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General syllabus for doctoral (third-cycle) studies in fluid mechanics at Luleå University of Technology

Decided by the Chair of TFN 20 December 2022.

1. Subject description

English name: Fluid Mechanics

Fluid Mechanics comprises the study of flow in porous media, multiphase flow and rheology, linked to industrial production, fluid flow optimisation and design of energy technology applications and magneto hydrodynamics.

2. Programme aim and intended learning outcome

The aim of the doctoral (third-cycle) studies in fluid mechanics at the University is to give the doctoral student specialised knowledge in fluid mechanics in-depth knowledge of different research methods and a good understanding of the challenges related to research and its practical application. The overall objective of the programme is that the doctoral student develops into a critical and autonomous researcher in fluid mechanics, able to plan and carry out research projects. The doctoral student shall fulfil all the qualitative targets specified in the Higher Education Ordinance as well as in the locally decided qualitative targets, if any (see attached Annex A).

3. Admission requirements and selection

3.1 General entry requirements

An applicant meets the general entry requirements for doctoral (third-cycle) studies if he or she has been awarded a Master's (second-cycle) qualification, has satisfied the requirements for courses comprising at least 240 credits, of which at least 60 second-cycle credits, or has acquired substantially equivalent knowledge in another way, in Sweden or elsewhere (Higher Education Ordinance (2010:1064) Chapter 7 Section 39).

3.2 Specific entry requirements

In addition to the requirement for basic qualifications, very good skills in oral and written communication in Swedish or English are required.

3.3 Selection

In selecting among applicants who meet the requirements, their ability to benefit from the course or the study programme shall be taken into account. However, the fact that an applicant may be credited for previous courses and study programmes or for professional or vocational experience may not alone give the applicant priority over other applicants (Higher Education Ordinance (2010:1064) Chapter 7 Section 41). The University's local guidelines in the Admissions procedure for doctoral (third-cycle) studies must also be applied.

The following criteria will be used in the selection of applicants for doctoral (third-cycle) studies in fluid mechanics:

- Knowledge relevant to the project in question
- The quality of the applicant's degree project
- Personal qualities relevant to education at post-graduate level.

4. The degree

The doctoral (third-cycle) studies lead to a Degree of Doctor. Within fluid mechanics, a student admitted to doctoral studies has the right to be awarded a licentiate degree after having completed at least 120 credits of the programme leading to a Degree of Doctor.

4.1 Degree requirements

For a Degree of Doctor, the doctoral student shall

- have been awarded a pass grade for courses of at least 60 credits
- have been awarded a pass grade for a research thesis (doctoral thesis) of at least 120 credits.

The thesis and the courses shall together amount to 240 credits for a Degree of Doctor.

For a Degree of Licentiate, the doctoral student shall

- have been awarded a pass grade for courses of at least 30 credits.
- have been awarded a pass grade for a licentiate thesis of at least 60 credits.

The thesis and the courses shall together amount to 120 credits for a Degree of Licentiate.

4.2 Titles of degree

- After the completion of the Degree of Doctor in fluid mechanics the doctoral student is awarded the title Doctor of Philosophy in Science.
- After the completion of the Degree of Licentiate in fluid mechanics, the doctoral student is awarded the title Degree of Licentiate of Science.

A request of a title of degree other than the stipulated may be submitted in accordance with laid down guidelines.

5. Programme structure and implementation

5.1 Programme scope and structure

The doctoral (third-cycle) programme includes two blocs; courses and thesis work. The programme comprises four years (two years for the licentiate degree). In case the doctoral student has a doctoral studentship and carries out departmental duties to a certain extent (no more than 20% of the whole programme), a corresponding prolonged period may be approved.

5.2 Individual study plan and supervision

An individual study plan outlining the implementation of the studies is drawn up for each doctoral student. The plan is established in consultation with the supervisor is decided by the Head of Department by delegation of the Vice-Chancellor. The plan is reviewed and revised at least once a year.

The Head of Department shall appoint at least two supervisors, one of whom is appointed principal supervisor, for each doctoral student. The person appointed principal supervisor shall have at least qualifications required for appointment as a docent and be employed by the University. A principal supervisor who no longer meets the job requirements may continue as

supervisor until the doctoral student completes his or her studies, by an individual agreement with the relevant department. The doctoral student is entitled to supervision during the studies, unless the Vice-Chancellor has decided otherwise in accordance with the Higher Education Ordinance (2010:1064) Chapter 6 Section 30. A doctoral student who so requests may have another supervisor (Higher Education Ordinance (2010:1064) Chapter 6 Section 28). The request does not need a justification.

5.3 Courses

The individual study plan shall specify the courses to be included in the doctoral student's education. The goal attainment is examined according to the examination procedure specified in the course syllabus. Credits may be transferred in accordance with the local guidelines in the Admissions procedure for doctoral (third-cycle) studies.
Courses like Viscous Flow, Turbulence, Computational Fluid Dynamics (CFD), Continuum Mechanics, Experimental Methods, Scientific Writing and Information Retrieval are recommended. Knowledge of gender equality is mandatory and will be ensured in postgraduate education through workshops, courses, seminars or the like.

5.4 Thesis

The thesis may take the form of either a single coherent work (a monographic thesis) or a compilation comprising a number of scientific articles interrelated by an introductory summary chapter (a compilation thesis). Quality and scope requirements for the research activities do not differ between the two alternatives. The scientific articles or, as appropriate, the monograph must be of such quality that they meet reasonable requirements for publication in a peer-reviewed scientific forum.

Education at post-graduate level in fluid mechanics is based on learning the basic physics of the subject in a lively environment that promotes cooperation. Depth is created through well-defined research questions and research is conducted systematically using modern tools and scientific methodology. Career paths are discussed early on and the student is given the opportunity to present his/her work at international conferences and to pursue his/her studies at universities and companies around the world for extended periods. It is also important that the student begin reporting the work at an early stage in order to be conducting independent research at the end of the study period. The post-graduate student presents his/her work at an internal seminar approximately one year after admission, often in the form of a licentiate thesis with 2-3 papers or an equivalent monograph after two years of full-time studies, and in the form of a doctoral thesis with a comprehensive summary and normally at least 5 publishable articles or a corresponding monography after approximately four years of full-time studies. Deviations from this approach may occur. The doctoral student also participates in subject days (two possible occasions per year) where the student presents her/his work and develops knowledge of gender equality, research ethics, scientific theory and the possibilities and limitations of science. The post-graduate student is normally employed as a predoctoral fellow, a position that can entail both departmental duties and teaching.

The introductory summary chapter shall include a separate section describing the doctoral student's contribution to the articles.

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The doctoral thesis shall be defended at a public defence seminar. The grades for the thesis are either 'pass' or 'failed'. When grading the thesis, the content and the defence of thesis shall be taken into account. The grade of a doctoral thesis is decided by an examining committee, appointed anew for each thesis.

A doctoral student wanting to be awarded a Degree of Licentiate shall, after consultation with his or her supervisor, request approval from the responsible Head of Department. The doctoral student defends his or her licentiate thesis at a licentiate seminar after which the thesis is graded 'pass' or 'failed'. When grading the thesis, the content and the defence of the thesis is taken into account. An examiner, appointed by the Head of Department, grades the licentiate thesis.

6. Entry into effect and interim regulations

The previous general syllabus will cease to apply for third-cycle students who are admitted to studies at third-cycle level after 2022-12-20.

If agreed between the third-cycle student and the supervisors, the new general syllabus (LTU-2717-2022) may be used as a steering document for a previously admitted third-cycle student.

It must be documented in the third-cycle student´s individual study plan which general syllabus that applies.

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ANNEX: QUALITATIVE TARGETS

Qualitative target in accordance with the Higher Education Ordinance (HF)

Degree of Doctor

Knowledge and understanding

For the Degree of Doctor, the doctoral student shall

- demonstrate broad knowledge and systematic understanding of the research domain as well as advanced and up-to-date specialised knowledge in a limited area of the research domain, and
- demonstrate familiarity with research methodology in general and the methods of the specific research domain 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

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

Research thesis (doctoral thesis)

For the Degree of Doctor, the doctoral student shall have been awarded a pass grade for a research thesis (doctoral thesis) of at least 120 credits.

Degree of Licentiate

Knowledge and understanding

For a Degree of Licentiate, the doctoral student shall

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

Competence and skills

For a 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 and research findings in speech and writing and in dialogue with the academic community and society in general, and
- demonstrate the skills required to participate autonomously in research and development work and to work autonomously in another qualified capacity.

Judgement and approach

For a Degree of Licentiate, the doctoral student shall

- demonstrate the ability to make assessments of ethical aspects of his or her own research,

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- demonstrate specialised 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 need for further knowledge, and take responsibility for his or her ongoing learning.

Thesis

For a Degree of Licentiate, the doctoral student shall have been awarded a pass grade for a research thesis of at least 60 credits.