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UMEÅ UNIVERSITY

General syllabus for doctoral studies in Energy Technology

with doctoral degree as goal

Scope: 240 higher education credits (ECTS)
Degree: Doctoral degree
Study level: Third-cycle
Established by: General syllabus established by the Faculty of Science and Technology Board on 2025-09-25
Enters into force: 2025-10-01
Responsible body: Faculty of Science and Technology
Specializations: Thermal Process Chemistry, Energy Efficiency

This document has been translated from Swedish into English. If the English version differs from the original, the Swedish version takes precedence.

1. Subject description and delimitation

Energy Technology in the sense of this syllabus is the scientific field that studies resources, storage, and conversion of energy. Research in Energy Technology creates new knowledge about processes, systems, materials, or systems that address or rely on energy conversion, its limitations and possibilities, with the overall goal of developing renewable, efficient, and sustainable energy systems. The research area includes both fundamental and applied research. To obtain a doctoral degree in Energy Technology, the student must acquire broad expertise in the research subject and the methods and issues that drive the field forward, as well as deep knowledge in their area of specialization. This is demonstrated by the ability to conduct research that makes significant contributions to the field of Energy Technology.

Energy Efficiency focuses on processes and systems with the goal of minimizing energy use, considering other factors and conditions. This may concern buildings, construction processes, industrial processes, or other processes where there is potential to reduce energy use. The subject includes supply, distribution, and use of energy, as well as power control at various system levels. For example, in building energy efficiency, all parts of the life cycle are examined, from material production and construction, through building use with focus on ventilation, thermal comfort, and health in indoor environments, to distribution and reuse.

Thermal Process Chemistry investigates physical and chemical phenomena related to energy conversion in thermochemical processes. The research addresses areas such as resource and process efficiency, fuel choice, operational availability, emission reduction, resource recovery, as well as reactor design and material issues.

2. Objectives of the education

2.1 Description of education at the current level

The education is at third-cycle level. The goals for third-cycle education can be found in Chapter 1 of the Higher Education Act 9 a §.

2.2 National goals for the degree

The national goals for the degree can be found in the Higher Education Act.

The learning outcomes for the doctoral degree in Energy Technology are those specified by the Higher Education Ordinance, Chapter 6, Sections 4 and 5 (see Appendix A), where the terms *research field* and *limited area of this field* refer to Energy Technology (as defined above) and the doctoral student's specialization, respectively .

3. Entry requirements and prerequisites

To be admitted for studies at doctoral level the applicant is required to meet the general entry requirements and the specific entry requirements as described below, and be deemed to have the necessary ability to benefit from the education. (Higher Education Ordinance, Chapter 7, Section 35)

General entry requirements

To fulfil the general entry requirements, the applicant must have qualifications equivalent to either a completed degree at advanced level (second-cycle), or completed course requirements of at least 240 ECTS, including at least 60 ECTS at advanced level, or has otherwise acquired essentially equivalent knowledge within or outside Sweden. The faculty board may, in the case of a specific applicant, consent to an exemption from the general entry requirements if there are special reasons to do so. (Higher Education Ordinance, Chapter 7, Section 39)

Specific entry requirements

To fulfil the specific entry requirement to be admitted to doctoral education in Energy Technology, the applicant is required to have completed at least 120 ECTS in Energy Technology or in closely related subjects considered to be directly relevant for the specialization in question.

The requirements for prior knowledge as described above are also considered to be met by those who have otherwise acquired equivalent knowledge within or outside Sweden that can be verified.

4. Selection

Selection among applicants who meet the entry requirements will be made with consideration of their ability to benefit from doctoral education, and is based on the following assessment criteria:

- personal suitability
- previous study results
- written and oral ability
- ability for critical assessment and analytical skills
- other merits

However, applicants must not be given preference over other applicants in the selection process solely based on the assessment that the applicant can receive accreditation for previous education or professional activities. (Higher Education Ordinance, Chapter 7, Section 41)

Decisions regarding admissions to studies at doctoral level concluding in a doctoral degree are made in accordance with Umeå University's delegation of authority.

5. Content and structure

5.1 General

An individual study plan is to be established for each doctoral student, which shall give details of financing, supervision, courses, thesis-related work, etc. For a doctoral degree, the studies shall entail 240 higher education credits (ECTS). A doctoral student can, if desired, pursue a licentiate degree as an intermediate goal.

Doctoral education leading to a doctoral degree corresponds to four years of full-time study and consists of a course component of 60–90 ECTS and an academic thesis of 150–180 ECTS.

5.2 Content

The content of the program consists of a course component and the thesis work. The coursework is planned at admission to the education, and at the yearly follow-ups of the doctoral student's individual study plan.

The character of the education is highly international. Doctoral students participate in international collaborations and are expected to present their research results in international contexts.

5.2.1 Courses

The course component consists partly of compulsory courses and partly of a number of courses and other activities determined individually, with the aim that the doctoral student shall achieve the learning outcomes for doctoral education.

The compulsory courses provide generic skills, general scientific methodology, and integrate issues of gender equality and equal opportunities.

Mandatory courses developing general competence:

- Introduction for doctoral students at the Faculty of Science and Technology, 1 ECTS
- Science, Ethics, and Society, 4 ECTS credits
- Oral Presentation, 1 ECTS credit
- Writing Science, 5 ECTS

Additional mandatory courses for the individual doctoral student can be specified in the individual study plan at the point of admission.

Elective courses for doctoral degrees: Courses are chosen by the doctoral student in consultation with supervisors and should be largely adapted to the doctoral student's study specialization.

The remaining part of the course requirement is met by taking elective broadening and deepening courses in the subject of at least 30 ECTS, as well as courses that provide additional generic skills.

5.2.2 Doctoral thesis

The doctoral thesis may be presented either as a coherent and unified scientific work (*monograph thesis*) or as a compilation of scientific papers accompanied by an introduction, summary, and

discussion (*compilation thesis*). A compilation thesis must also include a description of the author's contribution to each paper.

The doctoral dissertation shall be defended orally as a public disputation and is assessed with one of the grades, *Pass* or *Fail*. The assessment takes into account both the content of the thesis and its oral defence.

6. Examination

A doctoral degree is awarded upon completion of doctoral studies equivalent to 240 higher education credits, provided that the applicant has received the grade *Pass* in all mandatory parts. In particular, this includes the public defense of the doctoral thesis and its approval by the grading committee. Degree certificates are issued following application to Student Services/Examina.

7. Other instructions

The provisions that apply in respect of doctoral studies can be found in:

- The Higher Education Ordinance: Chapter 5 Employment of doctoral students, Chapter 6 Courses and study programmes, and Chapter 7 Admission to courses and study programmes, Annex 2 Qualifications ordinance.
- Admission regulations for doctoral education at Umeå University.
- Local degree ordinance at Umeå University.
- Rules for doctoral education at Umeå University.
- Handbook for doctoral studies at the Faculty of Science and Technology at Umeå University.

Appendix A

Learning outcomes for the doctoral degree

(Higher Education Ordinance, Chapter 6, Sections 4 and 5)

Knowledge and understanding

For the doctoral degree, the doctoral student shall

- demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialized 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 doctoral degree, the doctoral student shall

- demonstrate the capacity for scholarly analysis and synthesis as well 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 dissertation the ability to make 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 in 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 doctoral degree, the doctoral student shall

- demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics, and
- demonstrate specialized insight into the possibilities and limitations of research, its role in society, and the responsibility of the individual for how this is used.