HÖGSKOLAN I HALMSTAD

This is a translation of the approved general syllabus that is written in Swedish

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# General syllabus for doctoral studies in Signals and Systems Engineering

## Field and subject

### Field

The field of information technology is defined as technology and methods for collecting, representing, processing, analyzing, communicating, using and storing information in artificial and natural systems and how information intense systems are developed in the purpose to achieve usable system solutions for individuals, organizations or society.

### Subject description

Signals and systems engineering is a subject within the area Information technology that is dedicated to basic theories, models and applications related to systematic treatment of signals and systems. At Halmstad University, research within signals and systems engineering is focused on biometrics, machine learning, control theory, robotics and medical signal- and data analysis.

## Eligibility

### Basic eligibility

Basic eligibility to doctoral education is given in the higher education ordinance chapter 7, paragraph 39: Those who have basic eligibility to education on doctoral level are those who have

1. graduated with a degree on advanced level,
2. completed course requirements of at least 240 credits, where at least 60 credits are on advanced level, or
3. in some other way within or outside the country gained corresponding knowledge.

The university can for an individual applicant give an exception from the requirement of basic eligibility if there are special reasons (2010:1064).

### Special eligibility

For eligibility to be admitted as student to doctoral education in signals and systems engineering it is required that the student has a degree on advanced level (or has satisfied the requirements for courses comprising at least 240 credits of which at least 60 credits were awarded in the second-cycle) within computer science, computer engineering, electrical engineering or another area that is relevant for the research subject.

### Selection

A selection is made among the applicants who fulfill the eligibility requirements. Judgment of the ability to complete the education is primarily done based on study results from basic and advanced level but also from other relevant criteria. For example, the following are especially considered:

- knowledge and abilities relevant for the thesis work and the subject signals and systems engineering. These can be shown through appended documents and an interview,

- ability to do independent work, and to formulate and approach scientific problems, e.g. through a discussion of their previous thesis work,

- ability to do written and oral communication.

## Goals

### Licentiate degree

### Knowledge and understanding

For licentiate degree the doctoral student shall

- show knowledge and understanding within the research area, including current specialist knowledge within a limited part of this and deepened knowledge in scientific methodology in general and the specific methods of the research area in particular.

### Skills and abilities

For licentiate degree the doctoral student shall

- show ability to critically, independently and creatively and with scientific accuracy identify and formulate questions, to plan and with adequate methods conduct a limited research work and other qualified tasks within given timeframes and thereby contribute to the development of knowledge and to evaluate this work,

- show ability to clearly present and to discuss research and research results in both national and international contexts, in both written and oral form, in dialogue with the scientific community and society in general, and

- show such skill that is necessary to independently participate in research and development work and to independently work in other qualified activities.

- show ability to participate in cross-disciplinary cooperative work that signals and systems engineering is part of. (local goal)

### Judgment and approach

For licentiate degree the doctoral student shall

- show ability to do research ethical judgments in their own research,

- show insight about the opportunities and limitations of science, its role in society and humans' responsibility to how it is used, and

- show ability to identify need of additional knowledge and to take responsibility for knowledge development.

## Doctoral degree

### Knowledge and understanding

For doctoral degree the doctoral student shall

– show wide knowledge within and a systematic understanding of the research area as well as deep and current specialist knowledge within a limited part of the research area, and

– show familiarity with scientific methodology in general and with the specific research areas methods in particular.

### Skills and abilities

For doctoral degree the doctoral student shall

– show ability to do scientific analysis and synthesis as well as independent critical review and judgment of new and complex phenomena, questions and situations,

– show ability to critically, independently, creatively and with scientific accuracy identify and formulate questions as well as plan and with adequate methods conduct research and other qualified tasks within given timeframes and to review and value such work,

– with a thesis show the ability to through own research significantly contributes to the development of knowledge,

– show ability to make oral and written presentations, in both national and international contexts, that with authority present and discuss research and research results in dialogue with the scientific community and society in general,

– show ability to identify need of additional knowledge, and

– show conditions for both research and education, as well as in other qualified professional contexts, for how to contribute to the development of society and support the learning of others.

- show ability to participate in cross-disciplinary cooperative work that signals and systems engineering is part of. (local goal)

### Judgment and approach

For doctoral degree the doctoral student shall

– show intellectual independence and scientific probity, as well as the ability to do research ethical judgments, and

– show deepened insight about the possibilities of science and its limitations, its role in society and humans' responsibility to how it is used.

## Overview of the disposition and requirements of the education

The offered education consists of many components such as courses, seminars, projects and individual studies, whom all contribute to building the students' competence and to reach the goals according to the higher education ordinance. The student is offered the possibility and is encouraged to under supervision participate in research directly from the start of the education. Within the doctoral education, perspectives concerning internationalization, sustainable development, and equality are also treated.

Education on doctoral level is either 120 credits and lead to licentiate degree, or 240 credits and lead to doctoral degree. For licentiate degree shall 30 to 45 credits be course credits and the rest research work under supervision. The division into course credits and research work credits is shown in *Table 1* below.

| Overview of the educations disposition and requirements | Obligatory courses (credits) | Optional courses (credits) | Thesis (credits) | Sum (credits) |
|---|---|---|---|---|
| Doctoral degree | 12 | 48-78 | 150-180 | 240 |
| Licentiate degree | 12 | 18-33 | 75-90 | 120 |

*Table 1. Overview of credits for doctoral degree and licentiate degree.*

## Degree requirements

Education on doctoral level is ended with doctoral degree or licentiate degree. The doctoral student also has the possibility to get a licentiate degree as a partial stage in the education.

### Licentiate degree

For licentiate degree the following is required:
- approved courses of at least 30 credits and
- approved scientific thesis of at least 75 credits

Thesis and courses shall together be at least 120 credits.

### Courses

The course part consists of courses that are divided into two categories:

*Obligatory courses:*
- An introductory course to doctoral education 7.5 credits; the course content is ethics, pedagogics and theory of science. The course is general and is offered to all doctoral students at Halmstad University.

- An introduction course in embedded and intelligent systems, 4.5 credits, divided into three parts of 1.5 credits each.

*Electable courses:*
- *General courses*. Here are courses that prepare the doctoral student to conduct studies and work tasks. The courses shall be on doctoral level to, e.g., develop special skills or abilities, for example in scientific communication, to contribute to the learning of adults, or to increase knowledge in, e.g., research ethics. These courses shall be at most 7.5 credits for licentiate degree.

- *Individual courses*. Supervisors and doctoral student decide in agreement about other courses that shall be included in the individual study plan. The courses shall be subject

specific or such that they are needed for the thesis work and shall in total be at least 10.5 credits for licentiate degree. The courses shall, along other aims, be selected to ensure enough subject knowledge in terms of both breadth and depth.

- *Other electable activities*. Participation in research related activities such as summer schools, conferences, seminars and reading clubs can give course credits if the main supervisor decides it is appropriate. The total number of credits for these activities cannot exceed 3 credits.

Decision on credit transfer of courses from another education is made by Student Affairs after statement from the main supervisor.

### Scientific thesis

The scientific thesis (licentiate thesis) shall comprise 75-90 credits.

### Doctoral degree

For doctoral degree the following is required:
- approved courses of at least 60 credits and
- approved scientific thesis of at least 150 credits
Thesis and courses shall together be at least 240 credits.

### Courses

The course part consists of courses that are divided into two categories:

*Obligatory courses:*
- An introductory course to doctoral education 7.5 credits; the course content is ethics, pedagogics and theory of science. The course is general and is offered to all doctoral students at Halmstad University.

- An introduction course in embedded and intelligent systems, 4.5 credits, divided into three parts of 1.5 credits each.

*Electable courses:*
- General courses. Here are courses that prepare the doctoral student to conduct studies and work tasks. The courses shall be on doctoral level to, e.g., develop special skills or abilities, for example in scientific communication, to contribute to the learning of adults, or to increase knowledge in, e.g., research ethics. These courses shall be at most 18 credits for doctoral degree.

- *Individual courses*. Supervisors and doctoral student decide in agreement about other courses that shall be included in the individual study plan. The courses shall be subject specific or such that they are needed for the thesis work and shall in total be at least 30 credits for doctoral degree. The courses shall, along other aims, be selected to ensure enough subject knowledge in terms of both breadth and depth.

- *Other electable activities*. Participation in research related activities such as summer schools, conferences, seminars and reading clubs can give course credits if the main supervisor decides it is appropriate. The total number of credits for these activities cannot exceed 6 credits.

Decision on credit transfer of courses from another education is made by Student Affairs after statement from the main supervisor.

### Scientific thesis

The scientific thesis (doctoral thesis) shall comprise 150-180 credits.

## Degree title

After completed education a degree certificate is awarded (after application) with the following degree title:

### Licentiat degree

| | |
|---|---|
| Degree of Licentiate of Engineering in the subject Signals and Systems Engineering | Teknologie licentiatexamen inom ämnet Signal- och systemteknik |

### Doctoral degree

| | |
|---|---|
| Degree of Doctor of Philosophy in the subject Signals and Systems Engineering | Teknologie doktorsexamen inom ämnet Signal- och systemteknik |

## Transition

Doctoral students that have been admitted before the general syllabus is valid can, after consultation with the main supervisor and director of study, request to transition to this syllabus. The individual study plan shall then be updated.