 weeks of full time studies. The formulation of a detailed project description and plan is required as well as literature studies. The work will be presented in a written report and an oral presentation at an open seminar.

## Course literature

An independent literature search and study within the relevant field is expected. A reading list can be suggested by the examiner or supervisor.

## Examination

- XUPP - Examination Question, 30.0 credits, grading scale: P, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

## Other requirements for final grade

The degree project is carried out individually or together with another student. In the latter case, the examiner should make sure that each student's effort corresponds to the requirements for an individual degree project. The degree project is presented orally and in writing in English or Swedish. Depending on the student's degree programme, a public defence and participation in the evaluation of other degree project can be a requirement. The degree project will be assessed based on the learning objectives. The degree project must pass each of the requirements. The grade is assigned by examiner as an overall assessment after the written report has been checked for plagiarism. Students who have not completed the thesis within a year may fail the course. Such a decision is taken by the examiner after consultation with the programme co-ordinator.

### **Fulfilment of learning objectives:**

#### **Aim 1.**

**Pass:** The literature study is thorough. Current research and development relevant to the study is presented in a clear way. The method choice is well motivated, based on scientific or best practice and evaluated vis-a-vis other methods. Relevant knowledge from previous courses is adequately used.

**Fail:** The literature study is insufficient. Connections to current research and development is missing or is inadequate. The explanation of the chosen methods, or the evaluation of these methods is inadequate. The work shows on insufficient knowledge from previous courses.

#### **Aim 2.**

**Pass:** The work is done independently and systematically and based on critical analysis and synthesis of relevant literature. The work shows an overall perspective. Well chosen databases and search tools are used. The need of additional knowledge is discussed.

**Fail:** Relevant literature is to a great extent absent, or has not been integrated in the work. The literature is not examined critically. The work does not build on previous knowledge in the area. Discussions about possible further studies is missing.

#### **Aim 3.**

**Pass:** Relevant complex phenomena and topics are identified in the degree project. The work clearly shows that these are well handled and analysed even if available information is limited. Adequate assessment of the topic and results is carried out.

**Fail:** Relevant complex phenomena, issues and topics are not formulated, handled or analysed in the degree project. The work shows a deficient overall view of the topic or the topic is unnecessarily limited to avoid the complexity of the assignment. Relevant assessments connected to the topic of the degree project are lacking.

#### **Aim 4.**

**Pass:** The project plan was followed. A thorough study is completed within the agreed time and with the methodology agreed upon. Possible changes in the plan or study have been approved by the supervisor. Resources and limitations in the study are clearly presented.

**Fail:** The work does not reach the level that was intended initially (or subsequently adjusted). Critical evaluation of the work is missing. The project plan regarding time and methodology has not been implemented.

#### **Aim 5.**

**Pass:** The chosen strategy is motivated and implemented so that developed and evaluated products, processes, methods, systems or technical solutions, are adapted to human needs and conditions. Consideration to relevant social aims is shown in such a way that the ability of future generations to meet their needs is not jeopardised.

**Fail:** Product, process, systems, method or technical solution have not been evaluated or developed in the degree project. Relevant analysis of manageability and effects on our society, environment and economy is lacking.

#### **Aim 6.**

**Pass:** The report is well organized, linguistically sound and coherent. The discussion is well motivated. The citations are relevant and well integrated. Both the oral presentation and defence, as well as the communication during the work demonstrate the ability to present and discuss the work and the conclusions with different parties such as employers, supervisors, teachers, researchers and students.

**Fail:** The contents is not systematically presented, and the text or the oral presentation is difficult to understand. The argumentation in the discussion is deficient. The citations have an unclear aim, lie too close to the original source, or are piled without clear relationship. The written report is not linguistically sound or coherent. The continuous communication or the oral presentation do not show perceptiveness, clarity or ability to discuss the work and the conclusions.

#### **Aim 7.**

**Pass:** The degree project shows judgement, for example ability to to explain, motivate, criticise and recommend. Relevant topic-specific assessments based on scientific reasoning or previous experience are evident in the degree project. The degree project reflects on social and ethical aspects, unless this is shown to be irrelevant.

**Fail:** Judgement is lacking or inadequate. The work shows an inability to place the study in a larger context. The degree project does not consider ethical and social aspects even if these are relevant to the study, alternatively an explanation of why these aspects have not been discussed is absent.

#### **Aim 8.**

**Pass:** The student familiarizes him/herself with the topic at hand and demonstrate the ability to be a part of the working environment where the study was performed. The student shows an ability to test, evaluate and also reject ideas and solutions in the discussions on the assignment. The student shows initiative and is open for supervision and criticism. The degree project is carried out largely independently.

**Fail:** Despite supervision and guidance the student does not show the ability or will to participate and be part of the working environment. The student does not come up with constructive ideas during discussions with supervisors and doe not show interest in advice and new proposals. The student does not demonstrate independent and creative work between the supervision sessions.

## **Ethical approach**

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.