REGULATION

Valid from
2018-08-07

Reference number
V-2018-0675 3.2.3
V-2023-0932 3.2.3

Decision-maker
President

Revised as of
2024-01-30

Entity responsible for supervision and questions
School of Architecture and the Built Environment

General syllabus for education at third-cycle level in the subject **Industrial Ecology**

This regulatory document has been decided by the President (V-2018-0675) pursuant to chapter 6 sections 26-27 of the Higher Education Ordinance. The regulatory document is valid with effect from 07-08-2018 and was last modified on 30-01-2024 (V-2023-0932). The regulatory document regulates the main content of the education, requirements for special qualifications and the other regulations that are needed. The School of Architecture and the Built Environment is responsible for review and questions about the governing document.

1 Content of the education

1.1 The name of the subject in Swedish and in English translation

Industriell ekologi, Industrial Ecology

1.2 Subject description

Industrial Ecology (IE) originated in the engineering sciences but is today a multidisciplinary discipline studying how human societies, in their parts and as a whole, should be designed and operated to promote more sustainable development. The subject has a special focus on analysing socio-technical systems, identifying and testing innovative solutions to complex societal challenges and accelerating change processes that lead towards more sustainable societies. In many cases, collaborative processes are at the centre of research. The subject studies local, regional and global flows and stocks of materials, energy as related to industrial and societal processes and products, and private and public consumption in order to achieve resource efficiency, close resource flows, and aim for a circular economy and less negative environmental impacts, while also taking into account socio-economic dimensions. The subject includes environmental and energy systems analysis, waste management, circular systems of production and consumption, sustainable urban development for more efficient resource use and reduced climate impact, environmental modelling, environmental engineering, green and blue growth, and development and evaluation of the sustainability of socio-technical systems.

1.3 Specialisations

The subject has no specialisations.

1.4 Organisation of the education

1.4.1 Activities for fulfilment of outcomes for the education according to the Higher Education Ordinance (HF)

Below are described activities for the doctoral student's fulfilment of the learning outcomes for third-cycle education according to the Higher Education Ordinance (HF) and KTH's goals. The individual study plan specifies the activities for each individual doctoral student.

Learning outcomes: Knowledge and understanding

For the Degree of Doctor the doctoral student shall:

- Demonstrate broad knowledge and a systematic understanding of the research field as well as advanced and up-to-date specialist knowledge in a limited area of this field.

General and systematic understanding of the subject is developed in the compulsory course Industrial Ecology: Application and Research, the compulsory course in environmental systems analysis and in elective courses. In addition, this understanding is developed through supervision and seminar participation. The student demonstrates their achievement of this ability through summative assessment in the mentioned courses, through presentations at seminars and by writing a background section in the introductory chapter of their thesis. Specialised knowledge is developed through individual reading and research as well as through discussions with the supervisor and others. This is mainly demonstrated in the articles included in the thesis.

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

  General knowledge of scientific method is acquired through the compulsory course Introduction to the Philosophy of Science and Research Methodology More specialised methodological knowledge is acquired through the compulsory course Industrial Ecology: Application and Research and through various elective courses in the subject. Such knowledge is also acquired through supervision and participation in seminars and conferences.

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 research methodology in general and the methods of the specific field in particular.

General and systematic understanding of the subject is developed in the compulsory courses Industrial Ecology: Application and Research and Environmental Systems Analysis and in elective courses. In addition, this understanding is developed through supervision and seminar participation. The student demonstrates their achievement of this ability through summative assessment in the mentioned courses, through presentations at seminars and by writing a background section in the introductory chapter of the licentiate thesis. Specialised knowledge is developed through individual reading, according to the supervisor's suggestions and instructions, as well as through discussions with the supervisor and others. It is mainly demonstrated in the articles included in the licentiate thesis.

Learning outcome: Competence and skills

For the Degree of Doctor the doctoral 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.

  Supervision is designed to ensure that the graduate student gradually becomes more independent in analysing the data generated in their own research. The student's ability

to critically review the research findings and observations of others is developed, both in the department's seminars and in courses. This includes the Industrial Ecology courses: Application and Research, Writing Scientific Articles, and Scientific Theory and Research Methodology.

- 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.

  This is mainly developed through supervision, the student's own research and participation in doctoral courses and scientific conferences. In addition, doctoral students are encouraged to participate in discussions where research issues are identified and future research is planned. This applies to internal meetings as well as meetings with colleagues from other universities or with clients of importance to their own research

- Demonstrate through a dissertation the ability to make a significant contribution to the formation of knowledge through his or her own research.

  The study plan is used at regular supervision sessions to plan the doctoral students' research work. We also use the seminars for continuous monitoring and discussion of the doctoral students' work. At supervisor meetings, the progress of the doctoral students is discussed and supervision and other measures needed to further help the doctoral students to achieve this central outcome of third-cycle education are identified.

- 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.

  We attach great importance to doctoral students presenting their research in research contexts, as well as to clients and stakeholders. Our principle is that a full-time doctoral student must make an external presentation, e.g., at an international conference, at least once a year.

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

  In connection with the annual revision of study plans, the doctoral student is encouraged to present proposals for how further research should be planned. These suggestions are discussed with the principal supervisor as part of the study-plan process. As supervision continues, great importance is attached to the doctoral student's ability to identify himself or herself what needs to be done to drive the research forward

- 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.

Doctoral students are given the opportunity to participate both in scientific conferences and in our meetings with external stakeholders. They are also given the opportunity to gain teaching experience wherever possible. Many doctoral students conduct their studies in research projects involving collaboration with industry or public authorities. Doctoral students are given the opportunity to take the course Basic Communication and Teaching (3.0 credits) as part of the programme.

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 is mainly developed through supervision and the student's own research work. In addition, we seek to involve doctoral students in discussions where research issues are identified and future research is planned. This applies to internal meetings as well as to meetings with colleagues from other universities and with clients relevant to our research

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

  We attach great importance to doctoral students presenting their research in research contexts, as well as to clients and stakeholders. Our principle is that a doctoral student must make an external presentation, e.g., at an international conference, at least twice before receiving their Degree of Licentiate.

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

  Doctoral students are given the opportunity to participate both in scientific conferences and in our meetings with external stakeholders. They are also given the opportunity to gain teaching experience wherever possible. Many doctoral students conduct their studies in research projects involving collaboration with private companies or public authorities. Doctoral students are given the opportunity to take the course Basic Communication and Teaching (3.0 credits) as part of the programme.

Learning outcomes: Judgement and approach

For the Degree of Doctor the doctoral student shall:

- Demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics.

Research seminars address issues of scientific integrity and research ethics. The compulsory course Scientific Theory and Research Methodology includes elements on research ethics. In addition, 1.5 credits in the legal and ethical aspects of research are earned in a specially designed course.

- 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.

  Issues regarding the potentialities and limitations of science are continuously addressed in supervision and seminars. Doctoral students are expected to address issues of societal relevance in their theses. In addition, these issues are addressed in the compulsory doctoral course in Scientific Theory and Research Methodology.

For a Degree of Licentiate, the doctoral student shall:

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

  Both supervision and research seminars address issues of research ethics. The compulsory course Scientific Theory and Research Methodology includes elements on research ethics. In addition, 1.5 credits in research ethics are earned in a specially designed course.

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

  Issues regarding the potentialities and limitations of science are continuously addressed in supervision and seminars. Doctoral students are expected to address issues of societal relevance in their theses. In addition, these issues are addressed in the compulsory doctoral course in Scientific Theory and Research Methodology.

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

  In connection with the annual revision of study plans, the doctoral student is encouraged to present proposals for how further research should be planned. These suggestions are discussed with the principal supervisor as part of the study-plan process. As supervision continues, great importance is attached to the doctoral student's ability to identify himself or herself what needs to be done to drive the research forward.

KTH's outcome in sustainable development

For both the Degree of Licentiate and the Degree of Doctor, the doctoral student shall:

- Demonstrate with knowledge and skills the ability to be able to contribute to sustainable societal development towards an equal, inclusive and climate-neutral society.

  Sustainable development issues are constantly topical in the research area and arise in supervision, seminars and doctoral courses. They are covered in the compulsory doctoral course FAL 3100 Industrial Ecology: Application and Research, among other courses.

1.4.2 Compulsory courses

For the Degree of Licentiate, the following courses are compulsory:

Industrial Ecology: Application and Research, third cycle (3.0 credits)

Writing Scientific Articles, third cycle (5.0 credits)

Introduction to Research Ethics for Doctoral Students, third cycle (1.5 credits)

Programme-wide seminar course, third cycle (3.0 credits)

Scientific Theory and Research Methodology, third cycle (7.5 credits)

If the theory-of-knowledge course has not included a JML component, the doctoral student must take Introduction to Gender Equality, Diversity and Equal Opportunities (JML) for PhD Students, third cycle (0.5 credits).

Doctoral students not taking courses in sustainable development in the prerequisite courses and study programmes must acquire this knowledge in another way, e.g., through Industrial Ecology: Literature Course.

For the Degree of Doctor, in addition to the compulsory courses for the Degree of Licentiate, the following courses are also compulsory:

At least 3.0 credits of conditional elective courses

At least 1.5 credits and no more than 3.0 credits from conference courses.

At least 5.0 credits from literature study courses or another course in Industrial Ecology. A maximum of 15.0 credits from literature study courses can count towards the degree.

Doctoral students not taking MJ2615 and AL2142 or equivalent in the prerequisite courses and study programmes must acquire equivalent knowledge through Industrial Ecology: Literature Course.

There is a high degree of flexibility regarding which courses can be included in the programme. For each doctoral student, course choices must be planned together with supervisors and documented in the individual study plan. The courses chosen are to contribute to the knowledge acquisition required for the research work.

1.4.3 Recommended courses

Environmental Modelling: Dynamic processes in natural systems (6.0 credits)

"Blue food" (7.5 credits) This course is compulsory for doctoral students funded by Blå Mat.

Scientific Writing and Communication 3.0 credits

Basic Communication and Teaching (3.0 credits)

Scientific conferences

Participation in scientific conferences is a key element of all third-cycle programmes and is eligible for course credits. Presentation of one’s own research in an international scientific

conference relevant to the subject also entitles one to course credits. In total, a maximum of three credits can be awarded for conference participation. Specific courses have been set up for this purpose.

Conference attendance must be planned in advance with the principal supervisor.

Literature study courses

Research specialisation commonly leads to knowledge acquisition in a domain lacking established courses. In such cases, it is possible to formulate a literature study course; a course description is written, including intended learning outcomes, boundaries, scope and an implementation plan, and normally presented in a report and/or at a seminar. In total, a maximum of 15 credits can be awarded for literature study courses.

Industrial Ecology: Literature Course A (1.5 credits)

Industrial Ecology: Literature Course B (3.0 credits)

Industrial Ecology: Literature Course C (5.0 credits)

Industrial Ecology: Literature Course D (10.0 credits)

Industrial Ecology: Literature Course E (15.0 credits)

1.4.4 Conditional elective courses

1.4.5 Requirements for the degree

Degree of Doctor

A Degree of Doctor comprises 240 credits. At least 120 credits must consist of the doctoral thesis

Thesis

Quality requirements and possible other requirements for the thesis.

Thesis work is a compulsory part of third-cycle education and aims to develop the doctoral student's ability to make independent contributions to research and the scientific community. The thesis can either be written as a monograph or as a compilation of scientific articles (preferred). In the latter case, a specially written summary (an ‘introductory chapter’) must be included in the thesis. Whatever its form, the thesis is assessed as a whole. A doctoral thesis can be based on a licentiate thesis. The thesis is normally to be written in English.

A doctoral thesis must contain new theoretical or empirical research results that the doctoral student has developed through theoretical or empirical research work in the chosen subject area. It must also include an overview of previous research in the chosen subject area, and it must situate the doctoral student's contribution in relation to previous research.

A compilation thesis also includes a summarising introductory chapter, of the order of 30 to 50 pages. A compilation thesis must consist of peer-reviewed publications in international journals. In Industrial Ecology, the introductory chapter is of great importance and is an important part

of the thesis where the doctoral student independently formulates his/her work, and extra emphasis is placed on its assessment.

The thesis is reviewed and assessed by the principal supervisor and assistant supervisor; when they are satisfied, an internal reviewer from KTH is appointed to assess the thesis based on KTH's quality requirements.

The doctoral thesis must be presented and defended at a public defence, as set forth by KTH's governance document.

Courses

The doctoral student shall have completed courses of at least 60 credits, of which 45 credits must be at third-cycle level and no more than 10 credits can be at first-cycle level.

Degree of Licentiate

A Degree of Licentiate comprises at least 120 credits. At least 60 credits must consist of the academic thesis.

Thesis

Quality requirements and possible other requirements for the licentiate thesis.

An academic paper for a licentiate degree must contain results from theoretical or empirical research work. It must also include an overview of previous research in the chosen subject area, and it must situate the doctoral student's contribution in relation to previous research.

A compilation thesis also includes a summarising introductory chapter, of the order of 30 to 50 pages.

The licentiate thesis shall be presented in accordance with KTH's governance document.

Courses

The doctoral student shall have completed courses of at least 30 credits, of which 15 credits must be at third-cycle level and no more than 10 credits can be at first-cycle level

1.4.6 Other elements in the education to promote and ensure goal attainment

Seminar participation

The programme includes active participation in research seminars. The doctoral student should present his/her research on at least two occasions for the Degree of Licentiate and the Degree of Doctor. These occasions may involve, e.g., presenting the thesis plan, showing progression in thesis work and summarising the research results prior to writing the thesis.

In addition to these seminars, doctoral students must present their theses at a final seminar before the licentiate seminar/public defence of doctoral thesis. At such a presentation, one or more department faculty members should act as internal reviewer. Before presenting their own thesis, a doctoral student should have served as such an internal reviewer on at least one occasion.

Doctoral students not holding a Degree of Licentiate must present their thesis plan, progress and research results at an open half-time seminar. At the half-time seminar, at least one departmental docent must act as internal reviewer.

Participation in Industrial Ecology workshops

The doctoral student must actively participate in the workshops/meetings organised for the third-cycle subject area Industrial Ecology. These workshops are an important part of the third-cycle programme.

2 Admission to education at third-cycle level (qualification etc.)

Admission to education at third-cycle level is regulated in Chapter 7, Section 40 of the Higher Education Ordinance and in the admission regulations at KTH. KTH's regulations on specific prerequisites and such abilities in other respects as are needed to assimilate the education in the relevant subject at the doctoral level are set out below.

2.1 Specific prerequisites

To be admitted to the third-cycle education in Industrial Ecology the applicant must have passed courses resulting in at least 60 credits at minimum second-cycle level in technology, natural sciences, social sciences or economics, preferably with elements of sustainable development/technology or other subjects deemed directly relevant to the chosen specialisation. These entry requirements can be also be considered fulfilled by an applicant who has acquired essentially equivalent knowledge in arrangement.

In order to be admitted to third-cycle education in Industrial Ecology, the applicant must have knowledge of English equivalent to English 6.

2.2 Assessment criteria for testing the ability to assimilate the education

The following assessment criteria apply for testing the ability to assimilate the education:

Selection for third-cycle education is based on assessed ability to assimilate such education. The ability assessment is primarily based on having passed courses and programmes that satisfy the entry requirements. Particular consideration is given to the following:

1. Knowledge and skills relevant for thesis work and the subject.
   These can be shown through attached documents and a possible interview
2. Assessed ability to work independently
   a. ability to formulate and tackle scientific problems
   b. ability to communicate well in speech and writing
   c. maturity, judgement and ability to analyse critically and independently

   The assessment may be based, for example, on degree projects and discussion of these at a possible interview.
3. Other experience relevant for third-cycle education, e.g. professional experience.
   These can be demonstrated through attached documents and, potentially, an interview.

3 The other regulations needed

3.1 Transitional regulations

Doctoral students admitted to a previous general syllabus are entitled to follow either the new syllabus or the syllabus under which they were admitted. Requests to adopt a new syllabus are made to the director of third-cycle education. However, changing syllabi requires that the new syllabus can be achieved in time.

Doctoral students admitted to a previous general syllabus in the subject of Industrial Ecology are entitled to switch to the new syllabus or continue with the syllabus under which they were admitted. When changing syllabi, students must choose to take the compulsory courses stated in one or the other syllabus. The choice must be reflected in the first individual study plan following the switch.

Requests to change to a new syllabus are made to the director of third-cycle education at the school.