



**Curriculum for
Aalto Doctoral Programme
in Science 2022-2024
(Aalto SCI)**

March 2022

Contents

In accordance with the [Aalto University General Regulations on Teaching and Studying](#), the curriculum is a confirmed overall description of the learning outcomes of a programme, the goals and contents of its study modules and the courses offered as well as the organisation of teaching within a given period of time as indicated in the Aalto University General Regulations on Teaching and Studying (Section 2).

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1. Basic information about the Doctoral Programme in Science

1.1. Name of the programme

Aalto Doctoral Programme in Science

1.2. Degree of the programme

Doctor of Science (Technology)

Licentiate of Science (Technology)

1.3. Language of the degree

In accordance with the general definition of policy regarding languages at Aalto University, the language of degree can be Finnish, Swedish, or English. The personal language of the degree is confirmed for every doctoral student.

1.4. Research fields

The Aalto Doctoral Programme in Science comprises six research fields, which are based on the strong research traditions of the departments. The programme is a joint effort of the Department of Neuroscience and Biomedical Engineering, Department of Mathematics and Systems Analysis, Department of Applied Physics, Department of Computer Science, and Department of Industrial Engineering and Management.

The doctoral candidate chooses a research field when applying to the programme. The professor supervising the doctoral studies is agreed upon at the same time. The supervising professor is a professor at the tenure track. For special reasons with the approval of the department head and on the decision of the Dean, a non-tenure track professor can be assigned as the supervising professor of a doctoral student.

The research fields for academic years of 2022–2024 are:

- Neuroscience and Biomedical Engineering
- Mathematics and Statistics
- Systems and Operations Research
- Engineering Physics
- Computer Science
- Industrial Engineering and Management

1.5. Scope of the programme

The programme consists of theoretical studies (40 ECTS) including general research studies and research field studies, in addition to the doctoral thesis (or licentiate thesis) itself.

1.6. Timetable of the degree

Doctoral degree: 4 years of full-time study

Licentiate degree: 2 years of full-time study

1.7. Doctoral programme director

Professor Adam Foster

The doctoral programme director is in charge of the planning, execution, assessment and development of the programme.

2. Education objectives and intended learning outcomes of the Doctoral Programme in Science

Aalto University's future is built upon a foundation of high-quality research, education, impact and shared values – responsibility, courage, and collaboration. The purpose of the university is to shape a sustainable future.

Our joint purpose is to educate doctors who can process and solve the huge global and societal challenges with scientific tools, also in interdisciplinary teams.

Doctoral education prepares the doctoral student for an academic career as a highly qualified researcher or, increasingly also for diversity of career pathways outside of academia for example in the most demanding expert positions or as entrepreneurs or creative practitioners.

The education is carried out in a multidisciplinary international scientific community through both field-specific and multidisciplinary research work and various forms of education and learning. High quality education and transferable skills training together with network-building ensure the development of the doctoral student's competences.

3. Structure of the degree

The doctoral degree at the Doctoral Programme in Science consists of an approved doctoral thesis and 40 ECTS of studies. These studies comprise two study modules: general research studies of 5-20 ECTS and research field studies of 20-35 ECTS. If the student doesn't want to finish the doctoral degree, the licentiate degree can be completed as an intermediate degree. The licentiate degree consists of an approved licentiate thesis and the same 40 ECTS of studies as for the doctoral degree.

The general research studies prepare the student for research work, the application of research results, the dissemination of research findings and for adopting the principles of responsible conduct of research. The general research studies can include transferrable skill studies.

The research field studies and the doctoral thesis help students gain a comprehensive and in-depth knowledge of their research field. Doctoral studies can include studies from several Aalto doctoral programmes when agreed on in the doctoral personal study plan of the student (DPSP).

| | |
|--|--------------------------------------|
| Doctoral thesis / (Licentiate thesis) | General research studies (5-20 ECTS) |
| | Research field studies (20-35 ECTS) |

4. Content of studies

Each doctoral student must prepare a doctoral personal study plan (DPSP), which includes plans for the content, scope and duration of his or her studies, research, supervision, funding and career. ([Aalto University General Regulations on Teaching and Studying](#))

All doctoral students prepare their personal study plan for themselves on the basis of their programme's curriculum. If the doctoral student follows the curriculum of the programme, no extra approvals are needed. The credit plan needs to get the final approval before starting pre-examination or earlier if the student wishes to take courses from other universities. The school shall provide its students with guidance for the preparation and updating of their study plan.

The courses included in the doctoral degree must be doctoral level courses or master level courses. Courses suitable for the doctoral degree are indicated with the letter L in the course code (doctoral level course, e.g., PHYS-L1234) or with a letter E in the course code (master level course, e.g., PHYS-E1234 Interesting course). Some advanced courses have letter D in the end of the name of the course indicating suitability for the doctoral degree. No bachelor level courses (with letters A or C in the course code) can be included in the research field studies. One bachelor level course with the letter C (max. 5 ECTS) can be included in the general research studies (e.g. PHYS-C1234). Courses denoted by A-code cannot be included in the doctoral degree.

4.1. General research studies, 5-20 ECTS

Learning objectives

The aim of the module is to provide doctoral candidates with knowledge of the basic concepts of science, the key characteristics of scientific research and scientific knowledge, familiarisation with the most important research methods of their research field, and to develop their transferable skills.

After completing the module, doctoral candidates:

- have improved communication and interpersonal skills and project management skills.
- work responsibly in the light of ethical and sustainability considerations and their conduct in the scientific community will follow good scientific practice.
- have the ability to work in a multidisciplinary and international environment together with various actors.

Scope of the module

The scope of the module is 5–20 ECTS.

Content of the module

The content of the module is confirmed individually for each doctoral candidate following the requirements of the Doctoral Programme in Science:

<https://into.aalto.fi/display/endoctoralsci/Study+plan>.

The module may include the following:

- Postgraduate-level and advanced-level courses in:
 - LC-1333 Introduction to doctoral studies, career planning, and EDI (Equity, Diversity and Inclusion) (3 ECTS), highly recommended

- Research ethics courses, highly recommended
- Research methodology courses
- History or philosophy of science
- Transferable skills and competences:
 - Aalto University Communication courses:
<https://into.aalto.fi/display/enopinnot/Courses+for+doctoral+students>
 - Nationally jointly developed courses (*offered via <https://findocnet.fi/>*)
 - Research Ethics for Doctoral Students, LC-L1010 (1-2 ECTS)
 - Open Science for Doctoral Students, LC-L1011 (1-2 ECTS)
 - Business Skills for Doctoral Students, LC-L1012 (1 ECTS)
 - Career Course for Doctoral Students, LC-L1013 (1 ECTS)
 - Interactive Leadership Skills for Doctoral Students, LC-L1014 (1 ECTS)
 - Project Management for Doctoral Students, LC-L1015 (1 ECTS)
 - Writing Research Grant Applications for Doctoral Students, LC-L1016 (1 ECTS)
- Pedagogical studies: <https://www.aalto.fi/en/services/pedagogical-training-main-page>
- Individual study attainments, to be agreed with the supervising professor:

| | | Max. amount of ECTS |
|---|-----------------------------|----------------------------|
| Presentation of research work at scientific conferences | 1-2 ECTS/conference | 6 ECTS |
| Guidance of theses or special assignments | 2 ECTS/thesis or assignment | 6 ECTS |
| Teaching, planning or implementing a new course | 1-3 ECTS/course | 6 ECTS |

Restrictions

- Language courses (i.e. Finnish for international students) cannot be included in the degree.
- Module cannot consist solely of conference presentations.
- One bachelor-level course (denoted as PHYS-C1234) of max. 5 ECTS can be included in the degree in this module.

Compulsory courses

Industrial Engineering and Management

Doctoral candidates in the research field of **industrial engineering and management** must complete the following three methodology courses:

- TU-L0000 Research Methods in Industrial Engineering and Management (5 ECTS)
- TU-L0022 Statistical Research Methods (5-8 ECTS)
- TU-L0031 Qualitative Research Methods (3-6 ECTS)

Courses are compulsory for those doctoral candidates in the research field of industrial engineering and management who have received their study right after 1 August 2017.

Evaluation of the module

No grade is given for the module. Individual courses and study attainments are graded either as Pass/Fail or as grades 1-5.

4.2. Research field studies 20-35 ECTS

Learning objectives

The aim of the research field studies is to support the writing of the doctoral thesis and prepare the doctoral candidates for research and other demanding work that requires expertise.

After completing the module, doctoral candidate:

- has deep and broad discipline-specific knowledge of the chosen field of research
- is able to disseminate the research results through relevant research fora and to a wider audience
- is eligible to act as a thesis advisor for doctoral students and as the examiner for a doctoral thesis.

These studies are the core element of the doctoral studies, decided jointly by the doctoral student and their supervising professor.

Scope of the module

The scope of the module is 20–35 ECTS

Content of the module

The content of the module is confirmed individually for each doctoral candidate following the requirements of the Doctoral Programme in Science:

<https://into.aalto.fi/display/endoctoralsci/Study+plan>. The content is to be agreed on with the supervising professor in advance. There is no maximum number of credits of individual studies in this module, but it is highly recommended that the module doesn't consist of only individual studies.

The module may include the following:

- Doctoral-level and advanced-level courses, which support the doctoral thesis
- Individual study attainments, to be agreed with the supervising professor:

| | | Max. amount of ECTS |
|---|-------------------|----------------------------|
| Attending scientific summer/winter schools | 2-3 ECTS/week | |
| Journal articles and conference papers, which are not included in the doctoral thesis | 2 ECTS/article | 6 ECTS |
| Self-study (not included in the doctoral thesis, e.g. written/oral exam, review or a report). | 1-10 ECTS | |
| Refereeing scientific papers | 1 ECTS = 3 papers | |

Compulsory courses

Computer Science

Doctoral candidates in the research field of **computer science** must complete the following course:

- CS-L9000 Introduction to doctoral studies in computer science

Course is compulsory for those doctoral candidates in the research field of computer science who have received their study right after 1 August 2022. Course is optional for those doctoral candidates in the research field of computer science who have received their study right after 1 January 2021.

The course can be included either in the Research field studies -module or in the General research studies -module.

Engineering Physics

Full-time doctoral candidates in the research field of **engineering physics** must complete the following course:

- PHYS-L0666 Midterm review 10 ECTS

The course can be included either in the Research field -module or in the General research studies -module.

Industrial Engineering and Management

Doctoral candidates in the research field of **industrial engineering and management** must complete **two** courses:

- TU-L0010 Advanced Organizational Theory (a joint course with Aalto BIZ and Hanken, 5 ECTS)
- TU-L1004 Doctoral Course in Strategy, Venturing, Operations, and Organizations (8 ECTS)

Courses are compulsory for those doctoral candidates in the research field of industrial engineering and management who have received their study right after 1 August 2018.

Evaluation of the module

No grade is given for the module. Individual courses and study attainments are graded either as Pass/Fail or as grades 1-5.

4.3. Doctoral or licentiate thesis

Doctoral thesis

The doctoral thesis is written on a topic related to the research field that the doctoral candidate has chosen and that has been approved by the doctoral programme committee of the School of Science and the supervising professor. The doctoral thesis shall contribute to new scientific knowledge. The approval of the thesis includes a public defence after a pre-examination process. The accepted forms of theses are monographs, article-based doctoral theses and essay-based doctoral theses.

Learning outcomes of doctoral thesis:

- the graduate has competences to carry out independent and original academic research
- the graduate has high competences to search for and apply knowledge, the ability to independently formulate research questions and use scientific research methods to create new scientific knowledge
- the graduate is able to make such syntheses and critical assessments as are required to solve and process complex problems in research and innovation and in other areas of society.

A doctoral thesis is a public document and is kept for public display at the university. All thesis works are public in Finland (law 621/1999).

Doctoral theses are evaluated on a scale of Pass/Fail.

See more about the evaluation process of the thesis from the [degree regulations on doctoral education](#) and from the web pages of the doctoral programme regarding doctoral thesis [here](#).

Licentiate thesis

The licentiate thesis is written on a topic related to the research field that the doctoral candidate has chosen and that has been approved by the doctoral programme committee of the School of Science and the supervising professor. The thesis shall demonstrate good conversance with the field of research and the capability of independently and critically applying scientific research methods. Approval of the thesis includes a public presentation at the department.

The accepted forms of theses are monographs, a number of scientific publications or manuscripts vetted for publication deemed sufficient by the university, which deal with the same set of problems and a summary of the findings or some other work which meets corresponding scientific criteria. The publications may include co-authored publications if the author's independent contribution to them can be demonstrated.

A licentiate thesis is a public document and is kept for public display at the university. All theses works are public in Finland (law 621/1999).

Licentiate thesis is evaluated on a scale of Pass/Fail.

See more about the evaluation process of the thesis from the [degree regulations on doctoral education](#) and from the web pages of the doctoral programme regarding licentiate thesis [here](#).