Description of the PhD Programme in Chemistry

Description of the Programme

Introduction:

The Department of Chemistry offers a PhD Programme for students with an academic background from Natural Sciences or Technology. It is recommended to find a project within the supervisor's area of research. The Project will be a result of the supervisor's subject area and the candidate's preferences, possibly in collaboration with other institutions or companies in Norway or Internationally. The PhD Candidate will be included in a Research Group within the Department.

Learning objectives:

The PhD education programme in Chemistry has the objective of training candidates to be independent researchers who can work at an international level in cooperation with Norwegian and international research groups through

- the approved academic training plan
- the conducting of research
- dissemination, especially scientific and academic, but also as popular science in addition to the PhD Thesis

The PhD education programme has the objective of meeting the current and future requirements for research, development, supervision and dissemination within universities, other public institutions, private-sector institutions, enterprises and organizations.

Subject areas:

The Department of Chemistry offers PhD studies within all of its areas of research, often requiring collaboration with other departments:

- Organic Chemistry
- Physical Chemistry
- Environmental and Analytical Chemistry
- Chemistry Education and Dissemination

Organic Chemistry

Research within organic chemistry:

- New reactions and methods
- Metal catalysis in organic reactions
- Heterocyclic chemistry
- Total synthesis
- Synthesis of enantiomeric fine chemicals and pharmaceuticals
- Synthesis of fluorinated bioactive molecules
- Self- assembled synthesis, supramolecular synthesis
- Polymer chemistry (conductive polymers)
- Reactions in membranes

www.ntnu.edu/chemistry/organic

Physical Chemistry

The physical chemistry group performs research within the following areas:

1. Non-equilibrium thermodynamics and molecular dynamics simulations
A thesis in this field has often as the overall aim to add to the understanding of energy conversion, on a molecular level, as well as on a macroscopic process level. To reach this aim, we do experiments, theory and computer simulations. At present we study interface transport phenomena, fuel cells, reactormodels and biological systems. The course KJ8208 “Advanced Irreversible Thermodynamics” is obligatory within this field.

2. Chemometrics
The field focuses on the use and development of data analtytical methods in order to extract relevant and reliable information from measured data. Multivariate statistical methods are of central importance. The activity focuses on: Quantitative structure-activity/property relationships (QSAR/QSPR), de novo generation of molecular structures using artificial evolution, systems biology and chemical image analysis. The course KJ8200 "Chemical Image Analysis" is obligatory for this special field.

3. Quantum chemistry
The overall aim of research within this field is to develop theoretical models for description of spectroscopy, catalysis, pharmaceutical development and nanotechnology. The activity focus on: Electron correlation and modern quantum chemical methods, molecular electrical and magnetic properties, intermolecular interactions. One of the subjects KJ8205 "Molecular modelling" or KJ8206 "Advanced quantum chemical methods" are obligatory within this field.

4. Structure chemistry
Determination of the molecular structure/conformation (electron diffraction/theoretical calculations), spectroscopy (NMR – vibrational spectroscopy)

http://www.ntnu.edu/chemistry/physical

Environmental and Analytical Chemistry

Research activity within the group of Environmental- and Analytical Chemistry:

- occurrence, transport/mobility, exchange mechanisms and bioavailability of metals, organic environmental poisons, and other substance in the environment (air, water, soil, and food chain), and development of analytical methods for this purpose
- remote monitoring of important chemical elements and compounds in the nature and industry (environmental and industry surveillance)
- pollution from local discharge to global dispersion
- quality assurance of environmental data and analytical methods
- role of trace elements in medicine and biology
- functional materials and surface chemistry for sensor development and transport/mobility, exchange mechanisms studies
- sensors base don nanotechnology and bio electronics
- methods for trace elemental detection
- marine chemistry
- environmental research in the Arctic Zone

www.ntnu.edu/chemistry/evirchem

Chemistry Education and Dissemination

In chemistry education one studies chemistry from an overall perspective, as a research discipline, as a teaching subject, and as a subject for dissemination in a historical and societal context. Research projects may focus on experimental, empirical or theoretical aspects of chemistry in an educational perspective.

Some areas of interest for investigation at the Department of Chemistry at NTNU:

Experimental studies:
- Studies and development of experiments for the teaching of chemistry
- Bridging Chemistry and Art: Identification of chemical components of art objects in a contextual frame
- Reconstruction of historical experiments, particular iconic ones (see also studies in the history of chemistry below).

Empirical studies:
- Writing as a basic skill in chemistry

Studies in the history of chemistry:
- 19th and 20th century chemistry
- Chemical education in Norway
- Historical studies of textbooks in chemistry
- Women in chemistry
- Chemical instruments and collections

Students interested in chemistry education may be enrolled in the PhD programme in Science Education at the Faculty for Natural Sciences and Technology.

http://www.ntnu.edu/chemistry/education

§ 5 & 7.3 Admission

A master's degree in either the Natural Sciences or Technology within Chemistry qualifies for admission to a doctorate programme within Chemistry. The grade requirement for admission is B or better, and is calculated as the average of the last two years' study during the master studies. Applicants are also required to have an average grade of C or better on their bachelor's degree (or equivalent education).

§ 7.3 Organized academic training

The plan for the organized academic training must be elaborated in cooperation with the main supervisor and the Department according to the PhD Regulations. There are no obligatory courses for the PhD Programme in general, but some courses are obligatory within certain subject areas. If this is the case, it should be presented in the descriptions above.

PhD courses at the Department of Chemistry:

Course ID	Course	Semester	Credits
KJ8104	Nye metoder i organisk syntese *New Methods in Organic Synthesis*	H10	7,5
KJ8106	Avansert organisk kjemi *Advanced Organic Chemistry*	V11	7,5
KJ8200	Kjemisk billedbehandling *Chemical Image Analysis*	V11	7,5
KJ8204	Kvantitativ struktur-aktivitetsrelasjon *Quantitative Structure-Activity Relationships*	V11	7,5
KJ8205	Avansert Molekylmodellering *Advanced Molecular Modelling*	V11	7,5
KJ8206	Videregående kvantekjemiske metoder *Advanced Quantum Chemical Methods*	H10	7,5
KJ8208	Videregående irreversibel termodynamikk *Advanced Irreversible Thermodynamics*	V11	7,5
RFEL8093	Episoder fra naturvitenskapenes historie *Episodes from the History of Science*	H11	10,0

PhD/ master courses at the Department of Chemistry:

Course ID	Course	Semester	Credits
KJ8021	Stereokjemi og syntese av kirale stoffer *Stereochemistry and Synthesis of Chiral Compounds*	H	7,5
KJ8053	Analytiske metoder for industri- og miljøovervåking *Analytical Methods for Industrial and Environmental Monitoring*	H	7,5
KJ8056	Kjemiske og biologiske sensorer *Chemical and Sensors and Biosensors*	H	7,5
KJ8070	Videregående akvatisk kjemi *Advanced Aquatic Chemistry*	H	15,0
KJ8100	Organisk medisinsk og farmasøytisk kjemi *Organic Medicinal and Pharamaceutical Chemistry*	V	7,5
KJ8105	Organometalliske forbindelser i organisk syntese *Organometallic Compounds in Organic Synthesis*	V11	7,5
KJ8901	Enzymkjemi *Enzyme Chemistry*	V12	7,5
KJ8902	Molekylmodellering *Molecular Modelling*	H	7,5

V= Spring
H= Autumn