Translation of Curriculum Statement for Graduate Level (Third-level) Education

Engineering Sciences with specialization in Materials Science

Swedish title: Teknisk fysik med inriktning mot materialvetenskap

TNTEKF08

Swedish Curriculum adopted by the Board of the Faculty of Science and Technology (Board for Third-level Education) on 2008-08-26. Revised on 2020-01-15. Translation approved on 2010-09-03 and 2020-01-15.

The Curriculum Statement for Third-level Education consists of three parts: a general part, this subject-specific curriculum statement, and each doctoral student's individual study plan.

Objective

Supervision and thesis work will make the student well prepared to carry out independent scientific research. After the education, the student will be familiar with scientific questions and methods in materials science, and will have reached thorough knowledge within the specific area of the thesis. The student will be able to critically assess his/her own scientific work and that of others.

The doctoral student shall also be able to present her/his own goals and results orally and in writing to different target groups in English and, in the case of Swedish-speaking doctoral students, in Swedish.

Subject description

In materials science the physical and chemical basis of various materials in terms of their internal structure are studied, as well as the relationship between nano- and micro features and macro-mechanical properties. The research is a mix of theoretical and experimental approaches, containing both applied (e.g. tooling materials, electronic materials, biomaterials) and basic (e.g. studies of microstructure using electron
microscopy and atomic force microscopy, and theory for predicting mechanical properties of materials) elements. All types of materials are studied including: metals, ceramics, biomaterials, polymers, semiconductors and composites.

A large part of the research is spent on studying mechanical and thermal properties of materials. These areas are of applied character and the PhD students are often working in collaboration with industrial partners. A growing area is the use of nanotechnology within material development. International collaborations occur on a project basis.

Eligibility

Basic Eligibility
The basic eligibility for third level education is described in the general part of the curriculum statement.

Special Eligibility
Special eligibility is assigned to a candidate who has taken courses within all relevant areas in the subject with sufficient breadth and depth. Thus, a candidate is considered to have special eligibility if one of the following applies:

a) has obtained a Master’s degree in engineering (Swedish “Civilingenjörsexamen”) from a Swedish technical University/College and hence taken courses within the relevant areas of the subject
b) in a different way has gained knowledge principally to the same extent as in a), irrespective of the country of study

Admission
Applicants for the third level program in Engineering science with specialization in materials science must submit an application to the head of the Department of Materials Science and Engineering. Admission to third level programs normally takes place six times per year.

Upon admission to postgraduate education, the Swedish title of the degree is to be specified in the application. According to decision (TEKNAT 2012/215), postgraduate education in Engineering Sciences with specialization in Materials Science shall lead to a teknologie doktorsexamen. The English rendering will be a licentiate/doctorate degree of philosophy.
In connection with the admission it must be stated how the personal maintenance of the doctoral student as well as her/his research will be financed.

Program structure

In connection with the admission, each doctoral student and her/his supervisor shall write an individual study plan after consultation with the professor in charge of the third level program. The plan is to be approved by the head of the department (by delegation of the Faculty Board), in connection with the admission.

The individual study plan shall be reviewed jointly by the doctoral student and her/his supervisor, annually, and be provided with a summary of the achieved results and the plans for the coming year. Significant changes and any disagreement on the individual study plan shall be reported to the head of the department or, if deemed necessary, to the Board for Third-level Education.

Courses

Within the third level program there may be different kinds of courses, such as lectures, literature studies, practical training, field studies, etc. The courses should be divided into basic courses and special courses. Normally about half of the courses should be selected from the basic courses e.g.:

Microscopy and microanalysis
Metals and alloys
Polymers
Surfaces and surface properties
Deformation mechanisms
Ceramic materials
Semiconductors
Phase transformation and diffusion

Special courses can have a more specific direction towards the thesis work e.g.:
Image analysis
Tribology
Surface coatings
Fatigue
Nanostructured materials
Corrosion
Cutting
Other suitable courses are:
Materials Chemistry
Structural chemistry
Materials Selection
Innovation
Science history
FEM methods

In connection to the thesis work more specific studies of the literature is often needed.

A course in research ethics of at least 2 higher education credits is mandatory for licentiate and doctoral degree. A course in university educational theory is also mandatory for doctoral students who teach at basic and advanced level.

Students are also recommended to take courses in scientific writing and the introduction course to research studies.

**Requirements for doctoral degree**

The requirements for the doctoral degree consist of on the one hand passed examinations in the courses included in the approved individual study plan of each doctoral student, and on other hand passed public defense of the doctoral thesis. The program leading to the doctoral degree amounts to 240 higher education credits (four years of full-time studies), of which the thesis part amounts to a minimum of 120 higher education credits and the course part to a minimum of 50 higher education credits.

**Requirements for licentiate degree**

When at least 120 higher education credits (two years of full-time studies) in the third level program are completed, a licentiate degree may be awarded. The requirements for this are that the doctoral student has both passed the examinations included in the program and also had an academic paper amounting to a minimum of 60 higher education credits approved. The course part amounts to a minimum of 30 higher education credits.

**Other**

Research in Engineering science with specialization in materials science almost always involves collaborations across disciplinary boundaries, and also with partners within the industry. Good
interpersonal skills and an ability to obtain relevant knowledge from other disciplines are essential. The research’s industrial and technological relevance also requires a good ability to communicate scientific results so that users outside the university can assimilate the knowledge.

Further information can be obtained at http://www.teknik.uu.se/.