



General syllabus for third-cycle education in the third-cycle subject area Systems Engineering

1 Description of the third-cycle subject area at BTH

Systems engineering highlights fundamental questions for how a technical system with many different components can interact into a functioning whole. Systems engineering is a subject that traditionally has a strong position in Swedish industry. The subject aims to gain a systematic and basic understanding of large-scale systems. Systems engineering research is important in a number of areas of our society and makes it possible to transfer ideas from one application area to another. This applies both to the development of industrial products, as well as to infrastructure, transport and health care. In recent years, the availability of low-cost sensors and computer components has contributed to the subject's expansion. The increasing computational capacity of computers has opened up a number of new applications and at the same time has contributed to a more efficient use of resources. Systems engineering meets up where relevant issues are becoming increasingly complex and when there are demands for new theory to handle and analyze larger amounts of information and increased complexity while maintaining requirements for precision, flexibility and security.

The systems engineering specialization at BTH currently includes medical technology, measurement technology, mathematical modeling and optimization of systems, stochastic processes, automatic control, signal processing, remote sensing, sensor and information systems, marine technology as well as autonomous vehicles and transport systems.

2 Structure of the course/programme

Third-cycle courses and study programmes which finish with a Degree of Licentiate comprise an actual period of study of two years (120 higher education credits) and consist of a course component of at least 37 – 60 higher education credits and a licentiate thesis of 60 – 83 higher education credits.

Third-cycle courses and study programmes which finish with a Degree of Doctor comprise an actual period of study of four years (240 higher education credits) and consist of a course component of 67 – 90 higher education credits and a dissertation of 150 – 173 higher education credits.

A third-cycle student who is admitted to the Degree of Doctor is given the possibility to take a Degree of Licentiate (according to the above) after having completed minimum 120 higher education credits of the programme that is to be finished with a Degree of Doctor.

For each third-cycle student an individual study plan is set up. The individual study plan describes the individual set-up of the studies. The individual study plan is revised and followed up yearly in accordance with the routines that are established at BTH. The study plan is to show



in a convincing way how the goals for the third-cycle student's studies can be attained within the available time.

In accordance with the Higher Education Ordinance at least two supervisors are appointed for each third-cycle student of whom one is appointed principal supervisor. According to the Higher Education Ordinance, an examiner must also be appointed to each doctoral student for assessment and grading in doctoral education. The supervisors and the examiner will be appointed according to BTH's guidelines. The supervisor, who is not the main supervisor of the two, must have a PhD. In addition, further supervisors may be affiliated to the third-cycle student, e.g., from industry, if this is for the benefit of the third-cycle student's studies. For these additional supervisors there is no demand on having a doctoral degree.

2.1 Purpose of the education

BTH conducts third-cycle education to contribute with solutions to the complex challenges in society and to meet the demands of a changeable labour market.

Specifically, the third-cycle courses and study programmes aim at developing the third-cycle student's knowledge in the subject area and her/his capacity to independently carry-on research-, development-, teaching- and investigatory work based on a scientific foundation in different areas of society. The purpose of the Degree of Doctor is, in addition, to give the third-cycle student the capacity to plan, initiate, and lead such work critically and independently.

2.2 Goals for the education

According to the System of Qualifications in the Higher Education Ordinance (1993:100) according to enclosure.

2.3 Realization of the education

The third-cycle student carries on research and writes a scientific work (licentiate thesis/doctoral dissertation). In support of this, the education may include lectures, seminars, literature studies, project assignments, group supervision and individual supervision. Courses for each third-cycle student are established individually in consultation with the supervisors and the examiner and are entered into the individual study plan.

The supervision of the education aims at assisting the third-cycle student regarding choice of research domain, scientific method and organization and planning of the scientific work and pertaining studies. The supervisors are to assist with subject competence and see to that the work holds an international quality level. Furthermore, the supervision aims at introducing the third-cycle student to the scientific community and its demands on, e.g., ethics, honesty and critical thinking.

The third-cycle student is to participate in national and international contexts and present her/his own research.

During the education period, the third-cycle student is to take part of the scientific activities which are conducted in the scientific environment at the department/faculty by attending



seminars and guest lectures, and, in the normal case, give one seminar per year about her/his thesis work.

A third-cycle student, employed by the higher education institution as a doctoral student, is recommended to dedicate certain time (not more than 20 per cent of full working hours) to teaching in first- and second-cycle courses and programmes. Such work is financed by the first- and second-cycle courses and programmes and is to be accounted for in the individual study plan.

The education should be organized so that the third-cycle student attains the stipulated qualitative targets. How the knowledge needs of each individual third-cycle student are to be fulfilled to attain the qualitative targets is stated in respective individual study plan.

3 Entry requirements and selection

3.1 General entry requirements

According to 7 Chap. 39 § in the Higher Education Ordinance (1993:100).

3.2 Specific entry requirements

To be eligible for third-cycle studies, the applicant must have obtained a second-cycle degree in the field of science and technology or science or otherwise acquired the knowledge to be able to benefit from third-cycle education in the subject.

3.2 Selection

According to 7 Chap. 41 § in the Higher Education Ordinance (1993:100) and the current admission regulations at BTH. Selection is to be made in consideration of the applicants' capacity to profit by the education. The foundation for selection among the qualified applicants is the degree of capacity to profit by the third-cycle education, and the access to supervision and other resources in view of the planned specialization of the licentiate thesis/doctoral dissertation.

Examples of bases of assessment applied at the selection for third-cycle education are constituted by:

- Familiarity with the theory and applications of the subject,
- Relevant work experience where appropriate.
- Ability to express oneself in speech and writing,
- Familiarity with English,
- Creativity, initiative, independence, and ability of cooperation.

To assess how the applicant fulfils the bases of assessment, the following are used: results from higher education courses, quality of the independent work and possible publications, references, interviews, possible personal knowledge, and a personal letter from the applicant which describes the applicant's expectations on and intentions with the education. In certain cases, the applicant may undergo specific work tests.



Admission to third-cycle education is done on a continuous basis.

4 Examinations that form part of the education

The education consists of courses and a scientific work. Examinations that form part of the third-cycle education are assessed with the grades pass/failed. A grade on a course and a licentiate thesis, respectively, is determined by a specially appointed examiner. A grade on a doctoral dissertation is determined by a specially appointed grading committee.

For a possible credit transfer, see the current order for credit transfers and the guidelines for credit transfers.

4.1 Courses

In support of the research work and for the fulfilment of the qualitative targets generally, the third-cycle student studies several courses. Courses completed at BTH as well as courses from other higher education institutions can be included.

For third-cycle courses given at BTH there is to be a written course description which, among other things, states the title of the course in Swedish and English, the course objectives, content and credits. The individual study plan is to regulate which courses can form part of the studies and how many higher education credits each course should award (for participation in a course originally intended for first- or second cycle, see the guidelines for credit transfer of courses in third-cycle education).

Components of the education in the areas below are compulsory. How these are examined, through a course or other component, is regulated in each separate individual study plan.

- Research methodology
- Information search for researchers
- Scientific writing and scientific review
- Ethics in research

The choice of courses is to be characterized by flexibility about the third-cycle student's prior knowledge and the specialization of the research work and is to be determined in consultation between the third-cycle student, supervisors and examiner. The examination format is determined by the examiner in consultation with the supervisors. Goal attainment is tested by the examiner.

All compulsory courses or components are to be completed before the doctoral dissertation is publicly defended at the public defence of the doctoral dissertation. Other courses and components are to be chosen so that the third-cycle student obtains both breadth and depth in the research domain. The courses are also to benefit the third-cycle student's competence and skills, her/his studies, or scientific work.

4.2 Scientific work

Scientific work in the form of a licentiate thesis/doctoral dissertation is to be designed as an integrated, connected scientific work (monograph) or as a summary – introductory part – together with pertaining scientific academic papers (compilation), which the third-cycle student



has written alone or together with another person or persons. The scientific work is written in English or Swedish.

The licentiate thesis is to be presented orally at a public licentiate seminar. For further information, see “Rules for licentiate seminars” established by BTH.

The doctoral thesis must be defended orally at a public defence. The thesis must previously have been quality assured according to the description in "Appendix – Quality assurance of doctoral thesis" For further information, please refer to the "Rules for defending a doctoral thesis" established by the university.

5 Degree

5.1 Qualitative targets

Goals according to the System of qualifications in the Higher Education Ordinance (1993:100) according to “Enclosure – System of qualifications (Higher Education Ordinance 1993:100)”.

5.2 Title of qualification

The degree title of third-cycle studies in Swedish at BTH consists of a general degree with the addition of a prefix. The prefix is normally “teknologie”.

Third-cycle student taking a Degree of Licentiate in Systems Engineering normally receives the Swedish degree title teknologie licentiatexamen (Eng. Degree of Licentiate of Technology).

Third-cycle student taking a Degree of Doctor in Systems Engineering normally receives the Swedish degree title teknologie doktorsexamen (Eng. Degree of Doctor of Philosophy).

Exceptions to the prefix Technology in the Swedish degree: For individuals who do not have a second-cycle technical education¹ a degree of Philosophy will be awarded. The prefix should be clarified in the individual study plan. For a degree of Philosophy the Swedish degree title is:

Filosofie licentiatexamen (Eng. Degree of Licentiate of Philosophy).

Filosofie doktorsexamen (Eng. Degree of Doctor of Philosophy).

6 Effective date and interim regulations

This general syllabus becomes effective on December 1, 2022.

Third-cycle students admitted before December 1, 2022, will complete, as a general rule, their studies according to the older general syllabus. If a third-cycle student so requests and it is deemed suitable, the relevant examiner may accept a transfer to the new general syllabus. The third-cycle student will then report the transfer to the relevant Dean and attach a copy of an updated individual study plan updated according to the new general syllabus.

¹ A technical education refers to a Master’s degree in Engineering, Master’s degree in Science or equivalent in a technical or mathematical-scientific field.



Enclosure I – Quality assurance of a doctoral thesis

Pre-assessment of doctoral thesis within the third-cycle subject *Systems Engineering* at BTH

Prior assessment of a doctoral thesis in the third-cycle subject *Systems Engineering* at BTH means that the ordinary members of the examination board must each assess whether the thesis is of sufficient quality to be considered suitable for presentation and defense at a public defence. If this is considered to be the case, the rating need not be followed by any reasoning or comments. If this is not considered to be the case, the rating shall be justified. A positive pre-assessment is only advisory and does not exclude another assessment after the dissertation.

For the process, the following applies:

1. The pre-evaluation should be completed no later than seven weeks before the dissertation. The pre-assessment should not take more than two weeks and the thesis (in close to final version) should therefore be sent to the examining board members no later than nine weeks before the dissertation.
2. If a member of the examining committee is replaced after a preliminary assessment, the replacement does not need to pre-assess the thesis.
3. The review is sent in the form of a completed pre-assessment form (attached) by e-mail to the main supervisor. If an appraiser does not respond, despite a reminder, it is interpreted as a positive judgment. The main supervisor informs the dean of the outcome of the ex-ante assessment.
4. If all the ratings in the pre-assessment are positive, the process continues according to plan. If one or more assessors consider that the thesis is not of sufficient quality, the dissertation should be postponed. However, the doctoral student has the right to still present the thesis for dissertation according to the original plan.

The main supervisor is responsible for ensuring that the ex-ante evaluation is carried out in accordance with these guidelines.



Form for pre-assessment of doctoral thesis within the third-cycle subject
Systems Engineering at BTH

Doctoral student's name

Preliminary title of the thesis

Opinion

I believe that the thesis is of sufficient quality to be considered suitable for presentation and defense at a public defense

I do not believe that the thesis is of sufficient quality to be considered suitable for presentation and defense at a public defence

In case of negative review, please justify below or in the attached letter.

Justification:

Signature

Place and date:

Signature:

Name clarification:

| | |
|----------------------|----------------------|
| <input type="text"/> | <input type="text"/> |
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Enclosure – System of qualifications (Higher Education Ordinance 1993:100)

Degree of Licentiate

Scope

A Degree of Licentiate is awarded

either after a third-cycle student has completed a study programme of at least 120 credits in a subject in which third-cycle teaching is offered,

or after a third-cycle student has completed one part comprising at least 120 credits of a study programme intended to conclude with the award of a PhD, if a higher education institution decides that a Degree of Licentiate of this kind may be awarded at the institution.

Outcomes

Knowledge and understanding

For a Degree of Licentiate the third-cycle student shall demonstrate knowledge and understanding in the field of research including current specialist knowledge in a limited area of this field as well as specialised knowledge of research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For a Degree of Licentiate the third-cycle student shall

- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work
- demonstrate the ability in both national and international contexts to present and discuss research and research findings in speech and writing and in dialogue with the academic community and society in general, and
- demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

Judgement and approach

For a Degree of Licentiate the third-cycle student shall

- demonstrate the ability to make assessments of ethical aspects of his or her own research
- 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.

Thesis

For a Degree of Licentiate the third-cycle student shall have been awarded a pass grade for a research thesis of at least 60 credits.

Miscellaneous

Specific requirements determined by each higher education institution itself within the parameters of the requirements laid down in this qualification descriptor shall also apply for a Degree of Licentiate with a defined specialisation.

Degree of Doctor

Scope

A Degree of Doctor is awarded after the third-cycle student has completed a study programme of 240 credits in a subject in which third-cycle teaching is offered.

Outcomes

Knowledge and understanding

For the Degree of Doctor the third-cycle student shall

- demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialised knowledge in a limited area of this field, and
- demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For the Degree of Doctor the third-cycle student shall

- demonstrate the capacity for scholarly analysis and synthesis as well as to review and assess new and complex phenomena, issues and situations autonomously and critically
- demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames and to review and evaluate such work
- demonstrate through a dissertation the ability to make a significant contribution to the formation of knowledge through his or her own research



- demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general
- demonstrate the ability to identify the need for further knowledge and
- demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

Judgement and approach

For the Degree of Doctor the third-cycle student shall

- demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics, and
- demonstrate specialised insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

Research thesis (doctoral thesis)

For the Degree of Doctor the third-cycle student shall have been awarded a pass grade for a research thesis (doctoral thesis) of at least 120 credits.

Miscellaneous

Specific requirements determined by each higher education institution itself within the parameters of the requirements laid down in this qualification descriptor shall also apply for a Degree of Doctor with a defined specialisation.