AALBORG UNIVERSITET

CURRICULUM FOR THE MASTER OF SCIENCE (MSC) PROGRAMME IN ENERGY ENGINEERING 2017

MASTER OF SCIENCE (MSC) IN ENGINEERING
AALBORG

Link til denne studieordning

INDHOLDSFORTEGNELSE

§ 1: PREFACE

Pursuant to Act 261 of March 18, 2015 on Universities (the University Act) with subsequent changes, the following curriculum for the Master of Science programme in Energy Engineering is stipulated. The programme also follows the Joint Programme Regulations and the Examination Policies and Procedures of the Faculty of Engineering and Science.

The Master of Science programme in Energy Engineering is a two-year education which contains in total 6 specialisations within the areas of thermal, electrical and mechatronic control engineering.

- Thermal Energy and Process Engineering
- Fuel Cells and Hydrogen Technology
- Wind Power Systems
- Power Electronics and Drives
- Electrical Power Systems and High Voltage Engineering
- Mechatronic Control Engineering

The programme gives a possibility to obtain advanced skills in areas as for instance efficient use of energy, renewables, control engineering and energy distribution technology.

§ 2: BASIS IN MINISTERIAL ORDERS

The Master's programme is organised in accordance with the Ministry of Higher Education and Science's Order no. 1328 of November 15, 2016 on Bachelor's and Master's Programmes at Universities (the Ministerial Order of the Study Programmes) and Ministerial Order no. 1062 of June 30, 2016 on University Examinations (the Examination Order). Further reference is made to Ministerial Order no. 258 of March 18, 2015 (the Admission Order) and Ministerial Order no. 114 of February 3, 2015 (the Grading Scale Order).

§ 3: CAMPUS

The programme is offered in Aalborg.

§ 4: FACULTY AFFILIATION

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

§ 5: STUDY BOARD AFFILIATION

The Master's programme falls under the Study Board of Energy

§ 6: AFFILIATION TO CORPS OF EXTERNAL EXAMINERS

The Master's programme is affiliated to the nationwide engineering examiners corps: Ingeniøruddannelsernes landsdækkende censorkorps – Electrical or Mechanical depending on the specialisation..

§ 7: ADMISSION REQUIREMENTS

Applicants with a legal claim to admission:

Applicants with the following degree are entitled to admission to the Master of Science programme in Energy Engineering:

- Bachelor of Science (BSc) in Energy Engineering, Aalborg University
- Bachelor of Engineering (BE) in Sustainable Energy, Aalborg University

Applicants without a legal claim to admission:

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

§ 8: THE PROGRAMME TITLE IN DANISH AND ENGLISH

The Master's programme entitles the graduate to the designation Civilingeniør, cand.polyt. i energiteknik. The English designation is: Master of Science (MSc) in Engineering (Energy Engineering).

The designation is applied with one of the following titles:

- Civilingeniør, cand.polyt. (candidatus/candidata polytechnices) i energiteknik med specialisering i termisk energi og procesteknik. The English designation is: Master of Science (MSc) in Engineering (Energy Engineering with specialisation in Thermal Energy and Process Engineering)
- Civilingeniør, cand.polyt. (candidatus/candidata polytechnices) i energiteknik med specialisering i brændselsceller og brintteknologi. The English designation is: Master of Science (MSc) in Engineering (Energy Engineering with specialisation in Fuel Cells and Hydrogen Technology)
- Civilingeniør, cand.polyt. (candidatus/candidata polytechnices) i energiteknik med specialisering i vindmølleteknologi. The English designation is: Master of Science (MSc) in Engineering (Energy Engineering with specialisation in Wind Power Systems)
- Civilingeniør, cand.polyt. (candidatus/candidata polytechnices) i energiteknik med specialisering i effektelektronik og elektriske drivsystemer. The English designation is: Master of Science (MSc) in Engineering (Energy Engineering with specialisation in Power Electronics and Drives)
- Civilingeniør, cand.polyt. (candidatus/candidata polytechnices) i energiteknik med specialisering i elektriske anlæg og højspændingsteknik. The English designation is: Master of Science (MSc) in Engineering (Energy Engineering with specialisation in Electrical Power Systems and High Voltage Engineering)
- Civilingeniør, cand.polyt. (candidatus/candidata polytechnices) i energiteknik med specialisering i mekatronisk reguleringsteknik. The English designation is: Master of Science (MSc) in Engineering (Energy Engineering with specialisation in Mechatronic Control Engineering)

§ 9: PROGRAMME SPECIFICATIONS IN ECTS CREDITS

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

§ 10: RULES CONCERNING CREDIT TRANSFER (MERIT), INCLUDING THE POSSIBILITY FOR CHOICE OF MODULES THAT ARE PART OF ANOTHER PROGRAMME AT A UNIVERSITY IN DENMARK OR ABROAD

The Study Board can approve successfully completed (passed) programme elements from other Master's programmes in lieu of programme elements in this programme (credit transfer). The Study Board can also approve successfully completed (passed) programme elements from another Danish programme or a programme outside of Denmark at the same level in lieu of programme elements within this curriculum. Decisions on credit transfer are made by the Study Board based on an academic assessment. See the Joint Programme Regulations for the rules on credit transfer.

§ 11: EXEMPTIONS

In exceptional circumstances, the Study Board 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.

§ 12: RULES FOR EXAMINATIONS

The rules for examinations are stated in the Examination Policies and Procedures published by the faculty on their website.

§ 13: 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 formulation and spelling 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 good language performance alone; similarly, an examination normally cannot be assessed as 'Fail' on the basis of poor language performance alone.

The Study Board 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 (or another foreign language: French, Spanish or German upon approval by the Study Board). If the project is written in English, the summary must be in Danish (The Study Board can grant exemption from this). The summary must be at least 1 page and not more than 2 pages (this is not included in any fixed minimum and maximum number of pages per student). The summary is included in the evaluation of the project as a whole.

§ 14: REQUIREMENTS REGARDING THE READING OF TEXTS IN A FOREIGN LANGUAGE

At programmes taught in Danish, it is assumed that the student can read academic texts in modern Danish, Norwegian, Swedish and English and use reference works, etc., in other European languages (German or other languages can also be mentioned here if relevant). At programmes taught in English, it is assumed that the student can read academic text and use reference works, etc., in English.

§ 15: COMPETENCE PROFILE ON THE DIPLOMA

The following competence profile will appear on the diploma:

A Candidatus graduate has the following competency profile:

A Candidatus graduate has competencies that have been acquired via a course of study that has taken place in a research environment.

A Candidatus graduate is qualified for employment on the labour market based on his or her academic discipline as well as for further research (PhD programmes). A Candidatus graduate has, compared to a Bachelor, developed his or her academic knowledge and independence so as to be able to apply scientific theory and method on an independent basis within both an academic and a professional context.

§ 16: COMPETENCE PROFILE OF THE PROGRAMME

The graduate of the Master of Science programme has the following qualifications:

Knowledge

- Knowledge about the state of the art of research within their field of specialisation
- Have knowledge on a scientific basis to reflect over subject areas related to energy engineering and identify scientific problems within that area
- Knowledge and insight into publication ethics in research
- Knowledge about the ethics related to the social, economic and en-vironmental impact of research
- Have knowledge and comprehension within innovation and entre-preneurship in relation to project work and courses
- Have advanced skills in probability theory and statistics, control theory, simulation techniques and optimisation

In addition, students from the different specialisations have the following knowledge:

- The specialisation in Thermal Energy and Process Engineering:
  - Advanced knowledge about and comprehension of the conversion and transport processes within advanced thermal and fluid systems
  - Knowledge about the design, modelling and optimisation of energy systems used in various energy conversion applica-tions
  - Knowledge about the detailed operation, functionality and interactions between the various components of key thermal energy conversion technologies
  - Detailed knowledge regarding system integration with re-spect to both system efficiency and control aspects of energy systems
- The specialisation in Fuel Cells and Hydrogen Technology:
  - Advanced knowledge about and comprehension of the conversion and transport processes within fuel cells and hydrogen systems
  - Understanding of the design, modelling and optimisation of energy systems used in various energy conversion applica-tions involving fuel cell and hydrogen production technology
  - Knowledge about the detailed operation, functionality and interaction between the various components used in fuel cell and hydrogen production systems
  - Have detailed knowledge about system integration with respect to both system efficiency and control aspects of fuel cell and hydrogen production systems

- The specialisation in Wind Power Systems:
  - Advanced knowledge about and comprehension of the electrical area of wind turbine technology i.e. generators, converters, connection of wind turbines to the network grid and analysis of the systems under stationary and contingency situations
  - Knowledge about how to apply test methods and systems for high voltage components (non-destructive) according to applicable standards. This includes testing for electromagnetic compatibility
  - Knowledge and comprehension within operation and control of wind turbines and wind farms
  - Knowledge and comprehension within optimisation theory and its application on wind farms and electrical systems
- The specialisation in Power Electronics and Drives:
  - Advanced knowledge and comprehension within efficient usage of electrical energy, intelligent energy conversion us-ing power electronic systems and electrical machines
  - Understanding of the operation, function and interaction between various components and sub-systems used in power electronic converters, electric machines and adjustable-speed drives
  - Knowledge enabling the design, modelling, simulation and synthesis of power converter-based systems used for con-version of electric energy
- The specialisation in Electrical Power Systems and High Voltage Engineering:
  - Advanced knowledge and comprehension within production, transmission, distribution and consumption of electric energy both under stationary and contingency situations using the newest technologies in the power system field
  - Knowledge about how to apply test methods and systems for high voltage components (non-destructive) according to applicable standards. This includes testing for electromag-netic compatibility
- The specialisation in Mechatronic Control Engineering:
  - Knowledge and comprehension within advanced control engineering and understanding of the synergistic aspects in combining mechanical, thermal, electric and control tech-nologies in the design process when designing mechatronic systems
  - Understanding of the importance of physical and mathe-matical modelling in mechatronic system design
  - Understanding of more advanced control techniques, e.g. multi-variable control, sliding mode control, adaptive con-trol, feedback linearization, etc.

Skills

- Be proficient in the scientific methods, tools and general skills related to employment within the subjects of energy engineering
- Be able to obtain advanced skills in simulation techniques and mathematical methods
- Be able to evaluate and select among the scientific theories, methods, tools and general skills of the subject area(s) and, on a scientific basis, develop new analyses and solutions
- Be able to communicate research-based knowledge and discuss professional and scientific problems with both peers and non-specialists
- Be able to obtain skills which are related to his/her field within energy engineering
- Be able to use advanced laboratory test set-ups and data collection methods

In addition, the different specialisations have the following skills:

- The specialisation in Thermal Energy and Process Engineering:
  - The ability to develop, construct and understand the operation of thermal energy conversion systems in the laboratory and in real applications
- The specialisation in Fuel Cells and Hydrogen technology:
  - The ability to construct and understand the operation of fuel cell based systems in the laboratory and in real applications
  - Analytical skills in system integration with respect to system efficiency and control aspects of fuel cell energy systems
- The specialisation in Wind Power Systems:
  - The ability to analyse the dynamic behaviour of wind turbine systems when they are connected to a power system with varying loads
  - The ability to analyse the load flow in wind power systems, including reactive power flow and the ability to analyse the stability in wind power systems
  - The ability to analyse the power quality of the system and to determine the need for power compensation
  - The ability to synthesise control systems for different types of wind turbine systems and to analyse the power electronic interface between wind turbines and grids
  - The ability to implement optimisation in a wind farm and design its electrical system
- The specialisation in Power Electronics and Drives:
  - Experience in the design of controllers for power electronic drive systems using classical and modern control theory
  - Experience with the practical implementation of controllers using for example digital signal processors

    - The ability to develop, construct, operate and test power electronic converters and drives in the laboratory
    - Experience in relation to renewable energy and grid connected converters
- The specialisation in Electrical Power Systems and High Voltage Engineering:
    - The ability to apply different methods of analysis and synthesis for design and simulation of various electrical power systems both in stationary and in contingency situations
    - The ability to apply different control and surveillance systems for control of the network grid. This will include power system protection and the application of power electronic compensation units
- The specialisation in Mechatronic Control Engineering:
    - The ability to include the controller design as an integrated part of the mechatronic design process
    - The ability to apply different methods of analysis and synthesis for design and simulation of various mechatronic systems

Competences

- Be able to demonstrate an understanding of research work and be able to become a part of the research environment
- Be able to manage work and development in situations that are complex, unpredictable and require new solutions within the area of energy engineering
- Be able to independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility
- Be able to independently take responsibility for own professional development and specialisation and be able to collaborate in groups according to the PBL Model
- Upon completion of the MSc programme the student has achieved advanced professional competence in production, distribution and the usage of electrical, thermal and /or mechanical energy together with design, control and optimisation of energy or mechatronic systems
- The competences should advance the students ability to perform in functions within planning, development, consulting and research in Danish as well as international industries or public institutions. Examples could be research and development departments or managing positions in energy supply companies, the wind-, machine-, or process industry together with electro-technical- and consultancy companies, etc.

§ 17: STRUCTURE AND CONTENTS OF THE PROGRAMME

The programme is structured in modules and organised as a problem based study. A module is a programme element or a group of programme 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. Examination formats are defined in the modules of the present curriculum.

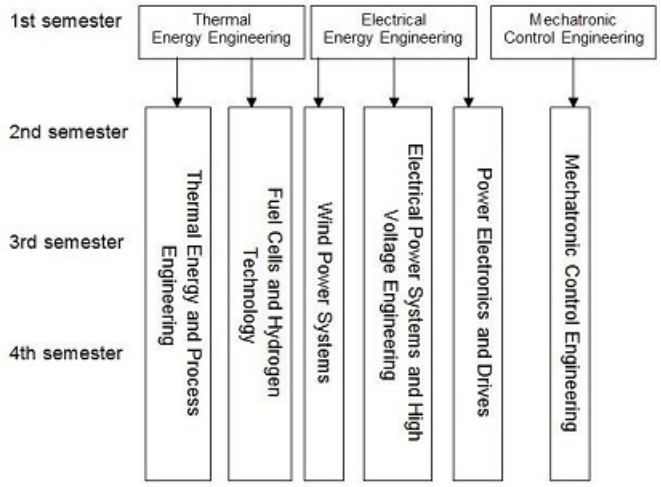
The programme is based on a combination of academic, problem oriented and interdisciplinary approaches and organised based on the following types of instruction that combine skills and reflection:

- lectures
- project work
- workshops
- exercises (individually and in groups)
- teacher feedback
- reflection
- portfolio work
- study circle
- self-study

1st to 4th semesters of the programme are taught in English, and projects are to be written in English.

The structure of the Master of Science study programme is shown in the following figure

MSc Programme in Energy Engineering



Background (Objective of 1st semester)

The objective of the 1st semester on the Master of Science programme in Energy Engineering is to prepare the students to follow one of the six specialisations offered:

- Thermal Energy and Process Engineering
- Fuel Cells and Hydrogen Technology
- Wind Power Systems
- Power Electronics and Drives
- Electrical Power Systems and High Voltage Engineering
- Mechatronic Control Engineering

To qualify for the 1st semester of the Master of Science programme in Energy Engineering, 5 routes are approved for students who have followed the Bachelor's study programme in Energy at Aalborg University:

- Electrical Energy Engineering (Aalborg Campus)
- Thermal Energy Engineering (Aalborg Campus)
- Mechatronics (Aalborg Campus)
- Thermal Processes (Esbjerg Campus)
- Dynamic Systems (Esbjerg Campus)

For students with a Bachelor's degree from another university an introductory 1st semester is mandatory (called INTRO semester), in which a basic course is taught to familiarize the students with Problem Based Learning, besides the engineering courses belonging to the specialisation. Furthermore, an extra course in Control Theory and Matlab is held for the INTRO semester students.

Content (Project work on 1st semester)

For all students
1st semester contains engineering subjects (courses and project work) in the area of the chosen specialisation.

For students with a Bachelor's degree from Aalborg University
The students are required to acquire knowledge about scientific English and the project work will be documented by a scientific paper, a summary report, a poster and a presentation at a conference, all in English.

For students with a Bachelor's degree from another university (INTRO semester students)

Here the focus is on the problem based, project organised learning method used at Aalborg University. The students will write a project report documenting their project work. The students must attend “Project Based Learning and Project Management” to gain knowledge about the problem based teaching method used at Aalborg University.

§ 18: OVERVIEW OF THE PROGRAMME

All modules are assessed through individual grading according to the 7-point grading scale or Passed/Not passed. All modules are assessed by the supervisor/lecturer together with an external examiner (external assessment) or with an additional examiner (internal assessment) or by assessment by the supervisor/lecturer only.

Control Theory and MATLAB (INTRO): For international students only.

3rd semester: The student may follow a relevant study as a guest student (30 ECTS) at another university in Denmark or abroad, see details in Moodle. **However the student’s special preferences for the semester must be approved by the Study Board in advance**.

Instead of doing the project work and the elective courses, the student can do project work in a company as an individual or as a part of a group. See details in Moodle. **However the student’s special preferences for the semester must be approved by the Study Board in advance.**

Offered as: 1-professional Specialisation: Thermal Energy and Process Engineering					
Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method
1 SEMESTER					
Fluid Mechanical Analysis Methods	Project	15	7-point grading scale	Internal examination	Oral exam based on a project
Problem Based Project Organised Learning in Thermo-Mechanical Analysis Methods (INTRO)	Project	10	7-point grading scale	Internal examination	Oral exam based on a project
Computational Fluid Dynamics (CFD) and Multiphase Flow	Course	5	7-point grading scale	Internal examination	Oral exam
Fluid Mechanics and Compressible Flow	Course	5	7-point grading scale	Internal examination	Oral exam
Probability Theory, Stochastic Processes and Applied Statistics	Course	5	7-point grading scale	Internal examination	Written or oral exam
Control Theory and MATLAB (INTRO)	Course	5	7-point grading scale	Internal examination	Written exam
2 SEMESTER					
Modelling and Optimisation of Energy Systems	Project	15	7-point grading scale	External examination	Oral exam based on a project
Fuel Conversion and Production	Course	5	7-point grading scale	Internal examination	Oral exam
Chemical Reactors and Process Systems	Course	5	7-point grading scale	Internal examination	Oral exam
Optimisation Theory and Reliability	Course	5	7-point grading scale	Internal examination	Written exam
3 SEMESTER					
Optimisation, Analysis and Control of Thermal Energy and Processing Systems	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
Voluntary Traineeship	Project	30	7-point grading scale	Internal examination	Oral exam based on a project
4 SEMESTER					

Master's Thesis	Project	30	7-point grading scale	External examination	Oral exam based on a project
Master's Thesis	Project	50	7-point grading scale	External examination	Oral exam based on a project

Offered as: 1-professional Specialisation: Fuel Cells and Hydrogen Technology					
Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method
1 SEMESTER					
Fluid Mechanical Analysis Methods	Project	15	7-point grading scale	Internal examination	Oral exam based on a project
Problem Based Project Organised Learning in Thermo-Mechanical Analysis Methods (INTRO)	Project	10	7-point grading scale	Internal examination	Oral exam based on a project
Computational Fluid Dynamics (CFD) and Multiphase Flow	Course	5	7-point grading scale	Internal examination	Oral exam
Fluid Mechanics and Compressible Flow	Course	5	7-point grading scale	Internal examination	Oral exam
Probability Theory, Stochastic Processes and Applied Statistics	Course	5	7-point grading scale	Internal examination	Written or oral exam
Control Theory and MATLAB (INTRO)	Course	5	7-point grading scale	Internal examination	Written exam
2 SEMESTER					
Modelling and Optimisation of Fuel Cell Systems	Project	15	7-point grading scale	External examination	Oral exam based on a project
Fuel Conversion and Production	Course	5	7-point grading scale	Internal examination	Oral exam
Chemical Reactors and Process Systems	Course	5	7-point grading scale	Internal examination	Oral exam
Optimisation Theory and Reliability	Course	5	7-point grading scale	Internal examination	Written exam
3 SEMESTER					
Optimisation, Analysis and Control of Fuel Cell and Hydrogen Technology Systems	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
Voluntary Traineeship	Project	30	7-point grading scale	Internal examination	Oral exam based on a project
4 SEMESTER					
Master's Thesis	Project	30	7-point grading scale	External examination	Oral exam based on a project
Master's Thesis	Project	50	7-point grading scale	External examination	Oral exam based on a project

Offered as: 1-professional Specialisation: Wind Power Systems

Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method
1 SEMESTER					
Dynamics in Electrical Energy Engineering	Project	15	7-point grading scale	Internal examination	Oral exam based on a project
Problem Based Project Organised Learning in Dynamics in Electrical Energy Engineering (INTRO)	Project	10	7-point grading scale	Internal examination	Oral exam based on a project
Dynamic Modelling of Electrical Machines and Control Systems	Course	5	7-point grading scale	Internal examination	Written exam
High Voltage Engineering and EMI/EMC	Course	5	7-point grading scale	Internal examination	Written exam
Probability Theory, Stochastic Processes and Applied Statistics	Course	5	7-point grading scale	Internal examination	Written or oral exam
Control Theory and MATLAB (INTRO)	Course	5	7-point grading scale	Internal examination	Written exam
2 SEMESTER					
Interaction between Wind Power Generation Units and Electrical Loads or Power System	Project	15	7-point grading scale	External examination	Oral exam based on a project
Advanced Course in Electrical Power Systems	Course	5	7-point grading scale	Internal examination	Written exam
Advanced Power Electronics and Applications	Course	5	7-point grading scale	Internal examination	Oral exam
Optimisation Theory and Reliability	Course	5	7-point grading scale	Internal examination	Written exam
3 SEMESTER					
Advanced Project in Wind Power Systems	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
Voluntary Traineeship	Project	30	7-point grading scale	Internal examination	Oral exam based on a project
4 SEMESTER					
Master's Thesis	Project	30	7-point grading scale	External examination	Oral exam based on a project

Master's Thesis	Project	50	7-point grading scale	External examination	Oral exam based on a project

Offered as: 1-professional Specialisation: Power Electronics and Drives					
Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method
1 SEMESTER					
Dynamics in Electrical Energy Engineering	Project	15	7-point grading scale	Internal examination	Oral exam based on a project
Problem Based Project Organised Learning in Dynamics in Electrical Energy Engineering (INTRO)	Project	10	7-point grading scale	Internal examination	Oral exam based on a project
Dynamic Modelling of Electrical Machines and Control Systems	Course	5	7-point grading scale	Internal examination	Written exam
High Voltage Engineering and EMI/EMC	Course	5	7-point grading scale	Internal examination	Written exam
Probability Theory, Stochastic Processes and Applied Statistics	Course	5	7-point grading scale	Internal examination	Written or oral exam
Control Theory and MATLAB (INTRO)	Course	5	7-point grading scale	Internal examination	Written exam
2 SEMESTER					
Control of Power Electronic Systems	Project	15	7-point grading scale	External examination	Oral exam based on a project
Control of Electrical Drive Systems and Converters	Course	5	7-point grading scale	Internal examination	Written exam
Advanced Power Electronics and Applications	Course	5	7-point grading scale	Internal examination	Oral exam
Optimisation Theory and Reliability	Course	5	7-point grading scale	Internal examination	Written exam
3 SEMESTER					
Advanced Project in Power Electronics and Drives	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
Voluntary Traineeship	Project	30	7-point grading scale	Internal examination	Oral exam based on a project
4 SEMESTER					
Master's Thesis	Project	30	7-point grading scale	External examination	Oral exam based on a project
Master's Thesis	Project	50	7-point grading scale	External examination	Oral exam based on a project

Offered as: 1-professional Specialisation: Mechatronic Control Engineering					
Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method
1 SEMESTER					

Control of a Hydraulically Actuated Mechanical Structure	Project	15	7-point grading scale	Internal examination	Oral exam based on a project
Problem Based Problem Organised Learning in Control of a Hydraulically Actuated Mechanical Structure (INTRO)	Project	10	7-point grading scale	Internal examination	Oral exam based on a project
Dynamic Modelling of Electrical Machines and Control Systems	Course	5	7-point grading scale	Internal examination	Written exam
Non-linear Control and Multi-body Systems	Course	5	7-point grading scale	Internal examination	Written or oral exam
Probability Theory, Stochastic Processes and Applied Statistics	Course	5	7-point grading scale	Internal examination	Written or oral exam
Control Theory and MATLAB (INTRO)	Course	5	7-point grading scale	Internal examination	Written exam
2 SEMESTER					
Advanced Control of Electrical Machines	Project	15	7-point grading scale	External examination	Oral exam based on a project
Control of Electrical Drive Systems and Converters	Course	5	7-point grading scale	Internal examination	Written exam
Multi Variable Control	Course	5	7-point grading scale	Internal examination	Written or oral exam
Optimisation Theory and Reliability	Course	5	7-point grading scale	Internal examination	Written exam
3 SEMESTER					
Mechatronic Systems	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
Voluntary Traineeship	Project	30	7-point grading scale	Internal examination	Oral exam based on a project
4 SEMESTER					
Master's Thesis	Project	30	7-point grading scale	External examination	Oral exam based on a project
Master's Thesis in Mechatronic Control Engineering (long Master's Thesis)	Project	50	7-point grading scale	External examination	Oral exam based on a project

Offered as: 1-professional

Specialisation: Electric Power Systems and High Voltage Engineering

Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method
1 SEMESTER					
Dynamics in Electrical Energy Engineering	Project	15	7-point grading scale	Internal examination	Oral exam based on a project
Problem Based Project Organised Learning in Dynamics in Electrical Energy Engineering (INTRO)	Project	10	7-point grading scale	Internal examination	Oral exam based on a project

Dynamic Modelling of Electrical Machines and Control Systems	Course	5	7-point grading scale	Internal examination	Written exam
High Voltage Engineering and EMI/EMC	Course	5	7-point grading scale	Internal examination	Written exam
Probability Theory, Stochastic Processes and Applied Statistics	Course	5	7-point grading scale	Internal examination	Written or oral exam
Control Theory and MATLAB (INTRO)	Course	5	7-point grading scale	Internal examination	Written exam
2 SEMESTER					
Modern Electrical Power Systems Analysis	Project	15	7-point grading scale	External examination	Oral exam based on a project
Advanced Course in Electrical Power Systems	Course	5	7-point grading scale	Internal examination	Written exam
Advanced Power Electronics and Applications	Course	5	7-point grading scale	Internal examination	Oral exam
Optimisation Theory and Reliability	Course	5	7-point grading scale	Internal examination	Written exam
3 SEMESTER					
Advanced Project in Electrical Power Systems and High Voltage Systems	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
Voluntary Traineeship	Project	30	7-point grading scale	Internal examination	Oral exam based on a project
4 SEMESTER					
Master's Thesis	Project	30	7-point grading scale	External examination	Oral exam based on a project
Master's Thesis	Project	50	7-point grading scale	External examination	Oral exam based on a project

Elective courses on 3rd semester MSc

In addition to the project work, the students should choose 10 ECTS courses on the 3rd semester MSc. The Study Board of Energy offers a portfolio of various, elective courses covering the technical aspects for the thermal, electrical, mechatronic and offshore specialisations with reference to well-defined research programmes which reflect the current research focus of the Department of Energy Technology. Each year the Study Board of Energy selects a number of the courses below to be announced as the year's elective courses (6 to 10). Based on the number of students assigned to each of these courses, 2 to 6 courses will be taught covering broadly all specialisations.

The elective courses approved by the Study Board of Energy are given in the following overview

Non-linear Control and Multi-body Systems: This course is not offered to the students on the Mechatronic Control Engineering specialisation since they have already had this course.

Courses from other specialisations at Aalborg University or from other universities might be relevant too. Nevertheless, the courses must be approved by the Study Board of Energy in advance.

Elective Courses Energy Engineering					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Advanced Analysis of Thermal Machines	Course	5	7-point grading scale	Internal examination	Written and oral exam
Advanced Modelling and Control of Voltage Source Converters	Course	5	7-point grading scale	Internal examination	Written and oral exam

Analysis of Advanced Thermal Process Systems	Course	5	7-point grading scale	Internal examination	Oral exam
Battery Energy Storage Systems	Course	5	7-point grading scale	Internal examination	Written and oral exam
Biomass Conversion and Biofuels	Course	5	7-point grading scale	Internal examination	Written and oral exam
Biomass Gasification, Combustion and their Advanced Modelling	Course	5	7-point grading scale	Internal examination	Oral exam
Control of Grid Connected Photovoltaic and Wind Turbine Systems	Course	5	7-point grading scale	Internal examination	Written and oral exam
Electrochemical Modelling of Fuel Cells, Electrolysers and Batteries	Course	5	7-point grading scale	Internal examination	Oral exam
Energy Conversion and Storage in Future Energy Systems	Course	5	7-point grading scale	Internal examination	Written and oral exam
Fault Tolerant Control	Course	5	7-point grading scale	Internal examination	Written exam
Future Power System in Denmark	Course	5	7-point grading scale	Internal examination	Written and oral exam
Modern Electrical Drives	Course	5	7-point grading scale	Internal examination	Written and oral exam
Modern Power Electronic Devices and their Models	Course	5	7-point grading scale	Internal examination	Written and oral exam
Non-linear Control and Multi-body Systems	Course	5	7-point grading scale	Internal examination	Written or oral exam
System Identification and Diagnosis	Course	5	7-point grading scale	Internal examination	Oral exam
Test and Validation	Course	5	Passed/Not Passed	Internal examination	Written and oral exam
Wind Power System and Renewable Energy Grid Integration	Course	5	7-point grading scale	Internal examination	Written and oral exam

§ 19: ADDITIONAL INFORMATION

All students, who have not participated in Aalborg University's PBL introductory course during their Bachelor's degree, must attend the introductory course "Problem-based Learning and Project Management". The introductory course must be approved before the student can participate in the project exam. For further information, please see the School of Engineering and Science's website on Problem Based Learning and Project Management.

The current version of the study curriculum is published on the Aalborg University website for study curricula.

Additional information about semester descriptions is available in Moodle which is the school room for School of Engineering and Science (SES). Moodle provides study-related information, i.e. course descriptions, course literature, timetables and information about activities and events.

§ 20: COMMENCEMENT AND TRANSITIONAL RULES

The curriculum is approved by the Dean of Faculty of Engineering and Science and enters into force as of September 2017 for all new, enrolled students.

Students who wish to complete their studies under the previous curriculum from 2012 must conclude their education by the summer examination period 2018 at the latest, since examinations under the previous curriculum are not offered after that date.

§ 21: AMENDMENTS TO THE CURRICULUM AND REGULATIONS

Minor editorial changes have been made in connection with the digitisation of the study curriculum.