AALBORG UNIVERSITET

CURRICULUM FOR THE MASTER'S PROGRAMME IN COMPUTER ENGINEERING, 2023

MASTER OF SCIENCE (MSC) IN ENGINEERING
AALBORG

Link to this studyline

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

Curriculum for the Master's Programme in Computer Engineering, 2022

TABLE OF CONTENTS

§ 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 Examination Policies and Procedures incl. the Joint Programme Regulations 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. 2285 of December 1, 2021 on Full-time University Programmes (the University Programme Order) and Ministerial Order no. 2271 of December 1, 2021 on University Examinations (the Examination Order). Further reference is made to Ministerial Order no. 35 of January 13, 2023 (the Admission Order) and Ministerial Order no. 1125 of July 4, 2022 (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 Civil engineering corps of external examiners.

§ 7: ADMISSION REQUIREMENTS

CE/AVS

Assessment of qualifications obtained from other technical or natural science bachelor educations will emphasize qualifications in computer engineering, computer science, and mathematics corresponding to a total of 60 ECTS credits. Equivalent qualifications can be accepted, although for the emphasized topics certain specific minimum requirements apply:

- Mathematical competences at BSc level equivalent to at least 20 ECTS, covering linear algebra, probability theory, and statistics, and other mathematical topics such as calculus, vector calculus, dynamical systems, and optimization.
- Computer science or computer engineering competences at BSc level equivalent to at least 20 ECTS, covering programming and other topics such as software engineering, AI, image processing, algorithms, data structures, informatics, distributed systems, and computer architectures.

CE/NDS

Assessment of qualifications obtained from other technical or natural science bachelor educations will emphasize qualifications in computer engineering, software engineering, computer science, and mathematics corresponding to a total of 60 ECTS credits. Equivalent qualifications can be accepted, although for the emphasized topics certain specific minimum requirements apply:

- Mathematical competences at BSc level equivalent to at least 20 ECTS, covering subjects such as linear algebra, discrete mathematics, probability, and statistics.
- Computer science or computer engineering competences at BSc level equivalent to at least 20 ECTS, covering the subjects such as programming and modelling, software engineering, distributed systems, computer networks, and computer architectures.
- Competences at BSc level equivalent to at least 15 ECTS, covering one or more of the following areas or similar: signal processing, embedded systems, IoT, cloud computing, data bases, algorithms, data structures, AI, secure communications, cyber security or communication technologies.

Applicants with a legal right of admission (retskrav)

Applicants with the following degrees are entitled to admission:

- Bachelor of Science (BSc) in Engineering (Computer Engineering) (AAU)

Applicants without legal right of admission

- Bachelor of Science (BSc) in Engineering (Electronic and IT with specialisation in Computer Engingeering) (AAU)
- Bachelor of Science (BSc) in Engineering (Electronic and IT with specialisation in Signal Processing) (AAU)
- Bachelor of Science (BSc) in Engineering (Electronic and IT with specialisation in Informatics) (AAU)
- Bachelor of Science (BSc) in Engineering (Electronic and IT with specialisation in Communication Systems) (AAU)
- Bachelor of Science (BSc) in Engineering (Electronic Systems Design), (AAU)
- Bachelor of Science (BSc) in Engineering (Robotics) (AAU)
- Bachelor of Science (BSc) in Engineering (Energy Engineering) (AAU)
- Bachelor of Science (BSc) in Engineering (Mathematical Engineering) (AAU)
- Bachelor of Science (BSc) in Engineering (Cyber and Computer Engineering) (AAU)
- Bachelor of Science (BSc) in Engineering (General Engineering with specialisation in Electrotechnics and Control Theory) (AAU)
- Bachelor of Science (BSc) in Engineering (General Engineering with specialisation in Informatics and Signal Processing) (AAU)
- Bachelor of Science (BSc) in Engineering (Software) (AAU)
- Bachelor of Engineering (BScEE) in Electronics (AAU)
- Bachelor in Computer Science (AU)
- Bachelor in Computer Engineering (AU)
- Bachelor of Engineering in Electronics (AU)
- Bachelor of Engineering (BScEE) in Electronics (AU)

As a prerequisite for admission to the master's programme, students must have completed a bachelor programme in technical sciences, a bachelor of engineering programme or a bachelor in natural science.

All applicants without a legal right 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 the following designations depending on the specialisation:

Specialisation in Network and Distributed Systems:

- Danish designation: Civilingeniør, cand.polyt. i computerteknologi med specialisering i netværk og distribuerede systemer. The English designation is: Master of Science (MSc) in Engineering (Computer Engineering with specialisation in Network and Distributed Systems)

Specialisation in Artificial Intelligence, Vision and Sound:

- Danish designation: Civilingeniør, cand.polyt. i computerteknologi med specialisering i kunstig intelligens, vision og lyd. The English designation is: Master of Science (MSc) in Engineering (Computer Engineering with specialisation in Artificial Intelligence, Vision and Sound)

§ 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.studyservice.aau.dk/rules

§ 12: RULES FOR EXAMINATIONS

The rules for examinations are stated in the Examination Policies and Procedures published at this website: https://www.studyservice.aau.dk/rules

§ 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

- Has a comprehensive base of knowledge of scientific foundations and technological principles within the field of Computer Engineering
- Has knowledge about machine learning methods and techniques and their applicability within the field of Computer Engineering
- Possess knowledge in one or more subject areas that is based on the highest international research within the field of Computer Engineering
- ***Specific for Networks and Distributed Systems specialisation:***
    - Has knowledge of theories and methods for design and implementation of complex communication and distributed systems with a focus on reliability, distributed mode of operation, realt-time requirements or security
- ***Specific for Artificial Intelligence, Vision and Sound specialisation:***
    - Has knowledge of theories and methods for computer vision, such as image recognition, visual scene analysis, object tracking, and methods within sound processing and acoustics

Skills:

- Excels in scientific methods, tools and general skills related to design, simulation, implementation, test, and evaluation of systems within the field of Computer Engineering
- Can analyze the specialization area's knowledge, theory, methodologies and practice
- Can critically assess and select among scientific theories and methods - including the application of analytical, numerical and experimental methods - for analysis, design and implementation of a system within a field of Computer Engineering
- Must be able to communicate orally and in writing , incl using digital tools, on topics within the field of knowledge, and in particular on the application of relevant techniques, procedures and algorithms used in the solution of a given problem

Competences:

- Can analyze and apply appropriate theories and methods within the field of Computer Engineering and evaluate the results regarding their accuracy and validity on a scientific basis
- Can develop and advance new analyses and solutions within the field of Computer Engineering
- Can manage work and development situations that are complex, unpredictable and require new solutions.
- Can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility.
- Can independently take responsibility for his or her own professional development and specialization, getting knowledge from different platforms, incl digital platforms
- Can communicate research-based knowledge and discuss professional and scientific problems with both peers and non-specialists using the correct terminology

§ 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 *or* Pass/Fail. All modules are assessed by external examination (external grading) *or* internal examination (internal grading or by assessment by the supervisor only).

Electives: The remaining 25 ECTS can be obtained by choosing elective courses and projects on the 3rd semester as described below. Note that elective courses might not be offered if less than 10 students sign up.

Offered as: 1-professional Specialisation: Network and Distributed Systems						
Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method	Language
1 SEMESTER						
Communication Systems (ESNNDSK1P2)	Project	15	7-point grading scale	Internal examination	Oral exam based on a project	English
Machine Learning (ESNESK1K6)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Dependable and Secure Distributed Systems (ESNNDSK2K4)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Performance and Reliability Analysis of Communication Networks (ESNNDSK1K3)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
2 SEMESTER						
Reliability, Safety and Security (ESNNDSK2P2)	Project	15	7-point grading scale	External examination	Oral exam based on a project	English
Advanced Network Security (ESNNDSK1K2)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
2nd Semester Elective Course Choose 2 course module	Course	10				
3 SEMESTER Option A						
AI in the Context of Computer Engineering (ESNNDSK3P8)	Project	20	7-point grading scale	Internal examination	Oral exam based on a project	English
3rd Semester Elective Course Choose 2 course modules	Course	10				
3 SEMESTER Option B						
Project-Oriented Study in an External Organisation (ESNNDSK3P5)	Project	20	Passed/Not Passed	Internal examination	Oral exam based on a project	English
3rd Semester Elective Course Choose 2 course modules	Course	10				
3 SEMESTER Option C						

Project-Oriented Study in an External Organisation (ESNNDSK3P6)	Project	25	Passed/Not Passed	Internal examination	Oral exam based on a project	English
3rd Semester Elective Course Choose 1 course module	Course	5				
3 SEMESTER Option D						
Project-Oriented Study in an External Organisation (ESNNDSK3P7)	Project	30	Passed/Not Passed	Internal examination	Oral exam based on a project	English
3-4 SEMESTER Option E						
Master's Thesis (ESNNDSK4P6)	Project	50	7-point grading scale	External examination	Master's thesis/final project	English
3rd Semester Elective Course Choose 2 course modules	Course	10				
4 SEMESTER						
Master's Thesis (ESNNDSK4P5)	Project	30	7-point grading scale	External examination	Master's thesis/final project	English

2nd Semester Elective Course
Choose 2 course module

Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method	Language
Deep Learning (ESNNDSK2K3)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Networks and Systems (ESNESK2K2)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Numerical Scientific Computing (ESNAVSK2K3)	Course	5	Passed/Not Passed	Internal examination	Active participation/continuous evaluation	English

3rd Semester Elective Course
Choose 2 course modules

Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method	Language
Stochastic Systems (ESNESK1K2)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Image Processing and Computer Vision (MSNAVSK1232)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Perception and Acquisition of Data (MSNAVSK1231)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Quantum Information and Computing (ESNESNK1K1)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English

3rd Semester Elective Course Choose 1 course module						
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method	Language
Stochastic Systems (ESNESK1K2)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Image Processing and Computer Vision (MSNAVSK1232)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Perception and Acquisition of Data (MSNAVSK1231)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Quantum Information and Computing (ESNESNK1K1)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English

Offered as: 1-professional Specialisation: Artificial Intelligence, Vision and Sound						
Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method	Language
1 SEMESTER						
Computer Vision (ESNAVSK1P1)	Project	15	7-point grading scale	Internal examination	Oral exam based on a project	English
Machine Learning (ESNESK1K6)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Perception and Acquisition of Data (MSNAVSK1231)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Image Processing and Computer Vision (MSNAVSK1232)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
2 SEMESTER						
Acoustics, Sound Processing and Sound Perception (ESNAVSK2P1)	Project	15	7-point grading scale	External examination	Oral exam based on a project	English
Deep Learning (ESNNDSK2K3)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Numerical Scientific Computing (ESNAVSK2K3)	Course	5	Passed/Not Passed	Internal examination	Active participation/continuous evaluation	English
Fundamentals of Acoustics and Sound (ESNAVSK2K2)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
3 SEMESTER Option A						
AI in the Context of Computer Engineering (ESNNDSK3P8)	Project	20	7-point grading scale	Internal examination	Oral exam based on a project	English

3rd Semester Elective Course Choose 2 course modules	Course	10				
3 SEMESTER Option B						
Project-Oriented Study in an External Organisation (ESNNDSK3P5)	Project	20	Passed/Not Passed	Internal examination	Oral exam based on a project	English
3rd Semester Elective Course Choose 2 course modules	Course	10				
3 SEMESTER Option C						
Project-Oriented Study in an External Organisation (ESNNDSK3P6)	Project	25	Passed/Not Passed	Internal examination	Oral exam based on a project	English
3rd Semester Elective Course Choose 1 course module	Course	5				
3 SEMESTER Option D						
Project-Oriented Study in an External Organisation (ESNNDSK3P7)	Project	30	Passed/Not Passed	Internal examination	Oral exam based on a project	English
3-4 SEMESTER Option E						
Master's Thesis (ESNNDSK4P6)	Project	50	7-point grading scale	External examination	Master's thesis/final project	English
3rd Semester Elective Course Choose 2 course modules	Course	10				
4 SEMESTER						
Master's Thesis (ESNNDSK4P5)	Project	30	7-point grading scale	External examination	Master's thesis/final project	English

3rd Semester Elective Course
Choose 2 course modules

Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method	Language
Stochastic Systems (ESNESK1K2)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Dependable and Secure Distributed Systems (ESNNDSK2K4)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Performance and Reliability Analysis of Communication Networks (ESNNDSK1K3)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Quantum Information and Computing (ESNESNK1K1)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English

3rd Semester Elective Course Choose 1 course module						
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method	Language
Stochastic Systems (ESNESK1K2)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Dependable and Secure Distributed Systems (ESNNDSK2K4)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Performance and Reliability Analysis of Communication Networks (ESNNDSK1K3)	Course	5	7-point grading scale	Internal examination	Written or oral exam	English
Quantum Information and Computing (ESNESNK1K1)	Course	5	7-point grading scale	Internal examination	Written or oral exam	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 Department of Electronics Systems's webiste.

§ 20: COMMENCEMENT AND TRANSITIONAL RULES

The curriculum is approved by the dean and enters into force as of 1 September 2023.

The Study Board does not offer teaching under the previous curriculum from 2022 after the summer examination period 2024.

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 20 September 2023 the Vice-Dean of Education has approved, that the prerequisite for enrollment for the exam in the module *"Machine Learning"* on the 1st Semester is deleted. The amendment is valid from Autumn 2023.

On November 12th, 2023, the Pro-Dean of Education has approved that the form of assessment in the module "Fundamentals of Acoustics and Sound" is changed from written to written and oral as of spring 2024.

The Vice dean of Education has on February 12, 2025, approved that the prerequisite for enrollment for the exam is erased in the module *Acoustics, Sound Processing and Sound Perception* and *Reliability, Safety and Security*, valid from Spring 2025.