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Responsibility for review and questions
School of Industrial Engineering and Management

General syllabus for the third-cycle studies in Production Engineering

This governance document was adopted by the Faculty Board of the School of Industrial Engineering and Management (registration number HS-2025-0013) with reference to Chapter 6, Sections 26–27 of the Higher Education Ordinance. This governance document is in force as of 9 June 2025. This governance document regulates the main content of the programme, specific entry requirements, and other necessary regulations. The Faculty Board of the School of Industrial Engineering and Management is responsible for reviewing the governance document and answering questions about it.

1 Content of the programme

1.1 Name of the subject in Swedish and translation into English

Industriell produktion (Production Engineering)

1.2 Subject description

Production engineering encompasses theoretical, experimental and applied science, ranging from the analysis of individual manufacturing processes to entire production systems, often in close collaboration with industry. The challenges and opportunities arising in production engineering require advanced scientific and technical knowledge and skills. To meet these challenges, the doctoral programme in production engineering, hereinafter referred to as the programme, offers a Degree of Doctor and a Degree of Licentiate in production engineering. The subject area covers:

- Manufacturing processes, including additive and hybrid manufacturing
- Assembly technology and systems
- Industrial automation and robotics
- Circular manufacturing systems
- Production systems
- Dynamic and structural analysis of machine tools and equipment
- Industrial metrology and surface characterisation
- Information modelling, advanced analysis, AI and data management in production applications
- Precision technology in production applications
- Manufacturing technology, reliability and maintenance
- Production logistics and supply chains
- Industrialisation and upscaling
- Production management and control

1.3 Specialisation(s)

There are no specialisations in the programme

1.4 Structure of the programme

1.4.1 Activities to achieve the intended learning outcomes of the programme in accordance with the Higher Education Ordinance (HEO)

Described below are activities that can enable the doctoral student to achieve the intended learning outcomes for third-cycle studies in accordance with the Higher Education Ordinance (HEO) and KTH's objectives. The activities of each individual doctoral student are specified in their individual study plan.

Intended learning outcomes: Knowledge and understanding

For a Degree of Doctor, the doctoral 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.

Broad knowledge and systematic understanding of the subject can be demonstrated through the publication of original work in peer-reviewed journals and conference papers. The thesis presents the results of the work from a broader perspective and positions the scientific contribution to the subject. In addition, seminars, workshops and courses provide opportunities to present to colleagues in the field of research, which helps to relate the work to the broader research perspective. To achieve this intended learning outcome, students need to participate in at least two international conferences. Through the seminar course FMG3510, students present their work to colleagues and faculty at the department.

- Demonstrate familiarity with scientific methodology in general and the methods of the specific field of research in particular.

To achieve this intended learning outcome, a course in scientific theory and research methodology, FMG3007 or equivalent, is compulsory. The course provides knowledge of applicable scientific theories and how to formulate research questions and hypotheses. Students are encouraged to take the course early in their studies. Achievement of this intended learning outcome is also demonstrated through the structure and content of publications and the thesis, where methodological aspects are discussed.

For a Degree of Licentiate, the doctoral 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 scientific methodology in general and the methods of the specific field of research in particular.

This intended learning outcome can be achieved through continuous development of the student's ability to plan and conduct their own research and to carry out scientific literature studies with critical analysis in order to identify potential areas for deeper or expanded research. Participation in the seminar course FMG3510, where the research work of other doctoral students and researchers is critically reviewed and discussed, is also important. The writing and defence of the licentiate thesis demonstrates knowledge and understanding of the subject.

Intended learning outcomes: Competence and skills

For a Degree of Doctor, the doctoral student shall:

- Demonstrate the capacity for scholarly analysis and synthesis as well as the ability 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.

The ability to independently interpret, analyse, discuss and synthesise research findings and complex phenomena is developed through a continuous and consistent focus on research. The applicability of research questions, hypotheses and proposed solutions is demonstrated through the use of industrial and complex scientific challenges as case studies. Participation in research and development projects is recommended to achieve this intended learning outcome.

- Demonstrate through a thesis the ability to make a significant contribution to the formation of knowledge through their own research.

A doctoral student who has independently planned and conducted experimental and theoretical studies on a sound and proven scientific foundation and methodology, followed by several presentations and discussions of the work or related work in various forums, leads to successful work with a clear impact, as demonstrated by a thesis that clearly shows the contribution to the formation of knowledge.

- 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.

This intended learning outcome can be achieved through continuous efforts to develop the ability to write scientific articles and present research results to both experts in the field and a wider audience. This is demonstrated by relating one's own research results to the current level of knowledge in the research field and to areas where the results are applicable. The course "Introduction to Scientific Writing", FDS3103 (or equivalent), is recommended.

- Demonstrate the ability to identify the need for further knowledge.

This intended learning outcome can be achieved by developing the ability to stay up to date through literature reviews of national and international developments in one's own field of research. A brief description of the need for further knowledge in the field should be provided in the thesis.

- 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.

A demonstrable capacity is achieved by developing the ability to identify and address societal challenges or relate the work to societal needs. Interaction through development projects, dissemination of results in industrial workshops, joint industry/KTH collaboration platforms, etc. In addition, active participation in teaching and supervision at the first- and second-cycle levels provides the conditions for achieving this intended

learning outcome. For an effective pedagogical method, the course “Basic Communication and Teaching”, FLH3000, is compulsory for those who wish to participate in first- and second-cycle teaching activities.

For a Degree of Licentiate, the doctoral 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.

This intended learning outcome is achieved by encouraging students to independently plan and conduct limited research tasks with clear objectives within appropriate time frames; Conducting literature studies, formulating new scientific questions, testing hypotheses and having relevant discussions with supervisors, fellow students and industrial partners (where appropriate) will lead to the achievement of this intended learning outcome. Progress towards achieving this outcome is documented through the updating of the eISP.

- Demonstrate the ability in both national and international contexts to present and discuss research and research findings clearly in speech and writing and in dialogue with the academic community and society in general.

This can be achieved by training and developing the ability to present ideas and results to researchers in the field and by taking responsibility for writing scientific publications. Active participation in the seminar course FMG3510, conference participation, disseminating results to students where they have a teaching role or via industrial projects are platforms where this ability is developed.

- Demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity.

This intended learning outcome can be achieved by developing the ability to independently initiate and discuss ideas and carrying out tasks within the planned time frame. This learning outcome can be achieved by conducting literature studies with critical analysis of relevant publications. Achievement of this intended learning outcome can be verified during the course of study and through the content of the literature review presented in publications and included in the thesis.

Intended learning outcomes: Judgement and approach

For a Degree of Doctor, the doctoral student shall:

- Demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics.
This intended learning outcome applies to the Degree of Doctor only.

Intellectual autonomy and disciplinary integrity are achieved by independently developing ideas while being aware of research ethics. Students train the ability to formulate and discuss ideas, plan and conduct research tasks, review related research, and publish articles as first author. In addition, they argue and discuss research themes

based on scientific foundation and proven experience. The compulsory course “Introduction to Research Studies”, FLF3019, also covers ethics. The course “Ethics for Doctoral Students”, FIL3608, is also recommended.

- 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.

This intended learning outcome can be achieved by developing the ability to critically review one's own research in order to evaluate the societal implications of the research and results. In addition, new opportunities and limitations in the use of research results should be considered from a broader societal perspective.

For a Degree of Licentiate, the doctoral student shall:

- Demonstrate the ability to make assessments of ethical aspects of their own research.

This intended learning outcome can be achieved by developing the ability to assess ethical research. The compulsory course “Introduction to Research Studies”, FLF3019, has ethics as a course component. For further study, the course “Ethics for Doctoral Students”, FIL3608, is also recommended.

- Demonstrate insight into the possibilities and limitations of research, its role in society and the responsibility of the individual for how it is used.

This intended learning outcome can be achieved by developing the ability to critically review research in order to evaluate the societal implications and results. In addition, the ability to identify new opportunities and limitations in the use of research results from a broader societal perspective is strengthened.

- Demonstrate the ability to identify the personal need for further knowledge and take responsibility for their ongoing learning.

This intended learning outcome can be achieved by developing the ability to conduct literature reviews and stay up to date with published and ongoing research. This includes reviewing their methodological and theoretical approaches with similar or related research to assess the need for further knowledge.

KTH's sustainable development objectives

For a *Degree of Licentiate* or a *Degree of Doctor*, the doctoral student shall:

- Demonstrate the ability to use knowledge and expertise to contribute to sustainable development toward an equal, inclusive and climate-neutral society.

This objective can be achieved by developing the ability to assess the consequences of one's own research, actions and approaches with regard to sustainable social development. Being aware of the UN's sustainable development goals and reflecting on how they relate to individual research is a recommended method for this assessment. This reflection and assessment shall be documented and updated in the ISP. Consideration should also be given to equality, diversity and equal opportunities.

1.4.2 Compulsory courses

The following courses are compulsory for both the Degree of Licentiate and the Degree of Doctor:

1. FMG3007 Scientific Methodology for Engineers, 7.5 credits, or equivalent doctoral courses in scientific methodology.
2. Courses in the subject of production engineering, equivalent to 7.5 credits. This can be done through the seminar course FMG3510 Manufacturing Systems: PhD Seminars.
3. FLF3019 Introduction to Research Studies at the ITM School, 6.0 credits.

For students involved in teaching activities, the following course is compulsory:

4. FLH3000 Basic Communication and Teaching, 3.0 credits.

1.4.3 Recommended courses

The seminar course FMG3510 Manufacturing Systems: PhD Seminars is recommended for both the Degree of Licentiate and the Degree of Doctor. This course normally includes all doctoral seminars and is where current research within the doctoral programme and the research environment is shared.

There is a high degree of flexibility when it comes to deciding which courses each individual student can take, with decisions made in consultation with the supervisors. In addition to the courses offered by the doctoral programmes at KTH, it is also possible to take courses from other universities, online courses and summer courses. The planning and completion of the courses must be documented in the individual study plan. Credit transfer for such courses can be requested as described below.

- Doctoral courses offered by other higher education institutions: For courses taken at other programmes and higher education institutions, a course certificate with a completed “Application for credit transfer” form must be provided. The link to the course website must be provided.
- Online courses (Massive Open Online Courses – MOOC: For non-edX courses, approval from DA is required in advance if credit is to be awarded. A course description showing the course level, credits or number of hours for lectures, assignments, experiments, etc. must be provided. The course website must be specified. FA/DA approves the credit transfer according to KTH's MOOC assessment criteria.
- Summer courses: The same rule as for MOOC courses applies to credit transfer for summer courses.
- First- and second-cycle courses: Credit transfer may be requested for first- and second-cycle courses with the restrictions specified in section 1.4.4. First- and second-cycle courses that constitute prerequisites in the field of engineering may not be credited.

1.4.4 Qualification requirements

Degree of Doctor

The Degree of Doctor comprises 240 credits. The doctoral thesis shall comprise at least 120 credits.

Doctoral thesis

Quality requirements and any other thesis requirements.

The doctoral thesis is normally presented as a compilation of scientific articles with an introductory summary (referred to as a “kappa”), but may also be presented as a monograph. For details, please refer to KTH's guidelines for third-cycle studies.

In total, the doctoral thesis must contain at least four publishable scientific articles, of which at least two must be approved for publication in international journals. The doctoral student must be the first author of the two journal articles. The doctoral student's contribution to a publication in which the student is not the first author must be described in the doctoral thesis.

Courses

The doctoral student must have completed courses worth at least 60 credits, of which at least 45 credits must be at the third-cycle level and a maximum of 10 credits may be at the first-cycle level.

Degree of Licentiate

The Degree of Licentiate comprises at least 120 credits. The licentiate thesis shall comprise at least 60 credits.

Licentiate thesis

Quality requirements and any other thesis requirements.

The licentiate thesis is normally presented as a compilation of scientific articles with an introductory summary (referred to as a “kappa”), but may also be presented as a monograph. For details, please refer to KTH's guidelines for third-cycle studies.

In total, the licentiate thesis must contain at least two publishable scientific articles, of which at least one must be approved for publication in international journals. The doctoral student's contribution to a publication in which the student is not the first author must be described in the licentiate thesis.

Courses

The doctoral student must have completed courses worth at least 30 credits, of which at least 15 credits must be at the third-cycle level and a maximum of 10 credits may be at the first-cycle level.

- i. Other elements of the programme to promote and ensure attainment of the intended learning outcomes

Each doctoral student shall present their research at the following seminars:

Once for a Degree of Licentiate, which should take place after approximately one year of study.

Three times for a Degree of Doctor, which should take place:

- A first seminar after approximately one year to present the research plan.
- A Degree of Licentiate may be an intermediate goal towards a Degree of Doctor. In cases where a Degree of Licentiate is not taken, a mid-way seminar shall be held after approximately half of the doctoral studies period has passed.
- A final seminar 3 to 5 months before the public defence of the doctoral thesis.

The format for all these seminars is a 30–45 minute presentation followed by a discussion led by a discussion leader appointed by the principal supervisor. Written material must be submitted to the discussion leader at least one week before the seminar. The discussion leader must not be involved in the doctoral student's work. The doctoral student's supervisor must participate in these seminars.

These seminars are normally held as part of the FMG3510 seminar series, in which doctoral students and researchers affiliated with the doctoral programme participate.

Updating of the ISP

Updating of the ISP (individual study plan) at least once a year is compulsory.

Admission to third-cycle studies (entry requirements, etc.)

Admission to third-cycle studies is regulated by Chapter 7, Section 40 of the Higher Education Ordinance and the KTH admission regulations. KTH's regulations on specific prerequisites and other abilities required to benefit from third-cycle studies are listed below.

b. Specific entry requirements

To be admitted to third-cycle studies in Production Engineering, the applicant must have successfully completed courses of at least 60 credits at the second-cycle level or above in Production Engineering or other subjects deemed to be directly relevant to the specialisation. These prerequisites are also considered to be met by those who have acquired substantially equivalent knowledge in some other way.

To be admitted to third-cycle studies in Production Engineering, the applicant must have knowledge of English equivalent to the Swedish upper secondary school course English 6.

c. Criteria for the assessment of the candidate's ability to benefit from the studies

The criteria for the assessment of the candidate's ability to benefit from the studies are as follows:

Selection for third-cycle studies is based on the assessed ability to benefit from such studies. The assessment of this ability is primarily based on academic qualifications. In particular, the following is taken into account:

1. Knowledge and skills of relevance to the thesis work and the subject.
These can be demonstrated via attached documents and an interview, if necessary.
2. An assessed ability to work independently
 - a. ability to formulate and tackle scientific problems
 - b. ability to communicate in speech and in writing
 - c. maturity, judgement and ability to perform independent critical analysis
 For example, the assessment can be based on the student's degree project and a discussion about this at a potential interview.
3. Other experiences of relevance to third-cycle studies, e.g. professional experience.

5. Other required regulations

a. Transitional regulations

This syllabus applies to doctoral students admitted after the approval of this syllabus. Current students in the programme may continue to make reference to the previous syllabus.

Appendix: Qualitative targets and assessment criteria

Intended learning outcomes pursuant to the System of Qualification, Annex 2 to the Higher Education Ordinance, plus requirements specified by KTH, with examples of assessment criteria that can determine whether the doctoral student has achieved the outcome in question. *The assessment criteria in the table are examples and were developed as support and inspiration for activities described in Section 1.4.*

Degree of Doctor

Knowledge and understanding	
Intended learning outcomes	Assessment criteria with reference to numbering in eISP
Demonstrate <i>broad knowledge and systematic understanding</i> of the research field as well as <i>advanced and up-to-date</i> specialised knowledge in a limited area of this field.	The outcome has been achieved through the doctoral student having A1.1: authored original scientific papers in which their own contributions are significant and identifiable. The papers are of such quality that they have been published, or are expected to be published, in peer-reviewed international scientific journals or conferences. A1.2: demonstrated both broad and specialised knowledge in the research area by writing a doctoral thesis in which the research results were positioned and discussed in a broader perspective, and presented a reference list of other researchers' results that spans the relevant breadth of the research area. A1.3: in a seminar, course or a doctoral thesis or its public defence, demonstrated a good ability to account for how their own research results relate to the research front within the research area, and justify how their own results advance this.

	A1.4: actively participated in seminar activities in which their own results were presented and discussed, and asked questions and provided feedback on the presentations on other students and researchers.
Demonstrate <i>familiarity</i> with scientific methodology in general and the methods of the specific field of research in particular.	The outcome has been achieved through the doctoral student having A2.1: been assessed with a passing grade for the intended learning outcome in scientific methodology, which may be a course or equivalent learning module at the third-cycle level. A2.2: described fundamental theories in scientific theory and correctly applied one or more of these in their own research. A2.3: practically applied methods appropriate to the research area and developed the ability to independently perform, interpret and critically review the results in order to clarify whether the method and its implementation were appropriate for obtaining credible results that answer the scientific question. A2.4: justified their choice of method and implementation in relation to the question and alternative methods. A2.5: described the advantages and disadvantages of different scientific methods used in their own research area, as well as methods used in the broader definition of the research area.
Competence and skills	
Intended learning outcomes	Assessment criteria with reference to numbering in eISP
Demonstrate the capacity for scholarly analysis and synthesis as well as the ability to review and assess new and complex phenomena, issues and situations autonomously and critically.	The outcome has been achieved through the doctoral student having B1.1: demonstrated the ability to independently formulate and critically analyse both existing and new complex phenomena. B1.2: presented concrete examples of scientific questions and problems of a complex nature from their own research, and explained how these were tested and how the results were analysed. B1.3: explained the interpretation of the results and how these were combined with existing knowledge to give rise to a new explanatory model. B1.4: where applicable, presented concrete examples of results that have led to the falsification of a hypothesis and revision of the hypothesis.
Demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to <i>undertake research</i> and other qualified tasks within predetermined time frames and to review and evaluate such work.	The goal has been achieved through the doctoral student having B2.1: presented examples of independently conducted experiments/simulations/tasks preceded by detailed time planning. B2.2: where applicable, presented examples of their own hypotheses tested within the framework of their own research project, and explained their choice of method and outcome. If any results were not as expected, the doctoral student shall have explained the possible sources of error and the measures taken to move the project forward. B2.3: presented examples of, and explained and argued for, the choice of methods for individual research tasks. B2.4: explained how it was ensured that the studies could be

	completed on time, and whether there were obstacles to staying within the time frame, as well as what measures were taken and their outcome.
Demonstrate through a thesis the ability to make a significant contribution to the formation of knowledge through their own research.	The outcome has been achieved through the doctoral student having B3.1: authored original scientific papers in which their own contributions are significant and identifiable. The papers are of such quality that they have been published, or are expected to be published, in peer-reviewed international scientific journals or conferences. B3.2: authored a doctoral thesis, based on scientific work, of good scientific and linguistic quality, which has been authoritatively defended and discussed at a public defence, and assessed with a passing grade by an independent examining committee.
Demonstrate the ability in both national and international contexts to present and discuss research and research findings <i>authoritatively</i> in speech and writing and in dialogue with the academic community and society in general.	The outcome has been achieved through the doctoral student having B4.1: where applicable, participated in national and international conferences and presented their own research results in speech or poster form, and participated in scientific discussions with other researchers in the research area. B4.2: described how experience from conference or seminar presentations contributed to the development of their own ability to communicate and defend scientific results, how the presentations were received by other participants, and whether valuable information could be obtained that helped their own studies progress. B4.3: been assessed with a passing grade for the intended learning outcomes in communication or presentation techniques in an appropriate compulsory or elective third-cycle course. B4.4: described basic concepts, tools and methods in presentation or communication techniques, as well as demonstrated the ability to put knowledge into practice by formulating different types of scientific presentation material of good quality. B4.5: presented their own research results in a pedagogical manner to other students and researchers at academic seminars, to a general audience or to another category of audience, where the formulation of presentation material and speech was based on pedagogical knowledge adapted to the audience's knowledge level, and also answered questions at an adequate level for the audience. B4.6: participated in outreach activities related to their own research in order to contribute to the dissemination and exchange of knowledge with relevant stakeholder groups, such as other higher education institutions, companies, authorities, schools, etc.
Demonstrate the ability to identify the need for further knowledge.	The outcome has been achieved through the doctoral student having B5.1: by means of concrete examples, described how the lack of essential knowledge needed to carry out a task was rectified and how this affected the possibility of carrying out the task. This may involve widely differing tasks and knowledge, with the proviso that the doctoral student him/herself must have realised that knowledge was lacking and handled this with measures relevant to the purpose. B5.2: demonstrated insight that the knowledge front in higher education and research is in constant change and development and

	that definitive answers cannot always be obtained, as well as the ability to determine whether certain knowledge already exists, for example by means of thorough and critical examination of existing scientific literature. B5.3: demonstrated the ability to question, evaluate and adapt their perception of their own level of knowledge and ability in relation to the prevailing knowledge front.
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.	The outcome has been achieved through the doctoral student having B6.1: presented their own research results in a pedagogical manner to other students and researchers at academic seminars, to a general audience or to another category of audience, where the formulation of presentation material and speech was based on pedagogical knowledge adapted to the audience's knowledge level, and also answered questions at an adequate level for the audience. B6.2: participated in outreach activities related to their own research in order to contribute to the dissemination and exchange of knowledge with relevant stakeholder groups, such as other higher education institutions, companies, authorities, schools, etc. B6.3: actively supervised other students in theoretical and/or practical projects. The doctoral student should use examples to describe and reflect on various aspects of their own efforts, such as how the supervision was structured, whether pedagogical methods were applied, how it was ensured that the person being supervised understood the instructions, etc. The doctoral student should also reflect on the different roles of teachers and students, and how personal dynamics and supervision techniques can affect the outcome of learning and interaction. B6.4: been assessed with a passing grade for intended learning outcomes in higher education pedagogy in an appropriate compulsory or elective third-cycle course. The doctoral student is thereby expected to be able to explain basic concepts, materials and methods, as well as conditions for teaching and learning in higher education, and to analyse, evaluate and develop teaching and learning. Furthermore, the doctoral student is expected to demonstrate the ability to evaluate and analyse different methods and approaches in higher education and to demonstrate the ability to take a student perspective into account. B6.5: demonstrated the ability to collaborate and communicate, in speech and writing, undertaken and completed tasks and assignments within the set time frame, and demonstrated the ability to follow applicable rules and directives, thereby acquiring general knowledge and skills that are in demand in various societal functions.
Judgement and approach	
Intended learning outcomes	Assessment criteria with reference to numbering in eISP
Demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics.	The outcome has been achieved through the doctoral student having C1.1: demonstrated intellectual integrity in the sense that their own choices and positions have been justified and defended based on independent critical thinking in relation to proven experience and scientific foundation.

	C1.2: described how they ensured that their own scientific procedure in theory and practice was carried out in an honest and ethical manner. C1.3: reflected on possible existing or hypothetical ethical dilemmas related to their own research area or to scientific research in general, and reported on their own ethically independent stance in the existing or hypothetical situation. C1.4: been assessed with a passing grade for the intended learning outcomes in ethics in a suitable compulsory or elective third-cycle course. The doctoral student is thus expected to be able to account for fundamental theories in research ethics and relate these to their own approach and research work.
Demonstrate <i>specialised insight</i> 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 use knowledge and expertise to contribute to sustainable societal development.	The outcome has been achieved through the doctoral student having C2.1: presented concrete examples of how their own research results, and the research area in general, can contribute new knowledge to the research front in the area and justify its societal relevance. C2.2: critically reflected on limitations of their own research results, and the research area in general, in order to contribute to solving societally relevant problems, as well as identify possible situations in which their own research results can be used in both a positive and a negative way. C2.3: demonstrated a good ability to reflect on how their own research results can contribute to sustainable societal development and can, where relevant, also link these to the prioritised global sustainable development goals. C2.4: described how their own actions and approach take the concept of sustainability into account. C2.5: been assessed with a passing grade for intended learning outcomes in sustainable development in an appropriate compulsory or elective third-cycle course. The doctoral student is thus expected to be able to account for fundamental theories in sustainability and relate these to their own approach and research work.

Degree of Licentiate

Knowledge and understanding	
Intended learning outcomes	Assessment criteria with reference to numbering in eISP
Demonstrate <i>knowledge and understanding</i> in the field of research, including <i>current</i> specialist knowledge in a limited area of this field. <i>Main difference compared to the Degree of Doctor: For the Degree of Licentiate, it is sufficient to demonstrate “knowledge and understanding”, as opposed to “broad knowledge and systematic understanding”. In addition, “advanced and up-to-date specialised knowledge” is replaced with “current specialist knowledge”.</i>	The outcome has been achieved through the doctoral student having A1.1: authored original scientific papers in which their own contributions are significant and identifiable. The papers are of such quality that they have been published, or are expected to be published, in peer-reviewed international scientific journals or conferences. A1.2: demonstrated both broad and specialised knowledge in the research area by writing a licentiate thesis in which the research results were positioned and discussed in a broader perspective, and presented a reference list of other researchers' results that spans the relevant breadth of the research area. A1.3: in a seminar, course or a licentiate thesis and its public defence, demonstrated a good ability to account for how their own research results relate to the research front within the research area, and justify how their own results advance this. A1.4: actively participated in seminar activities in which their own results were presented and discussed, and asked questions and provided feedback on the presentations on other students and researchers.
Competence and skills	
Intended learning outcomes	Assessment criteria with reference to numbering in eISP
Demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to <i>undertake a limited piece of research</i> and other qualified tasks within predetermined time frames in order to <i>contribute to the formation of knowledge</i> as well as to evaluate this work. <i>Main difference compared to the Degree of Doctor: For the Degree of Licentiate, there is emphasis that the student is to undertake a “limited piece of research” that is to contribute to the formulation of knowledge, as opposed to the Degree of Doctor, which specifies that the student is to demonstrate the ability to “undertake research”.</i>	The outcome has been achieved through the doctoral student having B1.1: demonstrated the ability to independently formulate and critically analyse both existing and new complex phenomena. B1.2: presented examples of their own questions that have been tested within the context of their own research project, and presented their choice of method and the outcome. If any results were not as expected, the doctoral student shall have explained the possible sources of error and the measures taken to move the project forward. B1.3: presented examples of independently conducted experiments/simulations/tasks preceded by detailed time planning. B1.4: presented examples of, and explained and argued for, the choice of methods for individual experiments. B1.5: explained how it was ensured that the studies could be completed on time, and whether there were obstacles to staying within the time frame, as well as what measures were taken and their outcome.
Demonstrate the ability in both national and international contexts to present and discuss	The outcome has been achieved through the doctoral student having

research and research findings <i>clearly</i> in speech and writing and in dialogue with the academic community and society in general. <i>Main difference compared to the Degree of Doctor: For the Degree of Licentiate, the requirement is for the student to communicate their research “clearly”, as opposed to communicating “authoritatively”.</i>	B2.1: where applicable, participated in national and international conferences and presented their own research results in speech or poster form, and participated in scientific discussions with other researchers in the research area. B2.2: described how experience from conference or seminar presentations contributed to the development of their own ability to communicate and defend scientific results, how the presentations were received by other participants, and whether valuable information could be obtained that helped their own studies progress. B2.3: been assessed with a passing grade for the intended learning outcomes in communication or presentation techniques in an appropriate compulsory or elective third-cycle course. B2.4: described basic concepts, tools and methods in presentation or communication techniques, as well as demonstrated the ability to put knowledge into practice by formulating different types of scientific presentation material of good quality. B2.5: presented their own research results in a pedagogical manner to other students and researchers at academic seminars, to a general audience or to another category of audience, where the formulation of presentation material and speech was based on pedagogical knowledge adapted to the audience's knowledge level, and also answered questions at an adequate level for the audience. B2.6: participated in outreach activities related to their own research in order to contribute to the dissemination and exchange of knowledge with relevant stakeholder groups, such as other higher education institutions, companies, authorities, schools, etc.
Demonstrate the skills required to participate autonomously in research and development work and to work autonomously in some other qualified capacity. <i>Main difference compared to the Degree of Doctor: The doctoral student's future contribution to society through research and education is downplayed, and the focus is placed on the doctoral student's ability to work in areas that require research skills but not a doctoral degree.</i>	The outcome has been achieved through the doctoral student having B3.1: authored original scientific papers in which their own contributions are significant and identifiable. The papers are of such quality that they have been published, or are expected to be published, in peer-reviewed international scientific journals or conferences. B3.2: authored a licentiate thesis based on their own studies of good scientific and linguistic quality, which has been defended and discussed at a licentiate seminar, and assessed with a passing grade by an independent examiner.
Judgement and approach	
Intended learning outcomes	Assessment criteria with reference to numbering in eISP
Demonstrate the ability to make assessments of ethical aspects <i>of their own research</i>. <i>Main difference compared to the Degree of Doctor: The ability to make assessments of research ethics is limited to the student's own research and not in general.</i>	The outcome has been achieved through the doctoral student having C1.1: demonstrated intellectual integrity in the sense that their own choices and positions have been justified and defended based on independent critical thinking in relation to proven experience and scientific foundation. C1.2: described how they ensured that their own scientific procedure in theory and practice was carried out in an honest and ethical manner. C1.3: reflected on possible existing or hypothetical ethical dilemmas related to their own research area or to scientific research in general,

	and reported on their own ethically independent stance in the existing or hypothetical situation. C1.4: been assessed with a passing grade for the intended learning outcomes in ethics in a suitable compulsory or elective third-cycle course. The doctoral student is thus expected to be able to account for fundamental theories in research ethics and relate these to their own approach and research 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. <i>Main difference compared to the Degree of Doctor: For the Degree of Licentiate, only "insight" is required, as opposed to "specialised insight" for the doctoral degree.</i>	The outcome has been achieved through the doctoral student having C2.1: presented concrete examples of how their own research results, and the research area in general, can contribute new knowledge to the research front in the area and justify its societal relevance. C2.2: critically reflected on limitations of their own research results, and the research area in general, in order to contribute to solving societally relevant problems, as well as identify possible situations in which their own research results can be used in both a positive and a negative way. C2.3: demonstrated a good ability to reflect on how their own research results can contribute to sustainable societal development and can, where relevant, also link these to the prioritised global sustainable development goals. C2.4: described how their own actions and approach take the concept of sustainability into account.
Demonstrate the ability to identify the personal need for further knowledge and take responsibility for their ongoing learning. <i>Main difference compared to the Degree of Doctor: Same requirement to be able to identify the need for further knowledge, with the addition of being able to take responsibility for one's own knowledge development, which is considered implicit in a doctoral degree.</i>	C3.1: by means of concrete examples, described how the lack of essential knowledge needed to carry out a task was rectified and how this affected the possibility of carrying out the task. This may involve widely differing tasks and knowledge, with the proviso that the doctoral student him/herself must have realised that knowledge was lacking and handled this with measures relevant to the purpose. C3.2: demonstrated insight that the knowledge front in higher education and research is in constant change and development and that definitive answers cannot always be obtained, as well as the ability to determine whether certain knowledge already exists, for example by means of thorough and critical examination of existing scientific literature. C3.3: demonstrated the ability to question, evaluate and adapt their perception of their own level of knowledge and ability in relation to the prevailing knowledge front.