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This is a translation of the approved general syllabus that is written in Swedish

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General syllabus for doctoral studies in Innovations in energy and environment

Field and subject

Field

Innovation science denotes an area where knowledge and understanding of processes and dynamics around innovation are developed and thus support business and society. The focus is on the development of new products and services, new technology, new business models, the establishments of new markets, the emergence of new knowledge-intensive industries and other forms of renewal of societal functions. Innovation science is a field of research and teaching where knowledge from different subject traditions works together around the common phenomenon of innovation. Examples of subjects that deal with innovation science issues[1] are Business Administration, Industrial Organization, Engineering Sciences, History, Environmental Science, Health Science, Economic Geography, Economics, Political Science, and Sociology.

Innovation science is an applied research field where proximity to practice and empirical phenomena and events are of central importance for research and knowledge development. Innovations are seen from a broad perspective, including different types or forms of innovation (e.g., new products, services, processes, markets, and ways of organizing) that can vary in degree of novelty (e.g., from incremental to radical) and lead to different outcomes (e.g., from supportive to destructive) at different levels (e.g., organizational, industry, society).

In addition, sustainability has relevance to the research field. Sustainability has ecological, economic and social dimensions, and the subject relates to the global sustainability goals (2030 Agenda) ratified by the UN.

Subject description

The subject of Innovations in energy and environment is a cross-disciplinary subject within the field Innovation science, which builds on knowledge within engineering, natural science, and social science. The subject is defined as product and systems development within energy, construction, water, land, waste treatment etc., and concerns improved handling of resources to achieve a sustainable societal development.

[1]For an overview, see e.g Ávila-Robinson, A., Islam, N. Sengoku, S. (2022) Exploring the knowledgebase of innovation research: Towards an emerging innovation model, Technological Forecasting and Social Change, 182, https://doi.org/10.1016/j.techfore.2022.121804.

The subject has high societal relevance, where the research contributes to knowledge within novel energy and construction systems, as well as biological and environmental solutions. The research methodology covers experimental investigations, empirical case studies, modeling, statistical analysis and living labs. The research is generally reasonably close to a product or solution that is implementable on a local, national or internation level.

The research subject Innovations in energy and environment has connections to the research fields energy engineering, construction engineering, environmental science, and biology.

Eligibility

Basic Eligibility

Basic eligibility to doctoral education is stated in the Higher Education Ordinance (chapter 7, paragraph 39):
Basic eligibility for education on doctoral level if the prospective student has:
1. Graduated with a master's degree,
2. Completed course requirements of at least 240 credits (ECTS), where at least 60 credits (ECTS) at master level, or
3. In some other way, within or outside the country, gained equivalent knowledge to 1) or 2).

The university can give an exception for individual applicants from the requirement of Basic eligibility, if there are special reasons (2010:1064).

Special Eligibility

To be eligible for admission to doctoral studies in Innovations in energy and environment, the applicant must have completed a second-cycle (Master's) degree with a specialization that sufficiently aligns with the research subject. The above prerequisite requirements may be considered fulfilled also by an applicant that by other means, within or outside the country, has achieved comparable knowledge and skills. The applicant must demonstrate strong oral and written communication skills in English. Selection amongst eligible applicants is based on the estimated ability to assimilate the doctoral education.

Learning goals

Licentiate degree

Knowledge and understanding

For the degree of licentiate, the doctoral student shall:

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

Competence and skills

For the degree of licentiate, the doctoral student shall:

– 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 findings in speech and writing and in dialogue with the academic community and society in general, and
– demonstrate the skills required to participate independently in research and development work and to work independently in some other qualified capacity.

Judgement and approach

For the degree of licentiate, the doctoral 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 on-going learning.

Doctoral degree

Knowledge and understanding

For the degree of doctor, 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 degree of doctor, the doctoral student shall:

– demonstrate the capacity for scholarly analysis and synthesis as well as 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 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 doctoral student shall:

– demonstrate intellectual independence 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 it is used.

Overview of the disposition and requirements of the education

Overview of the disposition and requirements of	Compulsory courses (credits)	Optional courses (credits)	Thesis (credits)	Sum (credits)
Doctoral degree	15	45	180	240
Licentiate degree	15	15	90	120

Table 1. Overview of credits for doctoral degree and licentiate degree.

Degree requirements

Education on a doctoral level ends with a doctoral or licentiate degree. The doctoral student also has the possibility of obtaining a licentiate degree as a partial stage in the education.

Licentiate degree

For the licentiate degree, the following is required:
- approved courses of at least 30 credits (ECTS) and
- approved scientific thesis of at least 90 credits (ECTS)
Thesis and courses must together comprise at least 120 credits (ECTS).

Courses and other electable educational activities

The course part totals 30 credits, wherein 15 credits are compulsory courses.

Compulsory courses:

- Introductory course for doctoral students, equivalent to 7.5 credits
- Innovations in energy and environment 7.5 credits (partly joint teaching with Introduction to Innovation science 7.5 credits)

Examples of optional courses:
- Course/courses in Scientific method equivalent to 7.5-15 credits
- Scientific communication 7.5 credits

- Higher seminar in Innovation science 7.5 credits

The doctoral student is allowed to choose optional courses freely, after consultation with his or her principal supervisor. Courses can be chosen in the student's area of research and in specialized courses in relation to the student's thesis. Postgraduate courses given outside Halmstad University, at other universities both in Sweden and abroad, can be credited upon approval of the student's principal supervisor.

Seminars

The doctoral student shall, during the time of study, participate actively in seminars. A final seminar (where the cohesive script is presented) is compulsory. The doctoral student and principal supervisor may agree upon participation in additional seminar(s), for example a half-time seminar. The doctoral student may also present their research to independent researchers within the framework of research environments' seminar series and PhD days. *Other compulsory activities:* Participation and presentation of original research at an international scientific conference relevant to the research subject. Conference participation shall be planned together with the principal supervisor. Activities shall be planned and reported in the individual study plan.

Scientific thesis

For a licentiate degree, the doctoral student writes a thesis equivalent to 90 credits (ECTS). The thesis demonstrates the doctoral student's ability to conduct independent research and present research methods and results in a logical and scientific manner. The thesis is defended orally at a public seminar. It is graded as either Pass or Fail. The grading considers the content of the work and its defense.
The thesis can be either a monograph or a compilation with a cover essay and a number of scientific articles.

The following apply specifically to monographs:

- The licentiate thesis consists of a coherent text that addresses one or several research problem(s).
- It includes an introduction, a review of relevant literature, a description of methods and materials, presentation and analysis of results, discussion and conclusions.

The following apply specifically to compilation theses:

- The licentiate thesis normally contains 2–3 scientifically publishable articles.
- The cover essay places the individual articles in context and shows how they contribute to an overall purpose.
- In cases of co-authorship, the doctoral student's contribution must be clearly distinguishable from that of the co-authors.

Doctoral degree

For a doctoral degree, the following is required:
- approved courses of at least 60 credits (ECTS) and
- approved scientific thesis to the equivalent of at least 180 credits (ECTS).

Thesis and courses must together comprise at least 240 credits (ECTS).

Courses and other electable educational activities

The course part totals 60 credits, wherein 15 credits are compulsory courses, and 45 credits are optional courses, wherein other electable activities may be included, as described below.

Compulsory courses:

- Introductory course for doctoral students, equivalent to 7.5 credits
- Innovations in energy and environment 7.5 credits (partly joint teaching with Introduction to Innovation science 7.5 credits)

Examples of optional courses:
- Course/courses in Scientific method equivalent to 7.5-15 credits
- Scientific communication 7.5 credits
- Higher seminar in Innovation science 7.5 hp

The doctoral student is allowed to choose optional courses freely, after consultation with his or her principal supervisor. Courses can be chosen in the student's area of research and in specialized courses in relation to the student's thesis. Postgraduate courses given outside Halmstad University, at other universities both in Sweden and abroad, can be credited upon approval of the student's principal supervisor.

Seminars

The doctoral student shall, during the time of study, participate actively in seminars. A final seminar (where the cohesive script is presented) is compulsory. The doctoral student and principal supervisor may agree upon participation in additional seminar(s), for example a half-time seminar. The doctoral student may also present their research to independent researchers within the framework of research environments' seminar series and PhD days. *Other compulsory activities:* Participation and presentation of original research at an international scientific conference relevant to the research subject. Conference participation shall be planned together with the principal supervisor. Activities shall be planned and reported in the individual study plan.

Scientific thesis

For a doctoral degree, the student writes a thesis equivalent to 180 credits (ECTS). The thesis demonstrates the doctoral student's ability to conduct independent research of high scientific quality and present research methods and results in a logical and scientific manner. The thesis contributes new knowledge within the research field. The doctoral thesis is defended orally at a public defense. It is graded as either Pass or Fail. The grading considers the content of the work and its defense.
The thesis can be either a monograph or a compilation with a cover essay and a number of scientific articles.

The following apply specifically to monographs:

- The doctoral thesis consists of a coherent text that addresses one or several research problem(s).
- It includes an introduction, a review of relevant literature, a description of methods and materials, presentation and analysis of results, discussion and conclusions.

The following apply specifically to compilation theses:

- The doctoral thesis normally contains 4–5 articles. At least two of these should be published or accepted for publication in recognized scientific publication outlets. The remaining ones should be scientifically publishable.
- The cover essay places the individual articles in context and shows how they contribute to an overall purpose.
- In cases of co-authorship, the doctoral student's contribution must be clearly distinguishable from that of the co-authors.

Degree title

On completion of the education, a degree certificate is awarded (after application) with the following degree title:

Licentiate degree

Filosofie *eller* Teknologie licentiatexamen inom ämnet Innovationer inom energi och miljö
Degree of Licentiate of Philosophy *or* Degree of Licentiate of Engineering in the subject Innovations in Energy and Environment

Doctoral degree

Filosofie *eller* Teknologie doktorsexamen inom ämnet Innovationer inom energi och miljö
Degree of Doctor of Philosophy in the subject Innovations in Energy and Environment.