

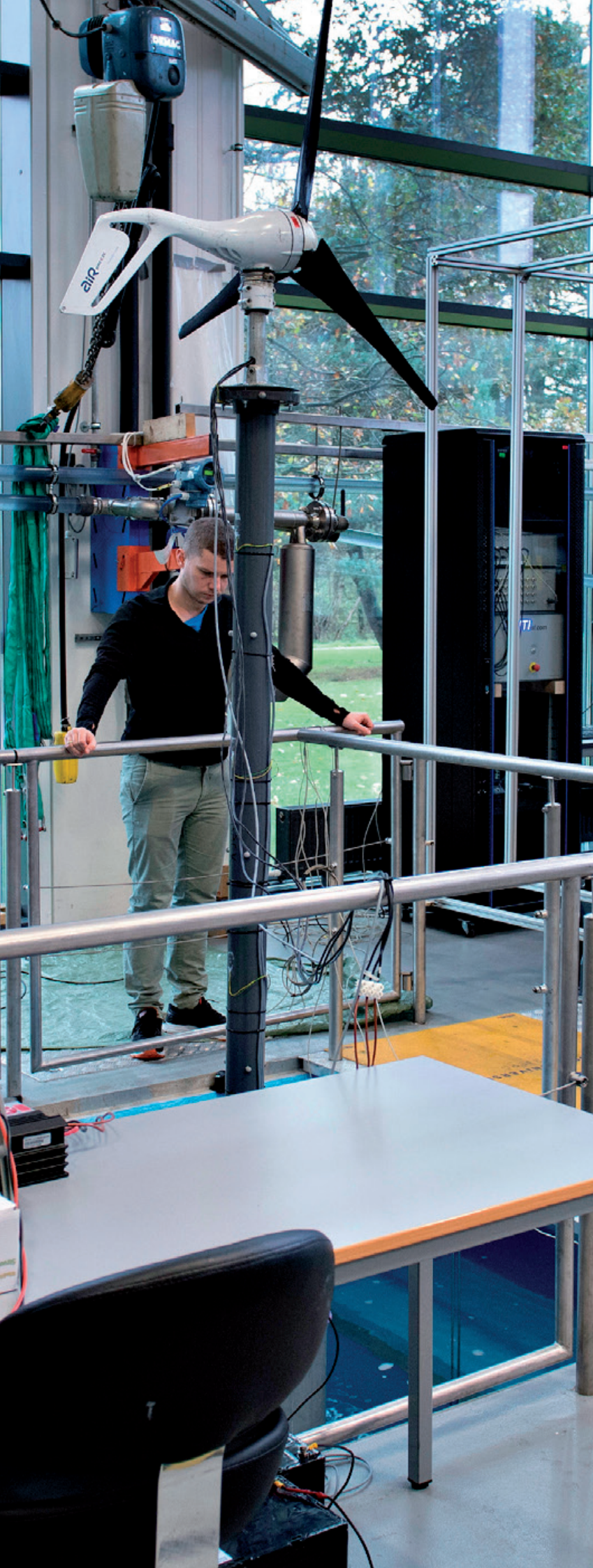
INTERNATIONAL  
PROGRAMME

# APPLIED INDUSTRIAL ELECTRONICS

3-YEAR BACHELOR'S PROGRAMME



AALBORG UNIVERSITY  
ESBJERG



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# APPLIED INDUSTRIAL ELECTRONICS

**Automation, robots, power electronics, electrical machines and instrumentation play key roles in our society today. With an education in Applied Industrial Electronics, you can help shape the development in these areas.**

The Bachelor's programme in Applied Industrial Electronics is taught at Aalborg University's campus in Esbjerg. The study programme equips you to work as an electronics engineer, because you learn how power electronic converters and electrical machines function and how they are developed. For example, you can work with underwater robots or the control of wind turbines.

**During the study programme, you gain knowledge about:**

- automation
- mechatronics
- robots and robotics
- embedded systems
- computers and programming
- signal processing
- instrumentation
- developing systems
- testing and validating systems
- power electronics

AAU Esbjerg works closely with the industry, which means that you have the possibility to work with some of the real-life issues and problems that companies and organisations face. This gives you the opportunity to enhance your academic skills with an industry-oriented and practical perspective.

The study programme in Applied Industrial Electronics is taught in English and you will become part of our international research environment at the Department of Energy Technology.



# ACADEMIC CONTENT

**The Bachelor's programme in Applied Industrial Electronics is wide ranging within electronics and power electronics.**

In the first semesters, you learn about basic electronic systems, and towards the end of the study programme you work with more specialised topics, such as industrial electronics, robotics and mechatronics.

During each semester, courses constitute half the study time, while the other half has focus on project work carried out in groups – often working closely with the Department of Energy's research environments and/

or external companies. This is a full-time study programme so you are required to be present at the university on a daily basis and spend the majority of your day there.

The laboratories at AAU Esbjerg are of the highest standard and you will work in the best conditions with access to the latest technology.

The study programme is set to 30 ECTS credits per semester which means 180 ECTS credits in total.

## 1<sup>ST</sup> SEMESTER

### Basic Electronic Systems

#### You learn about

- problem oriented course and project work
- calculus
- basic energy systems
- electrophysics

#### Project

- Basic Electronic Systems (15 ECTS credits)  
You can for example examine how a simple electronic system such as a doorbell or a LEGO robot works.

#### Courses

- Calculus (5 ECTS credits)
- Fundamental Energy System Physics and Topology (5 ECTS Credits)
- Problem-based Learning in Science, Technology and Society (5 ECTS credits)

## 2<sup>ND</sup> SEMESTER

### Microprocessor Based Systems

#### You learn about

- microprocessors
- electronics
- algebra
- the principles of microprocessor-based systems
- designing and programming a system

#### Project

- Microprocessor Based Systems (15 ECTS credits)  
You can for example develop an electronically controlled dosing system or control a football robot.

#### Courses

- Introduction to Electrical Engineering (5 ECTS credits)
- Real-Time Systems and Programming Languages (5 ECTS credits)
- Linear Algebra (5 ECTS credits)

## 3<sup>RD</sup> SEMESTER

### Instrumentation

#### You learn about

- circuit theory
- signal processing
- applied engineering mathematics

#### Project

- Instrumentation (15 ECTS credits)  
You can for example examine how battery storage for a solar cell system on a building works or how a dimmer is dimensionally configured.

#### Courses

- AC Circuit Theory (5 ECTS credits)
- Applied Engineering Mathematics (5 ECTS credits)
- Signal Processing (5 ECTS credits)





## 4<sup>TH</sup> SEMESTER

### Control and Regulation

#### You learn about

- regulation
- modelling
- simulation
- power electronics

#### Project

- Control Systems (15 ECTS credits)  
You can for example work with a speed-controlled pump system or a converter for a solar cell system.

#### Courses

- Fundamental Control Theory (5 ECTS credits)
- Modelling and Simulation (5 ECTS credits)
- Power Electronics (5 ECTS credits)

## 5<sup>TH</sup> SEMESTER

### Automation with Applied Power Electronics or Cyber-Physical Systems

#### You learn about

- automation
- digital control
- electrical machines
- numerical methods

#### Project

Choose one of two topics:

- Automation including Power Electronics (15 ECTS credits)  
You can for example examine how to regulate a heat pump for floor heating, how to control a DC motor for a go-cart or how the generator in a wind turbine can be connected via a power electronic converter.
- Cyber-Physical Systems (15 ECTS credits)  
You can for example construct a drone that can stabilise in the air and move with command from the user, you can design a robot that navigates a complex environment based on computer vision or you can design a robot that can follow a path using inputs from high precision Real Time Kinematic GPS (RTK).

#### Courses

- Modern and Digital Control (5 ECTS credits)
- Electrical Machines (5 ECTS credits)
- Numerical Methods (5 ECTS credits)

## 6<sup>TH</sup> SEMESTER

### Power Electronics and Electrical Machines or Modelling and Control of Robotic Systems

#### You learn about

- modelling and control of robots
- mechanics
- testing and validation
- system understanding and setup

#### Bachelor's project

Choose one of two topics:

- Power Electronics and Electrical Machines (15 ECTS credits)  
You can for example work with electrical machines in small isolated network systems, look at an active damper for mechanical vibrations on a drilling rig or look at the development of the generator system for a wave energy system.
- Modelling and Control of Robotic Systems (15 ECTS credits)  
You can for example work with underwater robots for inspecting cables on the seabed or drone systems for installation and/or environmental monitoring.

#### Courses

- Mechanics (5 ECTS credits)
- Modelling and Control of Robot Manipulator (5 ECTS credits)
- Test and Validation including System Set-up and Understanding (5 ECTS credits)



**”** The best thing about the study programme is that the freedom of choice for semester topics is vast. Technical enough to be challenging but flexible enough to really allow the students to research/implement what their interest is.

The electronics labs available at AAU Esbjerg are topnotch. They have everything you could need.

Although initially challenging, I felt fairly comfortable over a relatively short period structuring and composing project reports of quality. The best advice though is to start project work immediately. The semester flies by in an instant.

Supervisors are always available for consultation upon request. Their knowledge is a useful tool beyond measure.

The communities are rather small here; however, this allows new students to form stronger bonds with class/housemates that truly stick. The nature is gorgeous and extensive, you will never feel overcrowded.”

**DANIEL PLOEGER, STUDENT, APPLIED INDUSTRIAL ELECTRONICS**



# MASTER'S DEGREE OPPORTUNITIES

With a Bachelor's degree in Applied Industrial Electronics, you can continue on a Master's programme such as:

- Advanced Power Electronics, AAU Esbjerg, p. 8
- Energy Engineering with a specialisation in Power Electronics and Drives, AAU Aalborg, p. 9
- Sustainable Energy Engineering with a specialisation in Offshore Energy Systems, AAU Esbjerg, p. 10

# ADVANCED POWER ELECTRONICS

## ESBJERG

The Master's programme in Advanced Power Electronics combines contemporary technologies with classic technologies. This means that you combine electronics, power electronics, electrical machines and control engineering with artificial intelligence, reliability and maintenance issues. This gives you an understanding of the technologies and scientific disciplines involved in the advanced power electronic area and its application in apparatus and systems. Studying this programme, you learn how to model, analyse, synthesise and develop advanced power electronic apparatus and systems, and you will learn how power electronics and drives interact with externally connected components or systems.

### You will work with topics such as:

- off-shore wind turbine converters and control
- power electronics application for underwater robotics and drones
- diagnostic of power electronic and electrical machine installations
- optimal control of drives
- predictive maintenance of industrial electronic systems
- control of renewable energy systems
- electric propulsion systems for modern ships and vehicles

- condition monitoring and maintenance of power electronic systems
- reliability analysis of power electronics systems

### You will explore:

- how to extend the lifetime of a wind turbine power converter
- how to make a drive system for future electrical vehicles
- how to design reliable power electronic systems
- how to estimate the lifetime of a power electronic converter using artificial intelligence
- how to implement predictive maintenance for industrial electronic systems
- how to implement intelligent control for industrial electronic systems

### You will work with the following project themes:

#### 1<sup>st</sup> semester

Diagnosis and Maintenance

#### 2<sup>nd</sup> semester

Control of Power Electronic Systems

#### 3<sup>rd</sup> semester

Advanced Control in Industrial Electronics

#### 4<sup>th</sup> semester

Self-selected topic (Master's Thesis)





# ENERGY ENGINEERING POWER ELECTRONICS AND DRIVES

## AALBORG



When studying the Master's programme in Energy Engineering with a specialisation in Power Electronics and Drives, you will study efficient and intelligent energy conversion by means of power electronics technology and electrical machines. You will study these topics analytically, numerically and experimentally in an innovative research environment. This specialisation combines contemporary

technologies with classic technologies such as power semiconductor devices, electronics, electromagnetics, digital signal processors, control theory, EMC and energy technology. This gives you an understanding of the technologies and scientific disciplines involved in electric energy conversion by means of power electronic converters and electric machines. Studying this specialisation, you learn how to model, analyse, synthesise and develop power electronics and drive systems, and you will also learn how these interact with externally connected components or systems. During the specialisation in Power Electronics and Drives, you will study electric drive systems and learn about generators, power electronics, control systems, and integration of drive systems in transport and the industry.

### You will explore questions such as:

- How do we ensure production using the lowest possible energy consumption?
- How do we design a power electronics system with lowest cost, highest efficiency and reliability in a given application?
- Should future electrical vehicles be driven by a permanent magnet motor, an induction motor or another type of motor?
- How should a drive system be properly controlled to meet the required steady state and dynamic performances in an industrial application?
- How do we foresee new development trends in power electronics, electrical machines and drives?

### You will work with the following project themes:

#### 1<sup>st</sup> semester

Dynamics in Electrical Energy Engineering

#### 2<sup>nd</sup> semester

Control of Power Electronic Systems

#### 3<sup>rd</sup> semester

Advanced Project in Power Electronics and Drives

#### 4<sup>th</sup> semester

Self-selected topic (Master's Thesis)



# SUSTAINABLE ENERGY ENGINEERING OFFSHORE ENERGY SYSTEMS

## ESBJERG



When studying the Master's programme in Sustainable Energy Engineering with a specialisation in Offshore Energy Systems, you learn about design, analysis and modelling of offshore energy systems and the system component interaction. You get to work with fluid and water wave mechanics, offshore energy systems including electrical and mechanical systems, together with control, optimisation and diagnosis of offshore energy systems. The specialisation gives you insight into various technologies for energy transfer, harvesting and control of offshore energy systems. Also, you gain knowledge of how to design, analyse and model mechanical systems, fluid power systems and electrical systems with complex dynamics and elements with non-linear behaviour.

#### You will work with topics such as:

- design, modelling and optimisation of energy systems used in various offshore energy applications
- operation, functionality and interaction between the various components of offshore energy systems
- systems integration with respect to both system efficiency and control engineering aspects of offshore energy systems
- developing, constructing and operating offshore energy systems in the laboratory and in real applications
- practical realisation and implementation of offshore energy systems concerning both innovative aspects, business planning and economic considerations

This study programme provides you with knowledge of how to design, analyse and model mechanical systems, fluid power systems and electrical systems with complex dynamics and elements with non-linear behaviour.

#### You will learn

- how to analyse and design subsystems for offshore wind turbines
- how to model complex offshore energy systems
- how to develop advanced control algorithms for offshore energy systems

#### You will work with the following project themes:

##### 1<sup>st</sup> semester

Modelling and Identification of Offshore Systems

##### 2<sup>nd</sup> semester

Dynamic Control of Offshore Electrical Systems

##### 3<sup>rd</sup> semester

Advanced Control of Offshore Energy Systems

##### 4<sup>th</sup> semester

Self-selected topic (Master's Thesis)



# CAREER OPPORTUNITIES

The Bachelor's programme in Applied Industrial Electronics is especially organised for those who wish to continue in a two-year Master's programme to achieve a Master of Science degree in Engineering.

As an electronics engineer, you can work in the process, automation, and energy industry. You can develop new converters and machines for wind turbines, work with energy and performance optimisation of industrial processes or work with mechatronic systems such as robots or wave energy systems.

You can handle complex and development oriented situations in the electronics and power electronics area, and you possess skills in microprocessor systems, electrical machines and robotic systems that can be used in development, planning and operation of industrial energy systems.

With a Master of Science in Engineering you can for example work in

- the process industry
- the wind turbine industry
- energy companies
- manufacturing companies for electronics and electrical machines
- the offshore industry

# PROBLEM BASED LEARNING AND INTERNATIONAL RANKING

## PROBLEM BASED LEARNING (PBL)

As a student at Aalborg University, you will work closely together with your fellow students by way of problem based project work.

When writing your problem based projects, you will typically be part of a group consisting of 4-5 students. Once you have formed a project group, you need to define a problem within a broad theme frame that you want to examine as a group. This problem is the basis of your project.

The group work ensures a great variety of approaches and perspectives, which can lead to very educational discussions. At the same time, you are able to solve larger and more complex problems than if you were studying on your own.

Each of you has the opportunity to shape the project because group work requires a contribution from everyone. You may have different opinions about how to solve a problem but as a group, you will learn how to compromise and cooperate. Group work is very popular in the modern labour market so both you and your future workplace will benefit from the skills in cooperation you will acquire.

The project work in each semester is completed with a group exam.

## BENEFITS OF THE AALBORG PBL MODEL

The PBL-based pedagogical model is both nationally and internationally recognised by universities, researchers and students as an advanced and efficient learning model. Thus, UNESCO has placed its only Danish Chair in PBL at Aalborg University. AAU will continue to develop and adapt the Aalborg PBL Model to meet the societal and educational demands and changes.

This learning model provides AAU students with the possibility of:

- acquiring knowledge and skills independently and at a high academic level
- working analytically and according to interdisciplinary and problem and result oriented methods
- cooperating with the business community on the solution of authentic professional problems
- developing their abilities within teamwork
- becoming well prepared for the labour market



## RATED FOR EXCELLENCE

Aalborg University is rated for excellence in the QS-ranking system. Aalborg University has received five stars certifying the worldclass position of the university based on cutting-edge facilities and internationally renowned research and teaching faculty.



## BEST IN EUROPE AND 4<sup>TH</sup> BEST IN THE WORLD

Aalborg University is ranked one of the absolute best engineering universities in the world. In 2018 and 2019, U.S. News & World Report ranked Aalborg University Europe's best and the world's fourth best university within the field of engineering. This was reaffirmed by an analysis from MIT, which ranked Aalborg University's engineering study programmes Europe's best and the world's fourth best – only surpassed by three American universities. Read more at [www.aau.dk/ingenioeruddannelser](http://www.aau.dk/ingenioeruddannelser).



# STUDENT LIFE

## STUDY IN ESBJERG

Situated by the sea, Esbjerg is a city with more than 70,000 inhabitants. The city is characterised by wind energy, the oil industry, and shipping. As a student at Aalborg University's campus in Esbjerg, you can enjoy the city's many cultural experiences, sports and spare time activities. AAU Esbjerg is located 3 kilometres from Esbjerg's city centre and public transport options are great between the city centre and campus. The environment at AAU Esbjerg is characterised by a strong sense of community and a unique atmosphere, which makes it easier to feel at home.

## ACCOMMODATION

Your chances of finding student accommodation in Esbjerg are very good, and the price level is lower than in most other university cities in Denmark. In recent years, we have succeeded in providing accommodation for all international students and we plan to accomplish this for our future students as well.

## DANISH CLASSES

Learning the Danish language will significantly improve your chances of getting a job in Denmark after graduation. The municipality in Esbjerg offers Danish classes. For more information contact the AAU Esbjerg International Office at [international@esbjerg.aau.dk](mailto:international@esbjerg.aau.dk).



# APPLICATION AND REQUIREMENTS

## DANISH STUDENTS

### Adgangskrav

Adgang til bacheloruddannelsen i Applied Industrial Electronics forudsætter opfyldelse af følgende krav eller dokumentation af tilsvarende kvalifikationer:

- Bestået adgangsgivende eksamen (STX, HHX, HTX, HF aflagt før gymnasireformen 2017, HF med overbygning aflagt efter gymnasireformen 2017, GIF eller EUX)
- Engelsk B med et gennemsnit på minimum 3,0
- Matematik A med et gennemsnit på minimum 4,0
- Fysik B eller Geovidenskab A

Opfylder du ikke adgangskravene? Så har du mulighed for at tage på adgangskursus og blive klar. Læs mere på [www.ak.aau.dk](http://www.ak.aau.dk)

### Fri adgang for kvalificerede ansøgere

Alle ansøgere, der søger rettidigt og opfylder adgangskravene, er garanteret en studieplads.

### Er dit matematikniveau tilstrækkeligt?

Matematik benyttes som et essentielt redskab i mange aktiviteter gennem hele uddannelsen. Vores erfaring er, at du kommer bedre igennem studierne, når du har mindst 7 i matematik og med potentialet til at nå et 10-tal i din gymnasiale matematikeksamen.

Det anbefales derfor, at du genopfrisker matematik på A-niveau inden studiestart på denne uddannelse, hvis du har karakterer på 7 eller mindre i Matematik fra din gymnasieuddannelse, eller hvis din gymnasieuddannelse er et år gammel eller mere.

Følg et intensivt Brush up-kursus på A-niveau inden studiestart. Læs mere på [www.brushup.aau.dk](http://www.brushup.aau.dk)

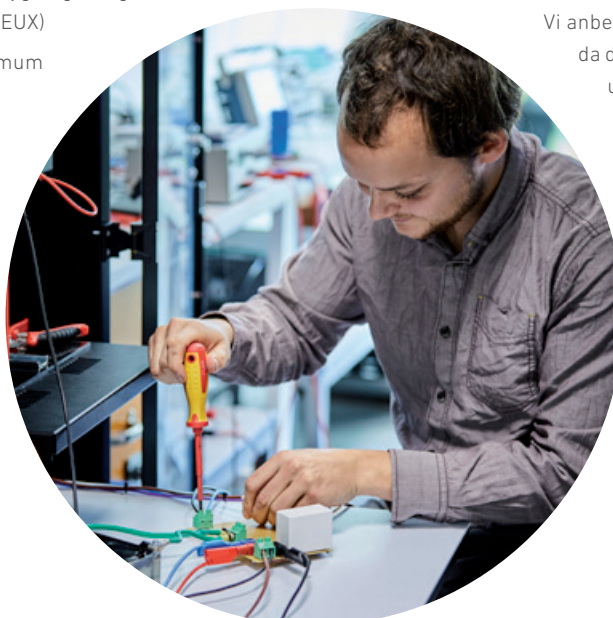
Vi anbefaler desuden, at du har mindst 7 i Fysik, da det erfaringsmæssigt vil sikre dig et bedre udbytte af uddannelsen.

Er du i tvivl, så kontakt studievejlederen (se bagsiden).

### Deadline

Ansøgning via [www.optagelse.dk](http://www.optagelse.dk) senest 5. juli kl. 12.

Hvis du har taget adgangskursus skal du huske at ansøgningsfristen er 15. marts klokken 12.



**MORE INFORMATION  
ABOUT HOW TO APPLY**

**DANISH STUDENTS:**  
[WWW.OPTAGELSE.AAU.DK](http://WWW.OPTAGELSE.AAU.DK)

**INTERNATIONAL STUDENTS:**  
[WWW.APPLY.AAU.DK](http://WWW.APPLY.AAU.DK)

## INTERNATIONAL STUDENTS

### Admission

In order to be admitted to the Bachelor's programme in Applied Industrial Electronics at Aalborg University Esbjerg, you need the following qualifications:

- Upper secondary school exam
- English B with a minimum grade of 3.0 in average or an acceptable IELTS, TOEFL or Cambridge score
- Mathematics A with a minimum grade of 4.0 in average on the Danish grading scale (AAU can convert your grades to the Danish scale)
- Physics B or Geoscience A

Please note that A, B and C refer to the course level - not grades.

### Deadline

Deadline for application: 15 March at 12:00 noon.

At [www.optagelse.dk](http://www.optagelse.dk) you must start your application process by filling in an application form and a priority form. Applied Industrial Electronics' admission area no. is 26512. This produces a Signature Page, that you must print out, sign and submit by email to [bacheloroptag@aau.dk](mailto:bacheloroptag@aau.dk). Your Signature page must be received by the Admissions Office before 15 March, 12:00 noon. Only the Signature page is proof that you have applied for a Bachelor's (undergraduate) programme. Your application process is not completed until the Signature page is received by the Admissions Office.

### English language requirements

Bachelor's programmes offered in English at Aalborg University require that your command of the English language is equivalent to level B (Danish level) in English. Level B (Danish level) in regards to languages is considered equivalent to level B2 referring to Common European Framework of Reference for Languages (CEFR).

Applicants applying for Bachelor's programmes must submit the results of one of the below mentioned IELTS, TOEFL, Cambridge or ECPE tests with the required minimum scores – by uploading the test results to [www.optagelse.dk](http://www.optagelse.dk).

We do not accept IELTS and TOEFL tests that are more than 2 years old at the time of the application deadline.

We do not accept the "TOEFL MyBest Scores".

Danish B level in English compares to:

- IELTS (academic test): 6.5 [www.ielts.org](http://www.ielts.org)
- TOEFL (internet-based): 85 [www.ets.org/toefl](http://www.ets.org/toefl)
- C2 Proficiency (CPE): 180/level C1 [www.cambridgeenglish.org](http://www.cambridgeenglish.org)
- C1 Advanced (CAE): 180/grade C [www.cambridgeenglish.org](http://www.cambridgeenglish.org)
- ECPE: Passed test including certificate [www.michiganassessment.org](http://www.michiganassessment.org)

### Tuition-free studies

Students from EU/EEA countries do not pay a tuition fee. However, all students must pay all other costs related to studying in Denmark: such as costs related to books, living expenses and accommodation. With the exception of students from partner universities outside the EU/EEA, a student from a non-EU/EEA country will need to pay a tuition fee.



# APPLIED INDUSTRIAL ELECTRONICS

3-YEAR BACHELOR'S PROGRAMME

# CONTACT INFORMATION

If you have questions about applying, the study programme or studying in Denmark, please contact:

## AALBORG UNIVERSITY ADMISSIONS OFFICE

Phone: (+45) 9940 9425

Email: [bacheloradmission@aau.dk](mailto:bacheloradmission@aau.dk)

## AAU ESBJERG INTERNATIONAL OFFICE AND STUDENT GUIDANCE

Phone: (+45) 9940 7669

Email: [international@esbjerg.aau.dk](mailto:international@esbjerg.aau.dk)

[studievejledning@esbjerg.aau.dk](mailto:studievejledning@esbjerg.aau.dk)

**MORE INFORMATION  
ABOUT HOW TO APPLY**

**DANISH STUDENTS:**  
[WWW.OPTAGELSE.AAU.DK](http://WWW.OPTAGELSE.AAU.DK)

**INTERNATIONAL STUDENTS:**  
[WWW.APPLY.AAU.DK](http://WWW.APPLY.AAU.DK)



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