The Faculty of Engineering and Science
Study Board for Civil Engineering

AALBORG UNIVERSITY
DENMARK

Curriculum for the Master's Program in Building Energy Design

Aalborg University 2015

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Campus Aalborg

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Preface:
Pursuant to Act 367 of March 23, 2013 on Universities (the University Act) with subsequent changes, the following curriculum for the Master's program in Building Energy Design is stipulated. The program also follows the Framework Provisions and the Examination Policies and Procedures for the Faculty of Engineering and Science.

Table of Contents

Chapter 1: Legal Basis of the Curriculum, etc.

1.1 Basis in ministerial orders

The Master's program in Building Energy Design is organized in accordance with the Ministry of Science, Technology and Innovation's Ministerial Order no. 1520 of December 16, 2013 on Bachelor's and Master's Programs at Universities (the Ministerial Order of the Study Programs) and Ministerial Order no. 1518 of December 16, 2013 on University Examinations (the Examination Order) with subsequent changes. Further reference is made to Ministerial Order no. 1488 of December 16, 2013 (the Admission Order) and Ministerial Order no. 250 of March 15, 2007 (the Grading Scale Order) with subsequent changes.

1.2 Faculty affiliation

The Master's program falls under the Faculty of Engineering and Science, Aalborg University.

1.3 Board of Studies affiliation

The Master's program falls under the Study Board of Civil Engineering in the School of Engineering and Science.

Chapter 2: Admission, Degree Designation, Program Duration and Competence Profile

2.1 Admission

Admission to the Master's program in Building Energy Design requires a

- Bachelor of Architectural Technology and Construction Management
- Bachelor of Technology Management and Marine Engineering
- Bachelor of Science in Civil Engineering; Structural and Civil Engineering
- Bachelor of Science in Civil Engineering; Indoor Environmental and Energy Engineering
- Bachelor of Science in Civil Engineering; Water and Environment
- Bachelor of Science in Civil Engineering; Transportation Engineering

Students with another Bachelor's degree, upon application to the Board of Studies, will be admitted after a specific academic assessment if the applicant is deemed to have comparable educational prerequisites. The University can stipulate requirements concerning conducting additional exams prior to the start of study.

2.2 Degree designation in Danish and English

The Master's program entitles the graduate to the designation cand.tech. (candidatus/candidata technologiae) i bygningers energidesign. The English designation is: Master of Science (MSc) in Technology (Building Energy Design).

2.3 The program's specification in ECTS credits

The Master's program is a 2-year, research-based, full-time study program. The program is set to 120 ECTS credits.

2.4 Competence profile on the diploma

The following competence profile will appear on the diploma:

> A graduate of the Master's program has competencies acquired through an educational program that has taken place in a research environment.
>
> The graduate of the Master's program can perform highly qualified functions on the labor market on the basis of the educational program. Moreover, the graduate has prerequisites for research (a Ph.D. program). Compared to the Bachelor's degree, the graduate of the Master's program has developed her/his academic knowledge and independence, so that the graduate can independently apply scientific theory and method in both an academic and occupational/professional context.

2.5 Competence profile of the program

Knowledge

- Has knowledge in Building Energy Design and Operations that, in Building Energy Design, is based on the highest international research
- Can understand and, on a scientific basis, reflect on the Building Energy Design and Operation's knowledge and identify scientific problems
- Must have knowledge about basic architectural design methodology, the integrated design process and integrated building concepts
- Must understand the relationship between the thermal comfort, indoor air quality and health issues and the heat, moisture, mass and momentum transfer in buildings
- Be able to critically evaluate knowledge and identify new scientific problems within the field of Building Energy Design and Operations
- Must have knowledge about Life cycle cost analysis
- Must have knowledge about Environmental Assessment Methods and Tools

Skills

- Excels in Building Energy Design and Operation's scientific methods and tools and general skills related to employment within consulting engineering
- Can evaluate and select among the Building Energy Design and Operation's scientific theories, methods, tools and general skills and, on a scientific basis, advance new analyses and solutions
- Can communicate research-based knowledge and discuss professional and scientific problems with both peers and non-specialists
- Must be able to apply both simple and advanced calculation methods for analysis and simulation of temperature conditions and heat flows in buildings and elements in HVAC systems under dynamic load conditions
- Must be able to apply, combine and evaluate advanced methods for analysis of the interplay between energy systems, architectural concepts, building design, building use, outdoor climate and HVAC systems
- Be able to apply a wide range of engineering methods in research and development in the field of Building Energy Design and Operations
- Must be able to measure the indoor environmental quality and energy consumption of a building and its systems
- Must be able to apply, combine and evaluate advanced methods for Life cycle cost analysis
- Must be able to apply, combine and evaluate advanced methods for Environmental Assessment Methods and Tools
- Must be able to design buildings using advanced methods at the highest international level

Competencies

- Can manage work and development situations that are complex, unpredictable and require new solutions.
- Can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility.
- Can independently take responsibility for own professional development and specialization
- Can optimise the operation of buildings based on measurement and analysis of the performance of the building
- Can combine, optimise and evaluate models for energy transport in buildings and HVAC systems
- Must be able to handle complex and research-oriented cases related to development of energy efficient buildings
- Be competent to solve new and complicated technical problems by the use of advanced scientific and technological knowledge
- Can design buildings using advanced methods at the highest international level

Chapter 3: Content and Organization of the Program

The program is structured in modules and organized as a problem-based study. A module is a program element or a group of program elements, which aims to give students a set of professional skills within a fixed time frame specified in ECTS credits, and concluding with one or more examinations within specific exam periods that are defined in the curriculum.
The program is based on a combination of academic, problem-oriented and interdisciplinary approaches and organized based on the following work and evaluation methods that combine skills and reflection:

- project work
- lectures
- classroom instructions
- study groups
- workshop
- exercises
- laboratory tests
- measurements and testing in the field
- portfolio work
- independent study

The modules are evaluated either through written or oral exams as started in the description of the modules in the Appendix.

For individual written exams the study board selects among the following possibilities:

- written exam based on handed out exercises
- multiple choice
- ongoing evaluation of written assignments

For individual oral exams the study board selects among the following possibilities:

- oral exam with or without preparation
- oral exam based on project report
- oral exam based on presentation seminar
- portfolio based oral exam

If the number of students following a module is small and/or if the number of students having to attend a re-exam is small the study board can decide that an exam is conducted either as an oral or written individual exam for economic reasons. In the first case decision must be notified before the start of the teaching activity in the latter case the students must be notified when the examination date is decided.

3.1 Overview of the program

All modules are assessed through individual grading according to the 7-point scale *or* Pass/Fail. All modules are assessed by external examination (external grading) or internal examination (internal grading or by assessment by the supervisor only).

Of a total of 120 ECTS, 80-110 ECTS are assessed by the 7-point scale and 45-75 ECTS are assessed by external examination.

Semester		Module	ECTS	Assessment	Exam
1st		Building Energy Consumption and Indoor Environmental Quality	15	7-point scale	Internal
		Introduction to PBL, Heat and Moisture Transport in Building	5	7-point scale	Internal
		Indoor Environmental Analysis and Measurements	5	7-point scale	Internal
		Building Energy Modelling	5	Pass/Fail	Internal
2nd		Building Ventilation, Heating and Cooling	15	7-point scale	External
		Building Ventilation	5	7-point scale	Internal
		Building Heating and Cooling Systems	5	Pass/Fail	Internal
		Control and Analysis of Building Energy Systems	5	7-point scale	Internal
3rd	A	Building Commissioning Operation and Environmental Impact	15	7-point scale	Internal
		Environmental Assessment Methods LCC Analysis	5	Pass/Fail	Internal
		Elective course[1)]	5	7-point scale	Internal
		Elective course[1)]	5	7-point scale	Internal
	B	Study at Other University	30	-[2)]	-[2)]
	C	Long Master's Thesis	15	-[3)]	-[3)]
4th		Master's Thesis	30	7-point scale	External
Total			120		

1) 10 ECTS points of course modules on the 3rd semester are elective and the student must choose course credits from a list of approved courses by the Study board of Civil Engineering
2) Assessment and exam according to the curriculum at the other university.
3) See module description for Master's thesis. By long thesis the Master's thesis is made at the 3rd and 4th semester and is 45 ECTS points plus 15 ECTS points of course modules from A.

The students are given options in the project modules as they can select among different projects within the same general theme. Moreover, the Master Thesis on the 4th semester can be selected freely within the field of Building Energy Design and Operations. The students have the choice of making a long master's thesis comprising both 3rd and 4th semester.

The study board of civil engineering can decide, that the contents of a course module on a semester is taught in the project module in the same semester, by increasing the ECTS extend of the project module by the same number of ECTS. The decision is taken regarding to capacity and/or economy.

3.2 Module descriptions

Descriptions of the modules of the education are inserted in the Appendix, ordered alphabetically after their English title.

Chapter 4: Entry into Force, Interim Provisions and Revision

The curriculum is approved by the Dean of the Faculty of Engineering and Science and enters into force as of 1 February 2015.

In accordance with the Framework Provisions for the Faculty of Engineering and Science at Aalborg University, the curriculum must be revised no later than 5 years after its entry into force.

Chapter 5: Other Provisions

5.1 Rules concerning written work, including the Master's thesis

In the assessment of all written work, regardless of the language it is written in, weight is also given to the student's spelling and formulation ability, in addition to the academic content. Orthographic and grammatical correctness as well as stylistic proficiency are taken as a basis for the evaluation of language performance. Language performance must always be included as an independent dimension of the total evaluation. However, no examination can be assessed as 'Pass' on the basis of language performance alone; similarly, an examination normally cannot be assessed as 'Fail' on the basis of poor language performance alone.
The Board of Studies can grant exemption from this in special cases (e.g., dyslexia or a native language other than Danish).

The Master's thesis must include an English summary.[1] If the project is written in English, the summary must be in Danish.[2] The summary must be at least 1 page and not more than 2 pages. The summary is included in the evaluation of the project as a whole.

5.2 Rules concerning credit transfer (merit), including the possibility for choice of modules that are part of another program at a university in Denmark or abroad

In the individual case, the Board of Studies can approve successfully completed (passed) program elements from other Master's programs in lieu of program elements in this program (credit transfer). The Board of Studies can also approve successfully completed (passed) program elements from another Danish program or a program outside of Denmark at the same level in lieu of program elements within this curriculum. Decisions on credit transfer are made by the Board of Studies based on an academic assessment. See the Framework Provisions for the rules on credit transfer.

5.3 Rules for examinations

The rules for examinations are stated in the Examination Policies and Procedures published by the Faculty of Engineering and Science on their website.

5.4 Exemption

In exceptional circumstances, the Board of Studies study can grant exemption from those parts of the curriculum that are not stipulated by law or ministerial order. Exemption regarding an examination applies to the immediate examination.

5.5 Additional information

The current version of the curriculum is published on the website of the School of Engineering and Science, including detailed information about the program, including exams.

5.6 Completion of the Master's program

The Master's program must be completed no later than four years after it was begun.

5.7 Rules and requirements concerning the reading of texts in foreign languages and a statement of the foreign language knowledge this assumes

It is assumed that the student can read academic texts in English and use reference works, etc

[1] Or another foreign language (upon approval from the Board of Studies).
[2] The Board of Studies can grant exemption from this.

Appendix: Module Descriptions

Building Commissioning Operation and Environmental Impact
Bygningens ibrugtagning drift og miljøpåvirkning

Prerequisites: Corresponding to having passed the 2st semester

Objective: Students who complete the module:

Knowledge:

- Must have knowledge about building Commissioning Operation and Environmental impact
- Must have knowledge about basic architectural design methodology, the integrated design process and integrated building concepts
- Must have knowledge on choice of passive energy technologies in relation to indoor environment, building services and running cost
- Must be able to understand the interplay between microclimate, buildings and operation of their services
- Must be able to understand the interplay between sustainable energy system, building energy demand and renewable energy production

Skills:

- Must be able to apply and combine design methods for energy efficient building design and operation
- Must be able to apply, combine and evaluate advanced methods for analysis of the interplay between energy systems, architectural concepts, building design, building use, outdoor climate and HVAC systems
- Must be able to design a building with focus on operation and reduced running cost

Competencies:

- Must be able to apply proper terminology in oral, written and graphical communication and documentation of problems and solutions within integrated design of buildings and building services.
- Must be able to optimise the operation of buildings based on measurement and analysis of the performance of the building
- Must be able to handle complex and research-oriented cases related to development of and running energy efficient buildings
- Must be able to communicate the results of the project work in a project report
- Must be able to contribute successfully to teamwork within the problem area and make a common presentation of the result of the project work

Type of instruction: Project work with supervision possibly supplemented with instructions, workshops, presentation seminars, lab tests, etc.

Exam format: Oral exam based on presentation seminar and project rapport.

Evaluation criteria: Are stated in the Framework Provisions.

Building Energy Consumption and Indoor Environmental Quality
Bygningers energiforbrug og indeklima

Prerequisites: Introduction to PBL, Heat and Moisture Transport in Building, Indoor Environmental Quality, Building Energy Modelling

Objective: Students who complete the module:

Knowledge

- Must be able to understand methods to evaluate the interplay between the indoor environment, heat and moisture transport and energy consumption of a building
- Must have knowledge of essential standards within indoor environment and energy

Skills

- Must be able to apply proper terminology
- Must be able to set up functional requirements regarding the indoor environment of a building
- Must be able to measure the indoor environmental quality and energy consumption of a building
- Must be able to carry out dimensioning of the building envelope regarding moisture
- Must be able to apply methods to analyse the interplay between the indoor environment, heat and moisture transport
- Must be able to analyse the building envelope in order to minimize the energy consumption
- Must be able to carry through and document energy calculation on a professional level

Competencies

- Must be able to apply proper terminology in oral, written and graphical communication and documentation of problems and solutions within indoor environment end building energy
- Must be able to communicate the results of the project work in a project report
- Must be able to contribute successfully to teamwork within the problem area and make a common presentation of the result of the project work

Type of instruction: Project work with supervision possibly supplemented with instructions, workshops, presentation seminars, lab tests, etc.

Exam format: Oral exam based on presentation seminar and project rapport.

Evaluation criteria: Are stated in the Framework Provisions.

Building Energy Modelling
Bygnings energisimulering

Prerequisites: Corresponding to the admission requirements

Objective: Students who complete the module:

Knowledge

- Must have knowledge of heat balance of buildings
- Must have knowledge of calculation methodology for building energy use
- Must have knowledge of legislation requirements regarding building energy use
- Must have knowledge of numerical solutions of mathematical problems
- Must be able to account for hygro thermal building simulation

Skills

- Must be able to set up a steady state heat balance for a building including in and external loads
- Must be able to document the building energy requirements using appropriate methods
- Must be able to perform dynamic simulation of heat flows in building using building energy simulation tools
- Be able to apply advanced simulation methods for analysis and simulation of temperature conditions and heat flows in buildings
- Be able to apply experimental results for verification of the calculated systems, including an estimate of the results with regard to model assumptions and uncertainties

Competences

- Be able to qualitative quantify the importance of boundary condition, user behaviour and detail level of mathematical models to estimate energy use and indoor environment
- Must be able to discus and evaluate the preconditions and results of building energy use

Type of instruction: Project work.

Exam format: Individual oral exam

Evaluation criteria: As stated in the framework provisions.

Building Heating and Cooling Systems

Bygningens varme- og kølesystemer

Prerequisites: Corresponding to having passed the 1st semester

Objective: Students who complete the module:

Knowledge

- Must understand the basics of water and airflows
- Must understand the physical properties and characteristics of liquids and gases
- Must have knowledge on functional requirements regulations and standards regarding heating and cooling systems
- Must be able to account in general for the system layout and control of heating and cooling systems
- Must be able to explain pressure distribution closed pipe systems
- Must have knowledge on sizing heating and cooling systems

Skills

- Must be able to calculate the hydrostatic forces
- Must be able to apply the continuity energy and momentum equations
- Must be able to set up functional requirements for heating and cooling systems
- Must be able to size heating and cooling systems
- Must be able to carry out calculation of pressure losses for closed duct systems including pumps
- Must be able to describe the control of the heating system

Competencies

- Must be able to evaluate different system designs according to a specific building the energy consumption future-orientated maintenance and security of supplies
- Must be able to discus and evaluate the optimal choice of heating and cooling systems

Type of instruction: Project work with supervision possibly supplemented with instructions, workshops, presentation seminars, lab tests, etc.

Exam format: Individual oral exam based on presentation seminar and project rapport.

Evaluation criteria: Are stated in the Framework Provisions.

Building Ventilation

Ventilationsteknik

Prerequisites: Corresponding to having passed the 1st semester

Objective: Students who complete the module:

Knowledge

- Must be able to account for the functional requirements regarding comfort in relation to ventilation
- Must have knowledge about the terminology within ventilation
- Must have knowledge on current standards and regulations within comfort ventialtion
- Must be able to understand the theory on mixing and displacement ventilation
- Must have knowledge on natural and hybrid ventilation
- Must have knowledge on design and balancing of duct systems
- Must have knowledge on choice of components for the ventilation unit
- Must hvar knowledge on noise in relation to ventilation
- Must be able to account in general for the control of ventilation systems
- Must have knowledge on the energy consumption of the individual parts of the ventilation unit
- Must have knowledge on the workflow of a ventilation contract including commissioning and maintenance

Skills

- Must be able to make an reasoned choice of ventilation principle and system based on the functional requirements and relevant loads
- Must be able to equip and size a ventilation system base on performance requirements
- Must be able to perform an impact assessment regarding the energy use of the system and its components
- Must be able to size a ventilation system base don noise requirements

Competencies

- Must be able to reflect on the chosen ventilations solution in relation to functional demands and loads
- Must be able to discus and evaluate the optimal choice of ventilation in relation to outdoor and indoor conditions users and the building

Type of instruction: Project work with supervision possibly supplemented with instructions, workshops, presentation seminars, lab tests, etc.

Exam format: Individual oral exam based on presentation seminar and project rapport.

Evaluation criteria: Are stated in the Framework Provisions.

Building Ventilation, Heating and Cooling
Bygningens ventilation og installationer

Prerequisites: Corresponding to having passed the 1st semester

Objective: Students who complete the module:

Knowledge

- Must be able to understand the principles and theories behind planning of HVAC systemse
- Must be able to apply methods to analyse the interplay between the indoor environment energy use and HVAC systems
- Must have knowledge of economic calculation of profitability including overall economy consequences of indoor related productivity changes
- Must have knowledge of key standards within building information modelling in the field of HVAC systems

Skills

- Must be able to apply proper terminology
- Must be able to set up functional demands to the indoor environment and HVAC systems of a building
- Must be able to measure the indoor environmental quality and energy consumption of a building and its systems
- Must be able to design the HVAC systems based on an overall consideration to ensure fulfilment of the building code
- Must be able to analyse the building to minimize the energy use by optimizing the HVAC systems and indoor environment level
- Must be able to analyse the financial profitability of the HVAC solution and the entire building design
- Must be able to use BIM in designing and quality assurance of the HVAC systems

Competencies

- Must be able to size the indoor environment and HVAC system of a building
- Must be able to argue for the chosen HVAC system in relation to the level of indoor environment to all parties in the building sector
- Must be able to communicate the results of the project work in a project report
- Must be able to contribute successfully to teamwork within the problem area and make a common presentation of the result of the project work

Type of instruction: Project work with supervision possibly supplemented with instructions, workshops, presentation seminars, lab tests, etc.

Exam format: Oral exam based on presentation seminar and project rapport.

Evaluation criteria: Are stated in the Framework Provisions.

Control and Analysis of Building Energy Systems
Styring og analyse af bygningers energisystemer

Prerequisites: Corresponding to having passed the 1st semester

Objective: Students who complete the module:

Knowledge:

- Must have knowledge on basic control theory, transfer functions, essential strengthening and accuracy of control
- Must have knowledge on feedback control and classical control (P, PI, PID)
- Must have knowledge on models for thermal systems and facilities
- Must have knowledge on state space modelling and control
- Must have knowledge on dynamical modelling and control of HVAC systems

Skills:

- Must be able to perform analysis and simulation of operational conditions of thermal systems and facility functions
- Must be able to setup a numerical model of the control system/design
- Must be able to device and perform control of a building HVAC system
- Must be able to prescribe functional requirements for building systems control

Competencies:

- Must be able to choose and compare different control designs and regulator types
- Must be able to establish evaluate and reflect on control of building energy systems

Type of instruction: Lectures, etc. supplemented with project work, workshops, presentation seminars, lab tests.

Exam format: Individual oral or written exam. Exam format is decided on by start of semester.

Evaluation criteria: Are stated in the Framework Provisions.

Environmental Assessment Methods and LCC Analysis
Bæredygtige vurderingsmetoder og LCC analyse

Prerequisites: Corresponding to having passed the 2st semester

Objective: Students who complete the module:

Knowledge:

- Must have knowledge about the design philosophy and calculation methods which can be used to minimize the environmental impact of a building throughout its life cycle
- Must have knowledge about the energy and environmental assessment of buildings including material production and transportation, building construction, operation, refurbishment, recycling, demolition and removal
- Must have knowledge about sustainable technologies and environmental design concepts
- Must have knowledge about assessment and certification methods for high performance buildings
- Must have knowledge about LCC analysis
- Must have knowledge about Cost Optimization

Skills:

- Must be able to perform a Life Cycle Assessment a building
- Must be able to evaluate buildings by using assessment and certification methods for high performance buildings
- Must be able to perform a LCC analysis
- Must be able to automate basic cost optimization

Competencies:

- Must be able to discuss and reflect on the prospects and limitations of Environmental Assessment Methods and Tools
- Can evaluate methodologies of building certification methods
- Must be able to evaluate and choose between different building designs based on LCC Analysis and Cost Optimization
- Must be able to discuss and reflect on the prospects and limitations of LCC Analysis and Cost Optimization

Type of instruction: Lectures, etc. supplemented with project work, workshops, presentation seminars, lab tests.

Exam format: Individual oral or written exam. Exam format is decided on by start of semester.

Evaluation criteria: Are stated in the Framework Provisions.

Indoor Environmental Analysis and Measurements
Analyse og måling af indeklima

Prerequisites: Corresponding to the admission requirements

Objective: Students who complete the module:

Knowledge

- Must have knowledge of functional demands regulatory requirements and standards regarding sizing and measuring the indoor environment
- Must have basic knowledge of the factors influencing the indoor environment and be able to asses the importance of the individual factors importance including adaptive comfort and productivity
- Must have knowledge about measuring and calibration technique within indoor environment and building energy

Skills

- Must be able to conduct an analyse of the interplay between the indoor environment and building energy use
- Must be able to set up functional requirements for the indoor environment
- Must be able to asses the indoor environment according to comfort productivity and energy use
- Must be able to perform relevant measurements of the indoor environment and building energy use

Competencies

- Must be able to participate in a dialogue regarding optimal choice of indoor environment level compared to building type and use
- Must be able to argue for the chosen level of indoor environment to all parties in the building sector
- Must be able to evaluate and reflect on the measured indoor environment and energy use including the used experimental methods and uncertainty of the measurements

Type of instruction: Project work with supervision possibly supplemented with instructions, workshops, presentation seminars, lab tests, etc.

Exam format: Individual oral exam based on presentation seminar and project rapport.

Evaluation criteria: Are stated in the Framework Provisions.

Introduction to PBL, Heat and Moisture Transport in Building
Introduktion til PBL, Hygrotermisk bygningsfysik

Prerequisites: Corresponding to the admission requirements

Objective: Students who complete the module:

Knowledge

- Must have knowledge and understanding of project organized problem-based learning
- Must have knowledge about group work/conflicts and ways to solve conflicts
- Must have knowledge and comprehension of planning and structuring the documentation of a project
- Must have knowledge of basic mathematics
- Must be able to understand heat transfer in the building envelope
- Must be able to understand moisture transport in the building envelope
- Must be able to understand rules and calculation methods for building energy consumption
- Must be able to account for the hygro thermal functional demands regarding materials and constructions used in the building envelope

Skills

- Must be able to apply the project organized learning to actual problem related work in groups
- Must be able to apply systematic methods
- Must be able to set up hygro thermal functional requirements regarding the building envelope and materials
- Must be able to size the building envelope according to hygro thermal functional demands
- Must be able to size the linear thermal transmittance using numerical simulations
- Must be able to conduct a blower door test of a building

Competencies

- Independently be able to define and analyse scientific problems
- Must be able to establish, evaluate and reflect on models on the essential problems within heat and moisture transport in buildings
- Must be able to apply proper terminology in oral, written and graphical communication and documentation of problems and solutions within sizing the building envelope

Type of instruction: Project work with supervision possibly supplemented with instructions, workshops, presentation seminars, lab tests, etc.

Exam format: Individual oral exam based on presentation seminar and project rapport.

Evaluation criteria: Are stated in the Framework Provisions.

Master's Thesis
Kandidatspeciale

Prerequisites: Successful completion of the first three semesters of the master programme.

Objective: Students who complete the module:

Knowledge:

- Have knowledge and comprehension within the field of the specialization at the highest international level
- Be able to critically evaluate knowledge and identify new scientific problems within the field of the specialization
- Have understanding of implications within the related research area including research ethics

Skills:

- Independently explain choice of scientific theoretical and/or experimental methods
- During the project and when finalising it make an independent and critical estimation of the chosen theories and methods as well as the analyses, results and conclusions
- Be able to apply a wide range of methods in research and development in the field of specialization
- Be able to communicate relevant scientific and professional aspects of project work in a clear and systematic way both to specialists and the public

Competencies:

- Be able to work independently with a project on a specific problem within the field of the specialization at the highest international level
- Independently be able to define and analyse scientific problems and based on that make and state the reasons for the decisions made
- Be competent to solve new and complicated technical problems by the use of advanced mathematics, scientific and technological knowledge
- Be able to evaluate the progress of the project independently and select and include additional literature, experiments or data when needed in order to maintain a scientific basis for the project
- Be able to control complex and unexpected working situations and be able to develop new solutions
- Can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility
- Must be able to communicate the results of the project work in a project report

Type of instruction: Project work with supervision possibly supplemented with instructions, workshops, presentation seminars, lab tests, etc.

Exam format: Oral exam based on presentation seminar and project rapport.

Evaluation criteria: Are stated in the Framework Provisions.