AALBORG UNIVERSITET

CURRICULUM FOR THE MASTER'S PROGRAMME IN SIGNAL PROCESSING AND ACOUSTICS, 2020

MASTER OF SCIENCE (MSC) IN ENGINEERING
AALBORG

Link to this studyline

Link(s) to other versions of the same line:

Master of Science (MSc) in Engineering (Signal Processing and Acoustics), 2018

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§ 1: PREFACE

Pursuant to consolidation Act 778 of August 7, 2019 on Universities (the University Act), the following is established. The programme also follows the Joint Programme Regulations and the Examination Policies and Procedures for Aalborg University.

§ 2: BASIS IN MINISTERIAL ORDERS

The Master's programme is organised in accordance with the Ministry of Higher Education and Science's Order no. 20 of January 9, 2020 on Bachelor's and Master's Programmes at Universities (the Ministerial Order of the Study Programmes) and Ministerial Order no. 22 of January 9, 2020 on University Examinations (the Examination Order). Further reference is made to Ministerial Order no. 153 of February 26, 2020 (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 The Technical Faculty of IT and Design, Aalborg University.

§ 5: STUDY BOARD AFFILIATION

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

§ 6: AFFILIATION TO CORPS OF EXTERNAL EXAMINERS

The programme is affiliated with the Nationwide engineering examiners/Electronics, IT and Energy (Electromagnetic direction).

§ 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
- Bachelor of Science (BSc) in Engineering (Computer Engineering), 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)

All applicants without a legal claim must prove that their English language qualifications is equivalent to level B (Danish level) in English

§ 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. 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. 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 that passed programme elements from other educational programmes at the same level replaces programme elements within this programme (credit transfer).

Furthermore, the Study Board can, upon application, approve that parts of this programme is completed at another university or a further education institution in Denmark or abroad (pre-approval of credit transfer).

The Study Board's decisions regarding credit transfer are based on an academic assessment.

§ 11: EXEMPTIONS

The Study Board's possibilities to grant exemption, including exemption to further examination attempts and special examination conditions, are stated in the Examination Policies and Procedures published at this website: https://www.studieservice.aau.dk/regler-vejledninger

§ 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/regler-vejledninger

§ 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. If the project is written in English, the summary can be in Danish. 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 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

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 criterions, 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	ECTS	Applied grading scale	Evaluation method	Assessment method	Language
1 SEMESTER						
Applied Signal Processing (ESNSPAK1P1)	Project	15	7-point grading scale	Internal examination	Oral exam based on a project	English
Stochastic Processes (ESNCAK1K1F)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Fundamentals of Acoustics and Electro-acoustics (ESNSPAK1K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Optimization Methods (ESNSPAK1K2)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
2 SEMESTER Option A						
Scientific Computing (ESNSPAK2P5)	Project	20	7-point grading scale	External examination	Oral exam based on a project	English
Reconfigurable and Low Energy Systems (ESNSPAK2K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Numerical Scientific Computing (ESNSPAK2K3)	Course	5	Passed/Not Passed	Internal examination	Active participation/continuous evaluation	English
2 SEMESTER Option B						
Reconfigurable Computing (ESNSPAK2P6)	Project	20	7-point grading scale	External examination	Oral exam based on a project	English
Reconfigurable and Low Energy Systems (ESNSPAK2K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Numerical Scientific Computing (ESNSPAK2K3)	Course	5	Passed/Not Passed	Internal examination	Active participation/continuous evaluation	English

3 SEMESTER Option A						
Signal Processing and Acoustics (ESNSPAK3P8)	Project	20	7-point grading scale	Internal examination	Oral exam based on a project	English
Array and Sensor Signal Processing (ESNSPAK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Machine Learning (ESNSPAK3K2F)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
3 SEMESTER Option B						
Project-Oriented Study in an External Organisation (ESNSPAK3P5)	Project	20	7-point grading scale	Internal examination	Oral exam based on a project	English
Array and Sensor Signal Processing (ESNSPAK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Machine Learning (ESNSPAK3K2F)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
3 SEMESTER Option C						
Project-Oriented Study in an External Organisation (ESNSPAK3P6)	Project	25	7-point grading scale	Internal examination	Oral exam based on a project	English
Machine Learning (ESNSPAK3K2F)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
3 SEMESTER Option D						
Project-Oriented Study in an External Organisation (ESNSPAK3P7)	Project	30	7-point grading scale	Internal examination	Oral exam based on a project	English
3-4 SEMESTER Option E: Long Master's Thesis						
Master's Thesis (ESNSPAK4P2)	Project	50	7-point grading scale	External examination	Master's thesis/final project	English
Array and Sensor Signal Processing (ESNSPAK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Machine Learning (ESNSPAK3K2F)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
4 SEMESTER Master's Thesis						
Master's Thesis (ESNSPAK4P1)	Project	30	7-point grading scale	External examination	Master's thesis/final project	English

Offered as: 1-professional

Specialisation: Acoustics and Audio Technology.

Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method	Language
1 SEMESTER						
Applied Signal Processing (ESNSPAK1P1)	Project	15	7-point grading scale	Internal examination	Oral exam based on a project	English
Stochastic Processes (ESNCAK1K1F)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Fundamentals of Acoustics and Electro-acoustics (ESNSPAK1K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Optimization Methods (ESNSPAK1K2)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
2 SEMESTER Option A						
Sound Technology for the Normal Hearing (ESNSPAK2P7)	Project	20	7-point grading scale	External examination	Oral exam based on a project	English
Human Sound Perception and Audio Engineering (ESNSPAK2K2)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Numerical Scientific Computing (ESNSPAK2K3)	Course	5	Passed/Not Passed	Internal examination	Active participation/continuous evaluation	English
2 SEMESTER Option B						
Sound Technology for the Hearing-impaired (ESNSPAK2P4)	Project	20	7-point grading scale	External examination	Oral exam based on a project	English
Human Sound Perception and Audio Engineering (ESNSPAK2K2)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Numerical Scientific Computing (ESNSPAK2K3)	Course	5	Passed/Not Passed	Internal examination	Active participation/continuous evaluation	English
3 SEMESTER Option A						
Signal Processing and Acoustics (ESNSPAK3P8)	Project	20	7-point grading scale	Internal examination	Oral exam based on a project	English
Array and Sensor Signal Processing (ESNSPAK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Architectural and Environmental Acoustics (ESNSPAK3K3)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
3 SEMESTER Option B						

Project-Oriented Study in an External Organisation (ESNSPAK3P5)	Project	20	7-point grading scale	Internal examination	Oral exam based on a project	English
Array and Sensor Signal Processing (ESNSPAK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Architectural and Environmental Acoustics (ESNSPAK3K3)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
3 SEMESTER Option C						
Project-Oriented Study in an External Organisation (ESNSPAK3P6)	Project	25	7-point grading scale	Internal examination	Oral exam based on a project	English
Architectural and Environmental Acoustics (ESNSPAK3K3)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
3 SEMESTER Option D						
Project-Oriented Study in an External Organisation (ESNSPAK3P7)	Project	30	7-point grading scale	Internal examination	Oral exam based on a project	English
3-4 SEMESTER Option E: Long Master's Thesis						
Master's Thesis (ESNSPAK4P2)	Project	50	7-point grading scale	External examination	Master's thesis/final project	English
Array and Sensor Signal Processing (ESNSPAK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Architectural and Environmental Acoustics (ESNSPAK3K3)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
4 SEMESTER Master's Thesis						
Master's Thesis (ESNSPAK4P1)	Project	30	7-point grading scale	External examination	Master's thesis/final project	English

§ 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 course description.

§ 20: COMMENCEMENT AND TRANSITIONAL RULES

The curriculum is approved by the dean and enters into force as of 01.09.2020.

The Study Board does not offer teaching after the previous curriculum from 2018 after the summer examination 2021.

The Study Board will offer examinations after the previous curriculum, if there are students who have used examination attempts in a module without passing. The number of examination attempts follows the rules in the Examination Order.

§ 21: AMENDMENTS TO THE CURRICULUM AND REGULATIONS

On March 25, 2022 the Vice-Dean of Education has approved that the type of exam in the module *"Numerical Scientific Computing"* is changed from *"Written or oral"* to *"Active participation/continuous evaluation"* and that the re-exam will be *"Written or oral"*. The amendment is valid as of Spring 2022.