



## General syllabus for third-cycle subject

Subject	Adopted	Registration number	Ks-kod
<b>Industrial Engineering and Management</b>	<b>5 April 2017</b> <i>Revised 4</i> <i>March 2019</i>	<b>V-2019-0208</b>	<b>3.2.3</b>

## General syllabus

**Established by the Faculty Council/Education Committee: 05/04/2017**

Revised: 04/03/2019

### **The name of the subject in Swedish and translated into English**

*Also indicated whether the subject has any specialisations.*

Industriell ekonomi och organisation (Industrial Engineering and Management)

### **Subject description Main content of the programme**

Industrial Engineering and Management comprises theoretical and practical knowledge that is central to the management of innovation, production and marketing in established and emerging industries. The focus is on developing efficient industrial operations, technology-based businesses and creating the conditions for innovation, development and growth. The subject is characterised by a diversity of initiatives at various levels of analysis. The natural point of departure is the organisation (company/department/project) and its activities, but the subject also includes studies of how industry structures and transformation processes intersect several organisations in time and space, as well as studies of work processes and working conditions from an employee perspective.

Industrial Engineering and Management is an applied subject in the intersection between technology, social sciences and humanities. The focus is on the development and use of technology in the service of humans, companies and society.

Research within the subject of Industrial Engineering and Management is eclectic and multidisciplinary and is centred around issues of economics and management that are relevant for engineering and technologically intensive activities. Research is conducted for example within the areas: production strategy, organisation management, innovation management, operations management, supply chain management, industrial marketing, project management, industrial dynamics, technology development, leadership, R&D management, industrial business financing and financial management, business strategy, knowledge management, work organisation, gender studies and diversity, critical management studies and technology-based business development and entrepreneurship.

### **Programme objectives based on the Higher Education Ordinance, Annex 2, Qualifications Ordinance.**

*The doctoral student's individual study plan must be designed to guarantee the possibility of attaining the qualitative targets in the Higher Education Ordinance and KTH's objectives. Attainment shall be evaluated for each individual doctoral student. This shall be done annually by monitoring the individual study plan. The latter shall comment on progression vis-à-vis the objectives based on the programme's courses and student's thesis work. Other activities, such as*

*supervision and external activities in line with education and public outreach shall also be factored into this.*

*State the programme elements for promoting goal attainment. Other details are to be given in an appendix to the subject's study plan.*

*Knowledge and understanding*

*For a Degree of Doctor, the doctoral student must*

- demonstrate broad knowledge within and a systematic understanding of the research area as well as deep and up-to-date specialist knowledge within a defined part of the research area, and*
- demonstrate familiarity with scientific methodology in general and with the methods of the specific research area in particular.*

These learning objectives are attained individually by each doctoral student through:

- Compulsory courses. The aim of examination in compulsory third-cycle courses is to ensure that each doctoral student has acquired broad knowledge and a systematic understanding of the field as well as a broad understanding of scientific methodology in general. For doctoral students who have departmental duties and spend all or parts of this teaching on first-cycle programmes, basic training in higher education teaching is mandatory.
- Elective courses. This normally refers to the advanced, subject-specific courses that each doctoral student takes to improve within their individual research specialisation and thereby ensure specialist knowledge as well as their knowledge of specialist methods. These courses are identified in consultation between the doctoral student and their supervisor.
- Gradual seminar processing of the doctoral student's research. Through a series of seminars, it is ensured that the doctoral student demonstrates the ability to present and discuss research. Doctoral students with departmental duties are also expected to present and discuss research at international conferences.
- Examination consists of a thesis. Through examination, it is ensured that the student has the ability to make essential contributions through their research to the knowledge development within the field of industrial engineering and management.
- Departmental duties where applicable. By participating in department teaching at first-cycle and second-cycle level, it is ensured that the doctoral student has a broad capacity to support the learning of others and the ability to present and discuss research and results orally and in writing.

*Skills and abilities, including communication ability*

*For a Degree of Doctor, the doctoral student must*

- demonstrate skills in scientific analysis and synthesis and ability to independently and critically consider and assess new and complex phenomena, questions and situations,*
- demonstrate ability to critically, independently, creatively and with scientific meticulousness identify and formulate questions as well as plan and conduct research and other qualified tasks using adequate methods within given time frames and review and evaluate such work,*
- write a thesis to demonstrate their ability to make significant contributions to knowledge development through their own research,*
- demonstrate ability in both national and international contexts, verbally and in writing, to confidently present and discuss research and research findings in dialogue with the scientific*

*community and society in general.*

*- demonstrate an ability to identify needs for further knowledge, and*

*- demonstrate ability, both in research and education and in other qualified professional contexts, to contribute to society's development and support the learning of others.*

These learning objectives are attained individually by each doctoral student through:

- Compulsory courses. The aim of examination in compulsory third-cycle courses is to ensure that each doctoral student has acquired a broad ability to carry out scientific analysis and synthesis. For doctoral students who have departmental duties and spend all or parts of this teaching on first-cycle programmes, basic training in higher education teaching is mandatory.
- Elective courses. This normally refers to the advanced, subject-specific courses that each doctoral student takes to improve within their individual research specialisation and thereby ensure specialist analytical capacity, ability to identify and plan research projects and the ability to identify needs for further knowledge. These courses are identified in consultation between the doctoral student and their supervisor.
- Gradual seminar processing of the doctoral student's research. Through a series of compulsory seminars, it is ensured that the doctoral student demonstrates the ability to present and discuss research. Doctoral students with departmental duties are also expected to present and discuss research at international conferences.
- Examination consists of a thesis.
- Departmental duties where applicable. By participating in department teaching at first-cycle and second-cycle level, it is ensured that the doctoral student has a broad capacity to support the learning of others and the ability to present and discuss research and results orally and in writing.

*Judgement and approach*

*For a Degree of Doctor, the doctoral student must*

*- demonstrate intellectual independence and scientific integrity as well as the ability to make ethical research assessments, and*

*- demonstrate a profound insight into the possibilities and limitations of the discipline, its societal role and the responsibility people bear for how it is used.*

These learning objectives are attained individually by each doctoral student through:

- Compulsory courses. The aim of examination in compulsory third-cycle courses is to ensure that each doctoral student has acquired intellectual independence, scientific integrity and the ability to make research-ethical assessments as well as a profound insight into the role of science in society. For doctoral students who have departmental duties and spend all or parts of this teaching on first-cycle programmes, basic training in higher education teaching is mandatory.
- Elective courses. This normally refers to the advanced, subject-specific courses that each doctoral student takes to improve within their individual research specialisation and thereby ensure specialist knowledge as well as their knowledge of specialist methods. These courses are identified in consultation

between the doctoral student and their supervisor.

- Gradual seminar processing of the doctoral student's research. Through a series of seminars, it is ensured that the doctoral student demonstrates the ability to present and discuss research. Doctoral students with departmental duties are also expected to present and discuss research at international conferences.
- Examination consists of a thesis. Through examination, it is ensured that the student has the ability to make essential contributions through their research to the knowledge development within the field of industrial engineering and management.
- Departmental duties where applicable. By participating in department teaching at first-cycle and second-cycle level, it is ensured that the doctoral student has a broad capacity to support the learning of others and the ability to present and discuss research and results orally and in writing.

#### Sustainable development

*For a Degree of Doctor, the doctoral student must*

*- demonstrate knowledge of, and an ability to make relevant environmental and ethical assessments in order to be able to contribute to sustainable societal development.*

These learning objectives are attained individually as course elements and through participation in the department's seminar activities. The seminars are used to discuss results and experience from research projects, and to make environmental and ethical assessments. Many of the department's research projects relate to sustainable development, for example in terms of transport, supply chain management or organisation.

#### **Specific entry requirements**

*Subject knowledge requirements and any language requirements are specified here*

KTH's general entry requirements for admission to third-cycle education are applied. A doctoral student is expected to read and write scientific English and to speak English fluently.

#### **Selection rules**

The admission of students for third-cycle education is carried out by the Dean/Head of School. The selection is based on the ability to assimilate the third-cycle programme. It is primarily made on the basis of documentation and material cited by the applicant. In addition, other bases for decisions can be of significance, such as interviews with the applicant. The suitability for third-cycle studies is determined based on a combined weighting of grades, earlier activities, interest and capacity for independent judgment and critical analysis.

#### **Contents and examination of course element**

The third-cycle programme consists of one course component and one thesis component:

- A Degree of Licentiate requires 120 credits, of which the thesis comprises 75

credits and the course component must comprise at least 45 credits.

- A Degree of Doctor requires 240 credits, of which the thesis comprises 150 credits and the course component must comprise at least 90 credits.

All courses must be approved by the doctoral student's principal supervisor and by the doctoral programme director.

### **Compulsory courses for the Degree of Doctor**

A Degree of Doctor in the third-cycle subject Industrial Engineering and Management requires the completion of third-cycle courses comprising at least 90 HE credits. Of these, the following course elements are compulsory and must comprise at least 30 HE credits.

- Qualitative Research Methods 7.5 credits
- Quantitative Research Methods in Industrial Economics and Management 7.5 credits
- Researching Industrial Economics and Management: An Introduction 7.5 credits
- Philosophy of Science 7.5 credits

Additional courses comprising at least 60 HE credits are also required to create the necessary grasp of the subject and sufficient individual specialisation.

### **Compulsory courses for the Degree of Licentiate**

A Degree of Licentiate in the third-cycle subject Industrial Engineering and Management requires the completion of third-cycle courses comprising at least 45 credits. Of these, the following course elements are compulsory and must comprise at least 15 credits.

- Researching Industrial Economics and Management: An Introduction 7.5 credits

along with one of the following courses, comprising at least 7.5 credits:

- Qualitative Research Methods 7.5 credits
- Quantitative Research Methods in Industrial Economics and Management 7.5 credits
- Philosophy of Science 7.5 credits

Additional courses comprising 30 credits are also required to create the necessary grasp of the subject and sufficient individual specialisation.

### **Elective courses**

There is a high degree of flexibility in the selection of courses to include in the

programme. The course elements for each doctoral student are to be planned together with the supervisors and documented in the individual study plan, so that the courses relate to the knowledge acquisition required for the research.

Following an agreement with the principal supervisor, courses from earlier education may be accredited. Accreditation must take into consideration the provisions on third-cycle degrees in KTH's system of qualifications. At least 45 credits for a Degree of Doctor and at least 30 credits for a Degree of Licentiate of the total course component must be at third-cycle level. No accreditation is possible of first-cycle and second-cycle level courses up to 240 credits. Courses required for specific entry requirements on the third-cycle programme cannot be accredited.

Additional course elements that subject representatives and students jointly deem to be important to the dissertation/thesis can also be included in the course component of the licentiate or doctoral degree. Such crediting activities may include individual literature courses, qualified contributions to the department's research activities or other qualified activities relating to science. For such activities to be accredited, there must be a prior agreement between the principal supervisor and the student, establishing the credits in the individual study plan. Massive Open Online Courses (MOOCs) should be approved in advanced by the principal supervisor in consultation with the doctoral programme director (DA) in order to be accredited within the scope of a doctoral or licentiate degree.

Courses in higher education teaching is a requirement if the doctoral student is expected to participate in teaching on KTH's first-cycle and second-cycle programmes.

### **Scientific conferences and seminar activities**

Participation in scientific conferences and seminars is a central component of all third-cycle programme and entitles the student to HE credits. Participation and presentation of an article at an international scientific conference relevant to the subject will normally be awarded 1 credit. A maximum total of 7.5 credits can be awarded for participation in conferences and seminars.

Participation in conferences and seminars must be planned in advance together with the principal supervisor.

### **Qualification requirements**

#### **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.*

The thesis project is a compulsory part of the third-cycle programme, which aims to develop the doctoral student's ability to make independent contributions to the

research and scientific community. A doctoral thesis can either be written as a monograph or as an aggregation of scientific articles. In the latter case, there must be a separately written summary (called a “summarising chapter”). Regardless of format, the thesis is assessed as a whole.

The doctoral thesis can be based on the licentiate dissertation.

The thesis must normally be written in English or Swedish (for Swedish dissertations, special permission is required from the ITM school).

A doctoral thesis must contain new theoretical or empirical research results within the chosen field, which the student has produced through theoretical or empirical research. It must also include an overview of previous research in the selected subject area and position the student’s contribution in relation to earlier research. Regardless of whether the doctoral thesis is presented as a monograph or as a compilation of scientific papers, it must be of such quality that it is deemed a suitable basis for at least four regular articles that can be published in internationally recognised, peer-reviewed journals.

A monograph must normally consist of between 150–200 pages.

In addition to a summarising chapter of around 50 pages, an aggregate thesis must include at least four publishable scientific articles (the international norm in the field). The doctoral student must normally be the lead author of at least one article and the sole author of at least one article. At time of the public defence of the thesis, normally two articles have been accepted for publication in internationally recognised, peer-reviewed journals.

In addition to internal work seminars, each doctoral student must also present the research relating to their thesis at no less than three official programme seminars over the course of their doctoral studies:

1. Thesis plan (after about 1 year of study)
2. Intermediate/Licentiate seminar (around halfway through)
3. Final seminar (when 6–12 months are assessed to remain until the public defence).

All doctoral students and researchers associated with the programme are invited to participate in these seminars. At the seminar, the manuscript is reviewed by an expert opponent/discussant who is not involved in the doctoral student’s work. The seminar will be chaired by a supervisor from the programme, who is not the doctoral student’s principal or assistant supervisor.

Written documents must have been received by the invited participants no later than one week ahead of the seminar.

At the intermediate/Licentiate seminar, the opponent/discussant should preferably have at least the qualifications required for appointment as docent.

Before finishing the thesis, the doctoral student must present the manuscript at a final

seminar. The final seminar is the part of the third-cycle quality evaluation process aimed to ensure that the doctoral thesis is of a high academic quality.

The final seminar relates to what is deemed to be the penultimate version of the thesis manuscript, which means that the thesis is presented in full. This seminar is held when the principal supervisor deems there to be 6–12 months' work remaining until the public defence of the thesis. An external, independent opponent is invited to participate in this seminar, who has not previously been involved in the doctoral student's thesis work. The opponent should preferably have at least the qualifications of a docent.

The final seminar must be announced to all supervisors and doctoral students on the programme.

The seminar will be chaired by a supervisor from the programme, who is not the doctoral student's principal or assistant supervisor.

#### Courses

A Degree of Doctor requires 90 credits obtained through courses.

#### **Degree of Licentiate**

*A Degree of Licentiate comprises at least 120 credits. At least 60 credits must consist of the dissertation.*

#### Dissertation

*Quality requirements and possible other requirements for the dissertation.*

A licentiate dissertation must contain an application of established scientific knowledge within a new field, which the student has developed through theoretical or empirical research. It must also include an overview of previous research in the selected subject area and position the student's contribution in relation to earlier research.

Regardless of whether the licentiate dissertation is presented as a monograph or as a compilation of scientific papers, it must be of such quality that it is deemed a suitable basis for at least two regular articles that can be published in internationally recognised, peer-reviewed journals. In the case of an aggregate dissertation, the doctoral student should be the sole author of at least one article.

Following approval by the principal supervisor, the thesis is presented at a public seminar in accordance with KTH's rules.

#### Courses

A Degree of Licentiate requires 45 credits obtained through courses.

Appendix

Qualitative targets, including KTH's objectives, as per the Higher Education Ordinance (Appendix 2 – Qualifications Ordinance) for concretising the subject and information on how the programme has been structured to help the doctoral student reach the targets.

**Degree of Doctor**

<p><b>Objectives based on the Higher Education Ordinance, Annex 2 – Qualifications Ordinance</b></p> <p><i>For a Degree of Doctor, the doctoral student must</i></p>	<p><b>Concretisation and adaptation of targets to the third-cycle subject area</b></p>	<p><b>Programme elements that promote goal attainment</b></p>
<p><i>demonstrate broad knowledge in and a systematic understanding of the field of research and deep and up-to-date specialist knowledge in a delimited part of the field of research</i></p>	<p>demonstrate broad knowledge in and a systematic understanding of the field of research and deep and up-to-date specialist knowledge in a delimited part of the field of research</p>	<p>Compulsory and elective subject courses.</p>
<p><i>demonstrate familiarity with scientific methodology in general and with the methods of the specific research area in particular.</i></p>	<p>demonstrate familiarity with scientific methodology in general and commonly used methods within the field of Industrial Engineering and Management in particular</p>	<p>Compulsory and elective methodology courses.</p>
<p><i>demonstrate skills in scientific analysis and synthesis and ability to independently and critically consider and assess new and complex phenomena, questions and situations,</i></p>	<p>demonstrate skills in scientific analysis and synthesis and ability to independently and critically consider and assess new and complex phenomena, questions and situations</p>	<p>Compulsory and elective methodology courses.</p>
<p><i>demonstrate an ability to critically, independently, creatively and with scientific meticulousness identify and formulate questions as well as plan and conduct research and other qualified tasks using adequate methods within given</i></p>	<p>demonstrate an ability to critically, independently, creatively and with scientific meticulousness identify and formulate questions as well as plan</p>	<p>Compulsory and elective courses on research methodology.</p>

General syllabus for Industrial Engineering and Management

<p><b>Objectives based on the Higher Education Ordinance, Annex 2 – Qualifications Ordinance</b></p> <p><i>For a Degree of Doctor, the doctoral student must</i></p>	<p><b>Concretisation and adaptation of targets to the third-cycle subject area</b></p>	<p><b>Programme elements that promote goal attainment</b></p>
<p><i>time frames and review and evaluate such work</i></p>	<p>and conduct research and other qualified tasks using adequate methods within given time frames and review and evaluate such work</p>	
<p><i>write a thesis to demonstrate their ability to make significant contributions to knowledge development through their own research</i></p>	<p>write a thesis to demonstrate the ability to make essential contributions through their research to the knowledge development within the field of industrial engineering and management.</p>	<p>Approved thesis following examination by public defence.</p>
<p><i>demonstrate ability in both national and international contexts, verbally and in writing, to confidently present and discuss research and research findings in dialogue with the scientific community and society in general.</i></p>	<p>demonstrate ability in both national and international contexts, verbally and in writing, to confidently present and discuss research and research findings in dialogue with the scientific community and society in general.</p>	<p>Gradual processing of the thesis project through compulsory seminars. Doctoral students with departmental duties are also expected to present and discuss research at international conferences.</p>
<p><i>demonstrate ability to identify needs for further knowledge</i></p>	<p>demonstrate ability to identify needs for further knowledge</p>	<p>Elective subject courses.</p>
<p><i>demonstrate ability, both in research and education and in other qualified professional contexts, to contribute to society's development and support the learning of others.</i></p>	<p>demonstrate ability, both in research and education and in other qualified professional contexts, to contribute to society's development and support the learning</p>	<p>Elective courses in higher education teaching. Knowledge transfer to industrial partners. Writing popular science articles in relevant national and international journals.</p>

General syllabus for Industrial Engineering and Management

<p><b>Objectives based on the Higher Education Ordinance, Annex 2 – Qualifications Ordinance</b></p> <p><i>For a Degree of Doctor, the doctoral student must</i></p>	<p><b>Concretisation and adaptation of targets to the third-cycle subject area</b></p>	<p><b>Programme elements that promote goal attainment</b></p>
	<p>of others.</p>	
<p><i>demonstrate intellectual independence and scientific integrity as well as the ability to make ethical research assessments</i></p>	<p>The third-cycle student’s own contributions must be clearly outlined in the thesis along with research ethical considerations.</p>	<p>Compulsory third-cycle courses will highlight the importance of intellectual independence, scientific integrity and research ethical considerations.</p>
<p><i>demonstrate a profound insight into the possibilities and limitations of the discipline, its societal role and the responsibility people bear for how it is used</i></p>	<p>Seminar activities in conjunction with our research are used to hold a dialogue on the various roles of science.</p>	<p>Voluntary participation in seminar activities</p>
<p><i>(KTH’s objectives for MHU) demonstrate knowledge of, and an ability to make relevant environmental and ethical assessments in order to be able to contribute to sustainable societal development.</i></p>	<p>Demonstrate knowledge of, and an ability to make relevant environmental and ethical assessments in order to be able to contribute to sustainable societal development</p>	<p>Compulsory and elective methodology courses.</p>

**Degree of Licentiate**

<p><b>Objectives based on the Higher Education Ordinance, Annex 2 – Qualifications Ordinance</b></p> <p><i>For a Degree of Licentiate, the doctoral student must</i></p>	<p><b>Concretisation and adaptation of targets to the third-cycle subject area</b></p>	<p><b>Programme elements that promote goal attainment</b></p>
<p><i>demonstrate knowledge and understanding within the research field, including current specialist knowledge within a part thereof, as well as advanced knowledge of general scientific methods and the methods of the specific research field in particular</i></p>	<p>demonstrate knowledge and understanding in the field of industrial engineering and management, including current specialist knowledge within a defined part thereof, and advanced knowledge of scientific methodology in general and the methods of the field Industrial Engineering and Management in particular.</p>	<p>Compulsory and elective methodology courses.</p>
<p><i>demonstrate ability to critically, independently, creatively and with scientific meticulousness identify and formulate questions as well as plan and conduct limited research and other qualified tasks using adequate methods within given time frames, thereby contributing to knowledge development, and review and evaluate such work.</i></p>	<p>demonstrate the ability to critically, independently, creatively and with scientific meticulousness identify and formulate questions as well as plan and conduct limited research and other qualified tasks using adequate methods within given time frames, thereby contributing to knowledge development, and review and evaluate such work.</p>	<p>Compulsory and elective methodology courses. Examination through licentiate dissertation.</p>
<p><i>demonstrate ability in both national and international contexts, verbally and in writing, to clearly present and discuss research and research findings in dialogue with the scientific community and</i></p>	<p>demonstrate ability in both national and international contexts, verbally and in writing, to clearly present and discuss research and</p>	<p>Gradual processing of the thesis project through seminars. Departmental duties where applicable. Doctoral students with departmental duties are also expected to present and discuss research at</p>

General syllabus for Industrial Engineering and Management

<p><b>Objectives based on the Higher Education Ordinance, Annex 2 – Qualifications Ordinance</b></p> <p><i>For a Degree of Licentiate, the doctoral student must</i></p>	<p><b>Concretisation and adaptation of targets to the third-cycle subject area</b></p>	<p><b>Programme elements that promote goal attainment</b></p>
<p><i>society in general.</i></p>	<p>research findings in dialogue with the scientific community and society in general.</p>	<p>international conferences.</p>
<p><i>demonstrate such skills as are required to independently participate in research and development work and to work independently in other qualified activities</i></p>	<p>demonstrate such skills as are required to independently participate in research and development work and to work independently in other qualified activities</p>	<p>Compulsory and elective methodology courses.</p>
<p><i>demonstrate the ability to make research ethical assessments in their own research.</i></p>	<p>demonstrate the ability to make research ethical assessments in their own research.</p>	<p>Compulsory and elective methodology courses.</p>
<p><i>demonstrate an insight into the possibilities and limitations of the discipline, its role in society and the responsibility people bear for how it is used</i></p>	<p>demonstrate an insight into the possibilities and limitations of the discipline, its role in society and the responsibility people bear for how it is used</p>	<p>Compulsory and elective methodology courses.</p>
<p><i>demonstrate the ability to identify their need for further knowledge and to take responsibility for their own knowledge acquisition.</i></p>	<p>demonstrate the ability to identify their need for further knowledge and to take responsibility for their own knowledge acquisition.</p>	<p>Elective third-cycle courses. Examination through licentiate dissertation.</p>
<p><i>(KTH's objectives for MHU) demonstrate knowledge of, and an ability to make relevant environmental and ethical assessments in order to be able to contribute to sustainable</i></p>	<p>Demonstrate knowledge of, and an ability to make relevant environmental and ethical assessments in order to be able to contribute to sustainable societal development</p>	<p>Compulsory and elective methodology courses.</p>

General syllabus for Industrial Engineering and Management

<b>Objectives based on the Higher Education Ordinance, Annex 2 – Qualifications Ordinance</b>  <i>For a Degree of Licentiate, the doctoral student must</i>	<b>Concretisation and adaptation of targets to the third-cycle subject area</b>	<b>Programme elements that promote goal attainment</b>
<i>societal development</i>		