



AALBORG UNIVERSITET

# **CURRICULUM FOR THE MASTER'S PROGRAMME IN ADVANCED POWER ELECTRONICS 2019**

MASTER OF SCIENCE (MSC) IN ENGINEERING  
ESBJERG

[Link to this studyline](#)

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## § 1: PREFACE

Pursuant to consolidation Act 172 of February 27, 2018 on Universities (the University Act) with subsequent changes, the following curriculum is established. The programme also follows the Joint Programme Regulations and the Examination Policies and Procedures of The Faculty.

## § 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) with subsequent changes and Ministerial Order no. 1062 of June 30, 2016 on University Examinations (the Examination Order) with subsequent changes. Further reference is made to Ministerial Order no. 106 of February 12, 2018 (the Admission Order) and Ministerial Order no. 114 of February 3, 2015 (the Grading Scale Order).

## § 3: CAMPUS

The programme is offered in Esbjerg.

## § 4: FACULTY AFFILIATION

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

## § 5: STUDY BOARD AFFILIATION

The Master's programme falls under the Study Board of Build, Energy, Electronics and Mechanics in Esbjerg

## § 6: AFFILIATION TO CORPS OF EXTERNAL EXAMINERS

The Master's programme is affiliated to the Nationwide engineering examiners/Electronics, IT and Energy (Electromagnetic direction)

## § 7: ADMISSION REQUIREMENTS

### Applicants with a legal right of admission (retskrav):

- Bachelor of Science (BSc) in Engineering (Applied Industrial Electronics), Aalborg University

### Applicants without legal right of admission:

- Bachelor of Science (BSc) in Engineering (Energy Engineering with specialisation in Electrical Energy), Aalborg University
- Bachelor of Science (BSc) in Engineering (Energy Engineering with specialisation in Mechatronics), Aalborg University
- Bachelor of Science (BSc) in Engineering (Energy Engineering with specialisation in Dynamic Systems), Aalborg University

Students with the following bachelor's degrees might be admitted if they have chosen electable courses with a minimum of 5 ECTS within electrical machines and 5 ECTS within power electronics:

- Bachelor of Science in Electrical Engineering from Danish Technical University
- Bachelor of Engineering in Electrical Engineering from Danish Technical University
- Bachelor of Engineering in Electronics from Southern Danish University
- Bachelor of Engineering in Electrical Power Technology from Aarhus University

## § 8: THE PROGRAMME TITLE IN DANISH AND ENGLISH

The Master's programme entitles the graduate to the designation: Civilingeniør, Cand. polyt. i avanceret effektelektronik. The English designation is: Master of Science (MSc) in Engineering (Advanced Power Electronics).

## **§ 9: PROGRAMME SPECIFICATIONS IN ECTS CREDITS**

The Master's programme is a 2-year, research-based, full-time study programme. 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 at this website: <https://www.studieservice.aau.dk/Studielegalitet/>

## **§ 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**

It is assumed that the student can read academic texts in his or her native language as well as in English and use reference works, etc., in other European languages.

## **§ 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's 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 advanced power electronics and identify scientific problems within that area
- Knowledge about the ethics related to the social, economic and environmental impact of research
- Have knowledge and comprehension within innovation and entrepreneurship in relation to project work and courses
- Have advanced skills in probability theory and statistics, reliability, system identification and diagnosis, advanced control methods, simulation techniques and optimisation
- Have knowledge about artificial intelligence
- Advanced knowledge and comprehension within efficient usage of electrical energy, intelligent energy conversion using power electronic systems and electrical machines
- Understanding of the operation, function and interaction between various components and sub-systems used in power electronic converters, electrical machines and adjustable speed drives
- Knowledge enabling the design, modelling, simulation and synthesis of power converter-based systems used for conversion of electrical energy

## *Skills*

- Be proficient in the scientific methods, tools and general skills related to employment within the subjects of advanced power electronics
- Have obtained 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 advanced power electronics
- Be able to use advanced laboratory test set-ups and data collection methods
- 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

## *Competences*

- Be able to demonstrate an understanding of research work and be able to become a part of a 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 competences in advanced power electronics and electrical machines together with design, control and optimisation of energy or mechatronic systems
- The competences should advance the student's 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 top management positions in energy supply companies, such as wind power, machine manufacturing, or process industries as well as 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. Examinations are defined in the curriculum.

The programme 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:

- 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.

## § 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.

An overview of the four semesters is shown in the table below

Offered as: 1-professional					
Module name	Course type	ECT S	Applied grading scale	Evaluation method	Assessment method
<b>1 SEMESTER</b>					
<a href="#">Diagnosis and Maintenance</a>	Project	10	7-point grading scale	Internal examination	Oral exam based on a project
<a href="#">System Identification and Diagnosis</a>	Course	5	7-point grading scale	Internal examination	Oral exam
<a href="#">Condition Monitoring and Product Life Cycle Management</a>	Course	5	7-point grading scale	Internal examination	Written or oral exam
<a href="#">Probability Theory, Stochastic Processes and Applied Statistics</a>	Course	5	7-point grading scale	Internal examination	Written or oral exam
<a href="#">Elective Courses 1st Semester</a> One course must be chosen	Course	5			
<b>2 SEMESTER</b>					
<a href="#">Control of Power Electronic Systems</a>	Project	15	7-point grading scale	External examination	Oral exam based on a project
<a href="#">Non-linear Control and Reliability</a>	Course	5	7-point grading scale	Internal examination	Oral exam
<a href="#">Dynamic Modelling of Electrical Machines and Control Systems</a>	Course	5	7-point grading scale	Internal examination	Written exam
<a href="#">Advanced Power Electronics and Applications</a>	Course	5	7-point grading scale	Internal examination	Oral exam
<b>3 SEMESTER</b>					

Option 1					
<a href="#">Advanced Control in Industrial Electronics</a>	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
<a href="#">Project Oriented Study in an External Organisation</a>	Project	10	7-point grading scale	Internal examination	Oral exam based on a project
3 SEMESTER					
Option 2					
<a href="#">Advanced Control in Industrial Electronics</a>	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
<a href="#">Elective Courses 3rd Semester</a> Two courses must be chosen	Course	10			
4 SEMESTER					
Master's Thesis					
<a href="#">Master's Thesis</a>	Project	30	7-point grading scale	External examination	Oral exam based on a project

### Elective modules

*1st semester:* One of the following modules: "Scientific paper and conference on diagnosis and maintenance" or "Control theory and MATLAB" must be chosen (total 5 ECTS).

*3rd semester:*

Option 1: The student can do project oriented study in an external organisation jointly with the module "Advanced Control in Industrial Electronics" as an individual or as a part of a group. **However the student's special preferences for the semester must be approved by the Study Board in advance.**

Option 2: You can combine the project module "Advanced Control in Industrial Electronics" (20 ECTS) with elective courses (10 ECTS) at AAU. Please see the courses below.

Option 3: On the 3rd semester you may follow a relevant study as a guest student (30 ECTS) at another university in Denmark or abroad. You must send an application to the Study Board before the study is commenced, where you apply for a preapproved credit transfer of the contents of the modules at the other university.

Elective Courses 1st Semester					
One course must be chosen					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
<a href="#">Scientific Paper and Conference on Diagnosis and Maintenance (elective)</a>	Project	5	Passed/Not Passed	Internal examination	Oral exam based on a project
<a href="#">Control Theory and MATLAB</a>	Course	5	7-point grading scale	Internal examination	Written exam

### Elective courses on 3rd semester MSc

In addition to the project work "Advanced Control in Industrial Electronics", the students can choose 10 ECTS courses on the 3rd semester. The Study Board of Energy offers a portfolio of elective courses covering the technical aspects for the Advanced power electronics programme 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.

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.**

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

Elective Courses 3rd Semester Two courses must be chosen					
Module name	Course type	ECT S	Applied grading scale	Evaluation Method	Assessment method
<a href="#">Artificial Intelligence</a>	Course	5	7-point grading scale	Internal examination	Written or oral exam
<a href="#">Adaptive and Predictive Control</a>	Course	5	7-point grading scale	Internal examination	Oral exam
<a href="#">Advanced Modelling and Control of Voltage Source Converters</a>	Course	5	7-point grading scale	Internal examination	Written and oral exam
<a href="#">Control of Grid Connected Photovoltaic and Wind Turbine Systems</a>	Course	5	7-point grading scale	Internal examination	Written and oral exam
<a href="#">Fault Tolerant Control</a>	Course	5	7-point grading scale	Internal examination	Written exam
<a href="#">Modern Electrical Drives</a>	Course	5	7-point grading scale	Internal examination	Written and oral exam
<a href="#">Modern Power Electronic Devices and their Models</a>	Course	5	7-point grading scale	Internal examination	Written and oral exam
<a href="#">Test and Validation</a>	Course	5	Passed/Not Passed	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. 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 the Faculty of Engineering and Science and enters into force as of September 2019.

## § 21: AMENDMENTS TO THE CURRICULUM AND REGULATIONS