Translation of Subject Curriculum (Study Plan) for Third-cycle (PhD) Education

Engineering Sciences with specialization in Science of Electricity

Swedish title: Teknisk fysik med inriktning mot elektricitetslära

TNTEKF02

Swedish Curriculum adopted by the Board of the Faculty of Science and Technology (Board for Third-level Education) on 2008-11-12. 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 specialized 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 the field of electricity, 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 his pioneering work "Treatise on Electricity and Magnetism," James Clerk Maxwell provided the world with a mathematical treatment of electromagnetic fields and laid the foundations for the modern theory of electricity. These equations are fundamental to all generation, transmission, distribution and utilization of electromagnetic energy. Graduate education in engineering physics with specialization in electricity is designed to provide a deeper understanding of Maxwell's equations in theory as well as in practical application, i.e. from analytical theory and computer simulations.
through laboratory and full-scale experiments. Education and research in this field cover all aspects of electromagnetic energy on all time scales from direct current through microwaves, in particular generation, transmission, distribution, storage and utilization of electromagnetic energy, and causes of as well as solutions to problems originating from electromagnetic disturbances. Furthermore, the field covers deeper studies into the influence of electromagnetism on technical systems as well as on human beings, animals and the environment. The education is aimed at providing the students with the knowledge necessary to meet the requirements of modern society for dependable, environmentally friendly and cost effective electrical systems and their interconnections with surrounding technologies. System couplings and technological system understanding are important for comprehensive system understanding, and therefore the importance of the ability to handle coupled partial differential equations within electromagnetism as well as within fluid mechanics, hydro mechanics and aerodynamics is stressed. The research is aimed at engineering science in conventional as well as alternative technologies in order to create environmentally friendly and cost effective electrical energy systems, to protect electrical systems from transients and disturbances and to develop basic knowledge and technology. The field is immensely important for securing future electric energy supply and utilization, not only in Sweden but in the whole world.

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, special eligibility is considerer a candidate with one of the following:

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), irrespectively of the country of study
Admission

Applicants for third level program in Engineering science with specialization in electricity must submit an application to the head of the Department of Electrical Engineering. Admissions to places in third level programs take place normally 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 electricity shall lead to a filosofie doktorsexamen or teknologie doktorsexamen. The English rendering will in either case be a licentiate/doctorate degree of philosophy.

In connection with the admission it must be stated how it is planned to finance both the personal maintenance of the doctoral student, and her/his research.

Program structure

In connection with the admission, each doctoral student and her/his supervisor shall draw up 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 are intended to provide wider insight into the subject as a complement to the specialist competence acquired in the research work. The courses included in the individual study plan may partly be selected by the following courses:

Electromagnetic field theory or equivalent
Electric circuits I or equiv.
Power engineering or equiv.
Electrical machinery or equiv.
Wave power
Hydro power
Wind power
Structural mechanics/dynamics or equiv.
Solid mechanics
Fluid mechanics, hydro mechanics, aerodynamics or equiv.

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.

Particular courses may be directed towards the thesis work (advanced level or master level courses). They may also be selected from neighboring fields or be of a more general character (other courses).

Further literature studies within the subject/specialization are usually required in connection with the thesis work.

Requirements for doctoral degree
The requirements for doctoral degree consist of on 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 60 higher education credits.

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

Other
Energy is increasingly important for the modern society. Energy consumption and power generation are in focus for many companies and industries. New companies are being established in the field of
renewable energy. It is therefore anticipated that demand for highly educated people in engineering physics with specialization in electricity in Sweden and Europe will increase. Further information can be obtained from the Department of Electrical Engineering, http://www.teknik.uu.se/.