

Doctoral Curriculum

Curriculum for Doctoral Studies in Chemical Engineering at Karlstad University.

Approved by the Faculty Board for the Faculty of Science and Technology on 11/06/2008, Reg.no. FAK2 2008/91.

Curriculum Approval

This document replaces the curriculum that was approved by the Faculty council on 23/11/1998 and revised by the Faculty Board on 4/10/2000 and on 7/12/2001. The PhD programme is offered to the extent permitted by available funding. General stipulations for PhD programmes are provided in the *Higher Education Act* and in the *Higher Education Ordinance*.

1. General Information

Research in Chemical Engineering at the university comprises studies of chemical engineering design, pulp technology, paper technology, surface treatment technology and graphical technology with a special focus on the pulp and paper industry. It is conducted with a multidisciplinary approach and often in co-operation with partners at Karlstad University, other universities, research institutes as well as with organisations in the local vicinity. Good regional collaboration with public authorities, as well as within industry, should also be mentioned. A large proportion of the projects conducted involve international partners.

Chemical Engineering is, in many ways, an applied field of research whereby research questions arising from the needs of society at large are investigated. The methods employed range from fundamental and theoretical to much more applied and experimental approaches. It is based on the different competences that the research activities engage, which come from several different disciplines. Besides Chemical Engineering, research activities involve skills and knowledge from the fields of Mechanical Engineering, Materials Engineering, Mathematics, Biochemistry, Physics and Energy and Environmental Systems.

Furthermore, research has been established by a high degree of national collaboration, e.g. in national projects, the appointment of industrial Ph.D. students, in research colleges and participation in several international projects that involve international students.

The areas of research for pulp technology are cellulose chemistry, process and environmental engineering and fibre chemistry/fibre physics/packaging. Paper

technology focuses on strong papers, validity and origin marking, runnability/web mechanics and tissue, whilst surface treatment technology deals with the areas of coating process technology, surface treatment for improved printing and barrier properties and the mechanical properties of paper surfaces. Graphical technology concentrates on the interaction between the surface treatment of the paper and its printing properties for both packaging printing and functional printing.

Aspects of multiplicity and equal treatment are taken into account in doctoral studies, in accordance with Karlstad University's equal opportunities policy. Doctoral students shall also gain insight into multidisciplinary working methods and experience meetings in which traditional interdisciplinary borders are crossed. In order to maintain this policy and reach the goals set, the Chemical Engineering department works conscientiously when recruiting new co-workers, ensures the ongoing further education of supervisors and widens interdisciplinary collaboration.

2. Aims and Objectives

The general objectives of licentiate or doctoral studies in terms of knowledge and understanding, skills and abilities, and judgement and approach are specified as follows in the *Higher Education Ordinance, attachment 2, SFS 2006:1053*):

Knowledge and understanding

For a degree of Licentiate research students must

- demonstrate knowledge and understanding in the field of research, including current specialist knowledge in a defined part of the field and a deeper knowledge of scientific methods in general and of methods in the specific field of research in particular.

For a degree of Doctor research students must

- demonstrate broad knowledge in and systematic understanding of the field of research, together with deep and up-to-date specialist knowledge in a defined part of the field of research; and
- demonstrate familiarity with scholarly methods in general and with methods in the specific field of research in particular.

Skills and abilities

For a degree of Licentiate research students must

- demonstrate an ability to identify and formulate issues, critically, independently and creatively, and proceeding with scientific precision; to plan a limited research project and other advanced tasks and to carry them out using appropriate methods within specified time limits, so as to contribute to the development of knowledge; and to evaluate this work;
- demonstrate an ability to clearly present and discuss research and research results in dialogue with the scholarly community and society in general, orally and in writing, in both national and international contexts; and
- demonstrate the skills required to independently participate in research and development work and to work independently in other advanced contexts.

For a degree of Doctor research students must

- demonstrate an ability to engage in scholarly analysis and synthesis and in independent, critical examination and assessment of new and complex phenomena, issues and situations;
- demonstrate an ability to identify and formulate issues, critically, independently and creatively, and proceeding with scientific precision, and to plan and, using appropriate methods, conduct research and other advanced tasks within specified time limits, and to scrutinise and evaluate such work;
- demonstrate, in a dissertation, their ability to make a substantial contribution to the development of knowledge by their own research;
- demonstrate an ability to present and discuss research and research results with authority, in dialogue with the scholarly community and society in general, orally and in writing, in both national and international contexts;
- demonstrate an ability to identify their need of further knowledge; and
- demonstrate a potential to contribute to the development of society and support other people's learning, both in the field of research and education and in other advanced professional contexts.

Judgement and approach

For a degree of Licentiate research students must

- demonstrate an ability to make ethical assessments in their own research;
- demonstrate insight into the possibilities and limitations of science, its role in society and people's responsibility for how it is used; and
- demonstrate an ability to identify their need of further knowledge and to take responsibility for developing their knowledge.

For a degree of Doctor research students must

- demonstrate intellectual independence and scholarly integrity and an ability to make ethical assessments relating to research; and
- demonstrate deeper insight into the potential and limitations of scholarship, its role in society and people's responsibility for how it is used.

Licentiate dissertation/doctoral dissertation

For a degree of Licentiate the research students must have received a pass grade on a scholarly dissertation of at least 60 ECTS credits.

For a degree of Doctor the research students must have received a pass grade on a doctoral dissertation of at least 120 ECTS credits.

Subject Specific Objectives

Doctoral candidates in Chemical Engineering should assimilate this post graduate education in such a way that:

- the student's knowledge reflect society's demands for individuals trained in the use of scientific methods (in accordance with the goals above) and with specialist skills within Chemical Engineering with particular focus placed on pulp technology, paper technology, surface treatment technology and graphical technology.
- the student completes a licentiate thesis and/or a doctoral dissertation, the contents and results of which are of such quality that they would be accepted for publication in internationally-recognized scientific journals and thereby open doors to the international scientific community.
- the student creates a personal network in the scientific community and with other organizations in society at large.
- the student develops his/her ability to plan and conduct research projects independently, fulfilling qualitative, leadership and organizational requirements. The doctoral studies thereby develop the competency of the student in a way that is attractive to society.

3. Admission Requirements

The requirements for admission to doctoral studies are that the applicant meets the general admission requirements as well as the specific admission requirements and is judged to have the ability otherwise required successfully to pursue the programme. (*Higher Education Ordinance, Ch.7*)

3.1 General eligibility

A person who has earned a master's degree of at least 240 credits of which at least 60 credits are studies at master's level, or who in some other way in the country or abroad has acquired largely equivalent knowledge has general eligibility for admission. If there are special reasons for doing so, the faculty board may grant an individual applicant exemption from the general eligibility. (*Higher Education Ordinance, Ch.6*)

3.2. Special eligibility

Qualifications to be accepted for doctoral studies in Chemical Engineering.

A person is deemed to possess the necessary competence for doctoral studies in Chemical Engineering if one of the following requirements is fulfilled:

- 120 ECTS credits in Chemical Engineering or another subject area that is relevant to the project
- a degree in Chemical Engineering or another subject area that is relevant to the project
- qualifications equivalent to the above.

3.3. Transitional Provisions

Students who met the general admission requirements for admission to doctoral studies before 1 July 2007 shall be considered generally eligible for admission to the doctoral level until 30 June 2015.

4. Admission Procedure

Applications for admission to doctoral studies are processed in accordance with the procedures prescribed by the Board of Karlstad University.

5. Selection

Candidates will be selected on the basis of their assessed capacity to successfully complete the programme.

6. Content and Outline

The doctoral programme can lead to a doctoral or licentiate degree. The doctoral degree requires four years of study, the equivalent of 240 credits, and the licentiate degree two years or 120 credits. The studies include course work as well as independent thesis work. To earn a doctoral degree, the candidate must complete 60 credits of course work. To earn a licentiate degree, the candidate is required to complete 30 credits of course work. Doctoral students in Chemical Engineering will be encouraged to take part in conferences, symposia and workshops, preferably international, in order to get to know the traditions of the scientific society and to form a network of their own.

6.1 Courses

General courses:

Mandatory courses for all doctoral students at Karlstad University must be included in the programme to the extent required by local regulations.

The course “The History and Philosophy of Science”, 7.5 credits, is mandatory for the licentiate degree.

The courses “The History and Philosophy of Science”, 7.5 credits, and “Communicating Science”, 4.5 credits, are mandatory for the doctoral degree.

Subject Specific Courses:

Doctoral students in Chemical Engineering are encouraged to participate in courses that are arranged by Karlstad University as well as by external educational networks.

Seminars

A seminar series, in the form of a course, is arranged at the department of Chemical Engineering. Doctoral students at the department are expected to participate.

6.2 Doctoral and Licentiate Dissertations

Doctoral students are required to write a dissertation for a doctoral or a licentiate degree, either as a monograph or as a unified collection of previously published papers.

Candidates are required to defend their licentiate dissertation at a seminar and their doctoral dissertation at a public examination. Further information is provided by the

policy documents “Doctoral Dissertation Requirements” and “Licentiate Dissertation Requirements”.

6.3 Supervision

Doctoral students are entitled to advisors in accordance with the principles stated in the current policy document.

6.4 Individual Study Plan

Each doctoral student must draw up an individual study plan in conjunction with the advisors. The plan should include a realistic estimate of time for course work, thesis work and supervision as well as an introduction to the proposed research field, problem, aim, methodological and theoretical frames, and relevant ethical considerations. The individual study plan is subject to continual revision (at least twice a year).

6.5 Examination

Doctoral students are examined in accordance with the requirements of each respective course syllabus. Doctoral or licentiate dissertations are examined in accordance with the *Higher Education Ordinance* (Ch.6, §§ 40-47) and Karlstad University’s current policy document.