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LUND UNIVERSITY
Faculty of Science

Faculty Board

General Syllabus for Third-Cycle Studies in Chemistry

Specialisation in Analytical Chemistry, NAKEMAK1

Specialisation in Biochemistry, NAKEMBK1

Specialisation in Physical Chemistry, NAKEMFK1

Specialisation in Chemical Physics, NAKEMKF1

Specialisation in Molecular Biophysics, NAKEMMB1

Specialisation in Inorganic Chemistry, NAKEMOO1

Specialisation in Organic Chemistry, NAKEMOR1

Specialisation in Theoretical Chemistry, NAKEMTK1

This is a translation of the general syllabus approved in Swedish.

This syllabus was approved by the Board of the Faculty of Science on 30 May 2007 and most recently amended by the Faculty Board 18 December 2013. The syllabus, including amendments, applies to third-cycle students admitted from 1 July 2007.

The syllabus is based on the Higher Education Ordinance (1993:100) Chapter 6 Sections 1–11, 25–36, Chapter 7 Sections 34–41 and Annex 2 Qualifications Ordinance.

1. Available degrees

The programme described in this syllabus can lead to one of the following degrees:

Doctor of Philosophy in Chemistry with one of the above-mentioned specialisations
Licentiate of Philosophy in Chemistry with one of the above-mentioned specialisations

In consultation with the Faculty of Engineering/LTH, the Faculty Board has decided (NA35 643/2005) that students admitted to third-cycle studies at the Faculty of Science on the basis of an MSc in Engineering shall be entitled to be awarded the degrees of Doctor of Philosophy in Science or Licentiate of Science without special application.

2. Subject description

Research in Chemistry deals with molecules and molecular processes. The third-cycle programme includes eight different specialisations. The current research areas are described on the departmental website.

Specialisation in Analytical Chemistry (NAKEMAK1)
Analytical Chemistry comprises research in modern aspects of analytical methodology. An important approach is to combine classical analytical techniques with biological and biochemical tools. Another important orientation is to develop effective solvent-free extraction methods for preparation of samples and sampling. The research also includes applications within areas such as biotechnology, medicine and environmental science.

Specialisation in Biochemistry (NAKEMBK1)
Biochemistry research aims to describe the structure, organisation and function of organic matter in molecular terms. The studies conducted deal with the structure, interaction and function of proteins, nucleic acids and other biomolecules. The development of methods to purify and study biologically significant molecules is also included in the discipline.

Specialisation in Physical Chemistry (NAKEMFK1)
Physical Chemistry comprises research on molecular issues. The experimental and theoretical methods used are often based in physics. The specialisation is focused on experimental and theoretical research of surface and colloid chemistry with an emphasis on self-aggregation systems. Among the systems studied are surfactants, polymers and biomolecules.

Specialisation in Chemical Physics (NAKEMKF1)
Femtochemistry and Femtobiology. Light-induced processes in biomolecules, organic polymers and semiconductor materials. The mechanisms of elementary reactions. The physics and chemistry of solid surfaces, experiments and calculations in quantum chemistry. Conventional and synchrotron-based spectroscopy. Intermolecular vibrations in molecular complexes and molecule-radical complexes. Computational chemistry (quantum chemistry, molecular dynamics, density matrix theory) for chemical and biological processes and reaction intermediates.

Specialisation in Molecular Biophysics (NAKEMMB1)
Molecular Biophysics includes studies of the structure, dynamics and function of proteins and nucleic acids by means of physical methods. The division primarily focuses on the use of X-ray crystallography and cryo-electron microscopy to determine the structure of proteins and study their interaction with other molecules. The main focus is on enzymes and enzyme families. Among the enquiries within this area are structural analyses of mutated proteins and the complex interaction between receptors and drugs.

Specialisation in Inorganic Chemistry (NAKEMOO1)
The coordination chemistry of metals is the main research area within Inorganic Chemistry. The discipline is essentially interdisciplinary, including other science subjects as well as medicine and engineering. Metal complexes are part of many

vital biological processes and are active in the circulation of metals in nature and as catalysts and drugs etc.

Specialisation in Organic Chemistry (NAKEMOR1)

Organic Chemistry is generally focused on the synthesis and structure of organic compounds and their properties such as reactivity. This focus is manifested in the development of new methods and strategies to generate both molecular and supra-molecular complexity, often in a context of medical, biological and physical application, and in the use of physical-chemical methods to study the structures and properties of molecules and systems. The subjects of the discipline include syntheses of complex organic compounds, method development, asymmetrical syntheses, natural product chemistry, chemical biology, catalysis, molecular self-organisation and recognition, nanochemistry and molecular photopigments.

Specialisation in Theoretical Chemistry (NAKEMTK1)

Research in Theoretical Chemistry entails developing quantum-mechanical and statistical-mechanical methods for the description of chemical systems and processes. The methods are employed to solve or highlight issues primarily within surface chemistry and polymer chemistry, biochemistry, intermolecular exchange and spectroscopy.

3. Objectives

Third-cycle courses and study programmes shall be based fundamentally on the knowledge acquired by students in first- and second-cycle courses and study programmes, or its equivalent. In addition to the requirements for first- and second-cycle courses and study programmes, third-cycle courses and study programmes shall develop the knowledge and skills required to be able to undertake autonomous research. It is desirable that the doctoral student is enabled to acquire teaching experience.

The general outcomes for third-cycle courses and study programmes are defined in the Higher Education Ordinance Annex 2 Qualifications Ordinance.

3.1. Outcomes for a degree of Doctor

Knowledge and understanding

For the degree of Doctor the third-cycle student shall

– demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialised knowledge in a limited area of this field, and

– demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For the degree of Doctor the third-cycle student shall

– demonstrate the capacity for scholarly analysis and synthesis as well as 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

– demonstrate through a thesis the ability to make a significant contribution to the formation of knowledge through his or her own research

– demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and society in general

– demonstrate the ability to identify the need for further knowledge and

– demonstrate the capacity to contribute to social development and support the learning of others both through research and education and in some other qualified professional capacity.

Judgement and approach

For the degree of Doctor the third-cycle student shall

– demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics, and

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

3.2. Outcomes for a degree of Licentiate

Knowledge and understanding

For a Degree of Licentiate the third-cycle student shall

– demonstrate knowledge and understanding in the field of research including current specialist knowledge in a limited area of this field as well as specialised knowledge of research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For a Degree of Licentiate the third-cycle student shall have:

– demonstrate the ability to identify and formulate issues with scholarly precision critically, autonomously and creatively, and to plan and use appropriate methods to undertake a limited piece of research and other qualified tasks within predetermined time frames in order to contribute to the formation of knowledge as well as to evaluate this work

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

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

Judgement and approach

For a Degree of Licentiate the third-cycle student shall

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

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

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

4. Admission requirements

The requirements for admission to third-cycle courses and study programmes are that the applicant meets the general and specific entry requirements that the higher education institution may have laid down, and is considered in other respects to have the ability required to benefit from the course or study programme.

General admission requirements

A person meets the general entry requirements for third-cycle courses and study programmes if he or she:

1. has been awarded a second-cycle qualification, or

2. has satisfied the requirements for courses comprising at least 240 credits of which at least 60 credits were awarded in the second cycle, or

3. has acquired substantially equivalent knowledge in some other way in Sweden or abroad.

The head of department may permit an exemption from the general entry requirements for an individual applicant, if there are special grounds.

Transitional provision: Those who meet the general admission requirements for doctoral programmes before 1 July 2007 will also be considered to meet the general admission requirements for third-cycle courses and study programmes until the end of June 2015.

If a specific number of credits or a qualification from previous first- or second-cycle courses and study programmes are required for admission to third-cycle courses and study programmes, those with corresponding credits or qualifications from undergraduate programmes awarded before 1 July 2007 will also be eligible.

Specific admission requirements

To be admitted to the third-cycle programme in Chemistry the student must have at least 120 credits from courses in Chemistry including a second-cycle degree project of at least 30 credits in the selected specialisation or an associated specialisation.

In certain cases, courses in subjects other than chemistry can be accepted. For the specialisation in chemical physics, for example, 90 credits in physics will accepted and for the specialisation in theoretical chemistry 60 credits in physics and 60 credits in mathematics.

Some specialisations have specific admission requirements in addition to the standard ones listed above:

Molecular Biophysics: a basic course in biochemistry or cell biology.

Equivalent knowledge acquired through corresponding programmes will be assessed individually.

5. Selection

In selecting between applicants who meet the requirements, their ability to benefit from the course or study programme shall be taken into account. However, the fact that an applicant is considered able to transfer credits from prior courses and study programmes or for professional or vocational experience may not alone give the applicant priority over other applicants.

The following selection criteria will be applied:

Study record from undergraduate and Master's courses or the equivalent. The breadth, depth and relevance of undergraduate and Master's courses or the equivalent. The quality of the degree project and other independent work.

Other knowledge and skills of relevance to the research specialisation.

Suitable candidates should be called to an interview, if possible.

The recruitment and selection to third-cycle studies must always take diversity and gender balance into account, in compliance with the Lund University gender equality policy, equal opportunities policy and diversity plan. The underrepresented gender should always be given precedence in cases of equal qualifications, unless there are valid reasons to the contrary.

Furthermore, it must be possible for the department to offer expert supervision in the student's research specialisation.

6. Degree requirements

The completion of the third cycle programme results in a degree of Doctor of Philosophy or, if the student so wishes or if this is stated in the admission decision, a degree of Licentiate. The student may also but is not obliged to complete a degree of Licentiate as a stage in the third-cycle programme.

The degree of Doctor comprises 240 credits and the degree of Licentiate 120 credits.

For a degree of Doctor or Licentiate the research student must have successfully completed a PhD or Licentiate thesis and passed all courses and other components specified below. The head of department (or person to whom the task has been delegated) is to check and determine if all the formal requirements of a degree of Doctor or Licentiate have been satisfied.

6.1. Thesis

The programme is to include a research project documented in a PhD or Licentiate thesis. The thesis is to be defended orally at a public defence and reviewed by a faculty examiner (opponent).

PhD thesis

The PhD thesis is to comprise at least 180 credits. Within Theoretical Chemistry the PhD thesis may comprise at least 150 credits.

The PhD thesis can be designed as *compilation thesis* or as a *monograph*.

A compilation thesis consists of copies of a number of research articles or manuscripts and a summarising chapter. The articles may be written by the doctoral student individually or in cooperation with others, but the summarising chapter must be written individually by the doctoral student. The research articles must be of a quality required for publication in recognised peer-reviewed journals and it must be possible to determine the contributions of different authors. The summarising chapter is to consist of an introduction to the research area of the thesis and a presentation and discussion of the findings of the articles. The presentation and discussion shall be written in a form and style that is independent and different from the articles. This makes it possible to situate the findings in a wider context.

A monograph thesis is a unified report including descriptions of the research issue, research questions, methods, analysis, findings and discussion.

Licentiate thesis

The Licentiate thesis is to comprise at least 90 credits.

The Licentiate thesis can be designed as a summary of at least one research article (or manuscript), written by the student individually or in cooperation with others, or a unified research report (monograph). The thesis must be of a quality required for publication in recognised peer-reviewed journals and it must be possible to determine the contributions of different authors. For more information on summary and monograph theses, please see compilation thesis and monograph thesis above.

6.2. Courses and other programme components

The courses and other components of the third-cycle programme in Chemistry are to comprise 45–60 credits for a degree of Doctor and 10–30 credits for a degree of Licentiate, with the exception of Theoretical Chemistry where courses and other components are to amount to 45–90 credits for a degree of Doctor. The exact number of credits required in addition to the credits for the thesis is to be specified in the individual study plan. Courses specific to the relevant specialisation are to comprise 30 third-cycle credits or the equivalent.

The required courses and other components can be offered at Lund University or at other higher education institutions. The head of department (or person to whom the task has been delegated) determines the number of credits that can be transferred

from courses and other components offered at other faculties or higher education institutions.

The following courses are compulsory: Introductory course to research studies of at least 1.5 credits, of which 0.5 credits is for all doctoral students at the Faculty of Science. For students admitted from 1 January 2009 the courses Work Environment, Environmental Considerations and Risks (2 credits) and Research Ethics for Chemists (2 credits) or their equivalent are compulsory. Doctoral students who teach need to pass Introduction to Teaching Methods (3 credits).