



AALBORG UNIVERSITET

MASTER OF SCIENCE (MSC) IN ENGINEERING (SIGNAL PROCESSING AND ACOUSTICS), 2018

MASTER OF SCIENCE (MSC) IN ENGINEERING
AALBORG

[Link til denne studieordning](#)

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§ 1: PREFACE

Pursuant to Act 261 of March 18, 2015 on Universities (the University Act) with subsequent changes, the following curriculum for the Master's programme in Signal Processing and Acoustics is stipulated. The programme also follows the Joint Programme Regulations and the Examination Policies and Procedures for The Technical Faculty of IT and Design.

§ 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. 111 of January 30, 2017 (the Admission Order) and Ministerial Order no. 114 of February 3, 2015 (the Grading Scale Order) with subsequent changes.

§ 3: CAMPUS

The programme is offered in Aalborg

§ 4: FACULTY AFFILIATION

The Master's programme falls under the Technical Faculty of IT and Design, Aalborg University.

§ 5: STUDY BOARD AFFILIATION

The Master's programme falls under the Board of Studies for Electronics and IT.

§ 6: AFFILIATION TO CORPS OF EXTERNAL EXAMINERS

The programme is affiliated with the body of external examiners for engineering educations: electro (In Danish: censorkorps for Ingeniøruddannelsernes landsdækkende censorkorps; elektro).

§ 7: ADMISSION REQUIREMENTS

Applicants with a legal claim to admission (retskrav):

Applicants with one of the following degrees are entitled to admission:

- Bachelor of Science in Engineering (Electronic Engineering and IT with specialisation in Signal Processing), Aalborg University
- Bachelor of Science in Engineering (Internet Technologies and computer Engineering with specialisation in Signal Processing), Aalborg University

Applicants without legal claim to admission:

Bachelor's programmes qualifying students for admission:

- Bachelor of Science (BSc) in Engineering (Electronic Engineering and IT with specialisation in Communication Systems) (AAU)
- Bachelor of Science (BSc) in Engineering (Electronic Engineering and IT with specialisation in Informatics) (AAU)
- Bachelor of Science in Engineering (Electronic Engineering and IT with specialisation in Control Engineering), (AAU)
- Bachelor of Science (BSc) in Engineering (Internet Technologies and Computer Engineering with specialization in Communication Systems) (AAU)
- Bachelor of Science (BSc) in Engineering (Internet Technologies and Computer Engineering with specialization in Informatics) (AAU)
- Bachelor of Science (BSc) in Engineering (Internet Technologies and computer Engineering with specialisation in Control Engineering), (AAU)
- Bachelor of Science (BSc) in Engineering (Mathematical Engineering) (AAU)

§ 8: THE PROGRAMME TITLE IN DANISH AND ENGLISH

The Master's programme entitles the graduate to one of the designation depending on the specialisation:

- civilingeniør, cand.polyt. (candidatus/candidata polytechnices) i signalbehandling og akustik med specialisering i signalbehandling og beregning. The English designation is: Master of Science (MSc) in Engineering (Signal Processing and Acoustics with specialisation in Signal processing and Computing).

or

- civilingeniør, cand.polyt. (candidatus/candidata polytechnices) i signalbehandling og akustik med specialisering i akustik og audioteknologi. The English designation is: Master of Science (MSc) in Engineering (Signal Processing and Acoustics with specialisation in Acoustics and audio Technology).

§ 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 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

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

§ 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

Knowledge:

Common:

- Has knowledge of methods for data acquisition and measurements, including physical sensors, their construction and application, data analysis and processing.
- Has knowledge of stochastic processes and signals, how they are generated, their distributional characteristics, how they can be modeled mathematically, and how such models can be applied according to limitations and constraints.
- Has knowledge of different classes of optimization problems typically found in signal processing, and associated methods for continuous and discrete optimization.
- Has knowledge about basic acoustic quantities and their physical significance, sound emission and reception, acoustical filters and acoustical transducers in the acoustical, mechanical and electrical domain.
- Has knowledge of signal processing concepts applied to multiple signals, non-stationary signals, and signals with multiple sample rates.
- Has knowledge of methods and tools for fast, efficient, and reliable numerical simulation of signal processing algorithms and systems on parallel computers.
- Has knowledge in one or more of the subject areas that is based on the highest international research in acoustics or signal processing.
- Can understand and, on a scientific basis, reflect on the knowledge within acoustics or signal processing, and identify scientific problems.

Signal processing and computing:

- Has knowledge of theories and methods associated with fundamental and advanced machine learning.
- Has knowledge of theories and methods for design and implementation of resource optimal real-time digital signal processing systems on reconfigurable and/or low power hardware/software platforms.

Acoustics and audio technology:

- Has a broad knowledge in the area of acoustics and audio, including physics, electronics, signal processing, transmission, hearing, perception and effects.
- Has knowledge in the field of sound and audio technologies including sound production, measurement and instrumentation.
- Has specialized knowledge about human sound perception, and the instrumental measures used to describe various perceptual dimensions
- Has specialized knowledge about the human hearing, its anatomy and physiology, and its significance for human sound perception

Skills:

Common:

- Can apply methods for advanced signal analysis and processing.
- Can select and apply analytical, numerical and experimental methods for analysis and design of complex systems.
- Can apply methods and tools for performance/resource optimization of signal processing algorithms and implementation platforms given specific objective functions.

Signal processing and computing:

- Can apply scientific methods and tools to design, simulate, test and document signal processing systems operating on stochastic stationary or non-stationary signals.
- Can, based on given design criteria, critically assess and select among scientific theories and methods for analysis, design and implementation of signal processing algorithms and associated non real-time and real-time hardware/software platforms.
- Can, based on a scientifically founded working methodology, advance new solutions and analysis models for an initial problem which requires signal processing concepts and efficient computing platforms in its solution.

- Can assess the results and quality of a design and the applied design trajectory, including experimental test and verification of signal processing systems.

Acoustics and audio technology:

- Can apply scientific methods, tools and general skills related to the solution of acoustic problems, including design, simulation, implementation, test, evaluation, and documentation of the solutions.
- Can demonstrate insight into and has the ability to assess various topics in the area of sound and vibration.
- Can use appropriate measurement and signal analysis techniques to investigate and solve advanced acoustic problems
- Can use appropriate psycho physical methods for subjective evaluations of sound.
- Can apply the understanding of the hearing and the human sound perception to the design and evaluation process of engineering solutions

Competencies:

Common:

- Can independently take responsibility for own professional development and specialization.
- Can manage work and development situations that are complex, unpredictable and require new solutions.
- Can communicate research-based knowledge and discuss professional and scientific problems with both peers and non-specialists using the correct terminology.
- Can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility.

Signal processing and computing:

- Can identify scientific problems within signal processing and computing, and select and apply suitable scientific theories, methods and tools for their solution.
- Can develop, advance, test and document new solutions to engineering problems within signal processing and computing.
- Can explain scientific hypotheses and results related to signal processing and computing.
- Can work in international industry and academia engaged in development, research and education of state-of-the-art signal processing and computing.

Acoustics and audio technology:

- Can conduct individually research and development in international companies within the acoustics and audio industry.
- Can conduct individually consultancy related to acoustics and audio primarily within environmental noise and architectural acoustics.
- Can contribute to legislation and standardization work within the acoustics and audio area.
- Can contribute to research and development in the audiology industry and the health care systems with diagnosis and solutions related to the human auditory system

§ 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 organised based on the following work and evaluation methods that combine skills and reflection:

- lectures
- classroom instruction
- project work

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

§ 18: OVERVIEW OF THE PROGRAMME

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

Offered as: 1-professional					
Specialisation: Signal Processing and Computing					
Module name	Course type	ECT S	Applied grading scale	Evaluation method	Assessment method
1 SEMESTER Applied Signal Processing					
Applied Signal Processing	Project	15	7-point grading scale	Internal examination	Oral exam based on a project
Stochastic Processes	Course	5	7-point grading scale	Internal examination	Written or oral exam
Fundamentals of Acoustics and Electro-acoustics	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
Optimization Methods	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
2 SEMESTER Signal Processing and Computing					
2nd Semester SPC Elective project module package Choose 1 project module	Project	20			
Reconfigurable and Low Energy Systems	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
Numerical Scientific Computing	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
3 SEMESTER					
3rd Semester Signal Processing and Computing: Option A 20 ECTS project unit + 10 ECTS courses					
3rd Semester Signal Processing and Computing: Option B1 20 ECTS Academic Internship + 10 ECTS courses					
3rd Semester Signal Processing and Computing: Option B2 25 ECTS Academic Internship + 5 ECTS course					

3rd Semester Signal Processing and Computing: Option B3 30 ECTS Academic Internship					
3-4 SEMESTER Long Master's Thesis					
3rd-4th Semester Signal Processing and Computing: Option C 50 ECTS long thesis + 10 ECTS courses					
4 SEMESTER Master's Thesis					
Master's Thesis	Project	30	7-point grading scale	External examination	Oral exam based on a project

2nd Semester SPC Elective project module package Choose 1 project module					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Scientific Computing	Project	20	7-point grading scale	External examination	Oral exam based on a project
Reconfigurable Computing	Project	20	7-point grading scale	External examination	Oral exam based on a project

3rd Semester Signal Processing and Computing: Option A 20 ECTS project unit + 10 ECTS courses					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Signal Processing and Acoustics	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
Array and Sensor Signal Processing	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
Machine Learning	Course	5	Passed/Not Passed	Internal examination	Written or oral exam

3rd Semester Signal Processing and Computing: Option B1 20 ECTS Academic Internship + 10 ECTS courses					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Academic Internship	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
Array and Sensor Signal Processing	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
Machine Learning	Course	5	Passed/Not Passed	Internal examination	Written or oral exam

3rd Semester Signal Processing and Computing: Option B2 25 ECTS Academic Internship + 5 ECTS course					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Academic Internship	Project	25	7-point grading scale	Internal examination	Oral exam based on a project
Machine Learning	Course	5	Passed/Not Passed	Internal examination	Written or oral exam

3rd Semester Signal Processing and Computing: Option B3 30 ECTS Academic Internship					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Academic Internship	Project	30	7-point grading scale	Internal examination	Oral exam based on a project

3rd-4th Semester Signal Processing and Computing: Option C 50 ECTS long thesis + 10 ECTS courses					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Master's Thesis	Project	50	7-point grading scale	External examination	Oral exam based on a project
Array and Sensor Signal Processing	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
Machine Learning	Course	5	Passed/Not Passed	Internal examination	Written or oral exam

Offered as: 1-professional Specialisation: Acoustics and Audio Technology.					
Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method
1 SEMESTER Applied Signal Processing					
Applied Signal Processing	Project	15	7-point grading scale	Internal examination	Oral exam based on a project
Stochastic Processes	Course	5	7-point grading scale	Internal examination	Written or oral exam
Fundamentals of Acoustics and Electro-acoustics	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
Optimization Methods	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
2 SEMESTER Acoustics and Audio Technologies					
2nd Semester AAT Elective project module package Choose 1 project module	Project	20			

Human Sound Perception and Audio Engineering	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
Numerical Scientific Computing	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
3 SEMESTER Signal Processing and Computing					
3rd Semester Acoustics and Audio Technology: Option A 20 ECTS project + 10 ECTS courses					
3rd Semester Acoustics and Audio Technology: Option B1 20 ECTS academic internship + 10 ECTS courses					
3rd Semester Acoustics and Audio Technology: Option B2 25 ECTS academic internship + 5 ECTS course					
3rd Semester Acoustics and Audio Technology: Option B3 30 ECTS academic internship					
3-4 SEMESTER Long Master's Thesis					
3rd-4th Semester Acoustics and Audio Technology: Option C 50 ECTS project + 10 ECTS courses					
4 SEMESTER Master's Thesis					
Master's Thesis	Project	30	7-point grading scale	External examination	Oral exam based on a project

2nd Semester AAT Elective project module package Choose 1 project module					
Module name	Course type	ECT S	Applied grading scale	Evaluation Method	Assessment method
Sound Technology for the Normal Hearing	Project	20	7-point grading scale	External examination	Oral exam based on a project
Sound Technology for the Hearing-impaired	Project	20	7-point grading scale	External examination	Oral exam based on a project

3rd Semester Acoustics and Audio Technology: Option A 20 ECTS project + 10 ECTS courses					
Module name	Course type	ECT S	Applied grading scale	Evaluation Method	Assessment method
Signal Processing and Acoustics	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
Array and Sensor Signal Processing	Course	5	Passed/Not Passed	Internal examination	Written or oral exam

Architectural and Environmental Acoustics	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
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3rd Semester Acoustics and Audio Technology: Option B1 20 ECTS academic internship + 10 ECTS courses					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Academic Internship	Project	20	7-point grading scale	Internal examination	Oral exam based on a project
Array and Sensor Signal Processing	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
Architectural and Environmental Acoustics	Course	5	Passed/Not Passed	Internal examination	Written or oral exam

3rd Semester Acoustics and Audio Technology: Option B2 25 ECTS academic internship + 5 ECTS course					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Academic Internship	Project	25	7-point grading scale	Internal examination	Oral exam based on a project
Architectural and Environmental Acoustics	Course	5	Passed/Not Passed	Internal examination	Written or oral exam

3rd Semester Acoustics and Audio Technology: Option B3 30 ECTS academic internship					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Academic Internship	Project	30	7-point grading scale	Internal examination	Oral exam based on a project

3rd-4th Semester Acoustics and Audio Technology: Option C 50 ECTS project + 10 ECTS courses					
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method
Master's Thesis	Project	50	7-point grading scale	External examination	Oral exam based on a project
Array and Sensor Signal Processing	Course	5	Passed/Not Passed	Internal examination	Written or oral exam
Architectural and Environmental Acoustics	Course	5	Passed/Not Passed	Internal examination	Written or oral exam

§ 19: ADDITIONAL INFORMATION

The current version of the curriculum is published on the Board of Studies' website, including more detailed information about the programme, including exams

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.

§ 20: COMMENCEMENT AND TRANSITIONAL RULES

The curriculum is approved by the Dean of The Technical Faculty of IT and Design and enters into force as of September 2018.

Students who wish to complete their studies under the previous curriculum from 2017 must conclude their education by the summer examination period 2019 at the latest, since examinations under the previous curriculum are not offered after this time.

§ 21: AMENDMENTS TO THE CURRICULUM AND REGULATIONS

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