AALBORG UNIVERSITET

CURRICULUM FOR THE MASTER'S PROGRAMME IN COMMUNICATION TECHNOLOGY, 2019

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 Communication Technology, 2021
Curriculum for the Master's Programme in Communication Technology, 2020

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§ 1: PREFACE

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

§ 2: BASIS IN MINISTERIAL ORDERS

The Master's programme is organised in accordance with the Ministry of Higher Education and Science's Ministerial 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) with subsequent changes. Further reference is made to Ministerial Order no. 106 of February 12, 2018 (the Admission Order) and Ministerial Order no. 114 of February 3, 2015 (the Grading Scale Order) 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 Study Board of Electronics and IT

§ 6: AFFILIATION TO CORPS OF EXTERNAL EXAMINERS

The Master's programme is associated with the external examiners corps on 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 (BSc) in Engineering (Computer Engineering), Aalborg University
- Bachelor of Science in Engineering (Electronic Engineering and IT with specialisation in Communication Systems), Aalborg University
- Bachelor of Science in Engineering (Internet Technologies and computer Engineering with specialisation in Communication Systems), 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 Signal Processing) (AAU)
- Bachelor of Science (BSc) in Engineering (Electronic Engineering and IT with specialisation in Informatics) (AAU)
- Bachelor of Science (BSc) 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 Signal Processing) (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)
- Bachelor of Science (BSc) in Engineering (Electronics and Computer Engineering) (AAU Esbjerg)
- Bachelor of Engineering (BScEE) in Electronics (AAU)

- Bachelor of Engineering (BScEE) in Electronics (AU)
- Bachelor of Engineering (BScEE) in Electronics (SDU)
- Bachelor of Engineering (BScEE) in IT-Electronics (DTU)
- Bachelor of Engineering (BScEE) in Electrical engineering (DTU)
- Bachelor of Science (BSc) in Engineering in Electrical Engineering (DTU)

§ 8: THE PROGRAMME TITLE IN DANISH AND ENGLISH

The Master's programme entitles the graduate to the Danish designation Civilingeniør, cand.polyt. i kommunikationsteknologi. The English designation is: Master of Science (MSc) in Engineering (Communication 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 in his or her native language as well as in English and use reference works etc. in other European languages.

§ 15: COMPETENCE PROFILE ON THE DIPLOMA

The following competence profile will appear on the diploma:

A Candidatus graduate has the following competency profile:

A Candidatus graduate has competencies that have been acquired via a course of study that has taken place in a research environment.

A Candidatus graduate is qualified for employment on the labour market based on his or her academic discipline as well as for further research (PhD programmes). A Candidatus graduate has, compared to a Bachelor, developed his or her academic knowledge and independence so as to be able to apply scientific theory and method on an independent basis within both an academic and a professional context.

§ 16: COMPETENCE PROFILE OF THE PROGRAMME

The graduate of the Master's programme

Knowledge

- **Must know** fundamental theories and methods for analysis of a communication system and its subcomponents,
- **Be able to understand** how to describe and account for the different functional blocks of a communication systems.
- **Must possess knowledge of** existing wireless communication systems, including their multiple access principle, basic terminology and overall architecture
- **Must know** some key features of international standards for one or several wired and/or wireless communication systems
- **Must understand** channel allocation principles and radio resource management as it applies to wireless communication systems
- ***Specific for Networks and Distributed Systems specialization:***
  - **Must have** an understanding of network design of both general purpose, multipurpose and dedicated networks.
  - **Must possess knowledge** in one or more subject areas that is based on the highest international research within the fields of networks and distributed systems
- ***Specific for Radio Systems specialization:***
  - **Be able to understand** the terminology and methods used to characterize electromagnetic properties of antennas and propagation for wireless communication
  - **Be able to understand** the terminology and parameters used to describe and characterize radio propagation mechanisms and channel response, including their impact to functionality and performance of multiple antenna systems

Skills

- **Must be able to choose between** a series of advanced analysis, simulation or experiments and model tests with relevance to communication systems
- **Must be able to plan** a communication system solution for a given set of relevant system specifications and requirements
- **Must be able to communicate** orally and in writing on topics within the field of knowledge, and in particular on the application of relevant techniques, procedures and algorithms used in the solution of the aforementioned problems.
- ***Specific for Networks and Distributed Systems specialization:***
  - **Must able to analyze and apply** methods, including analytical, numerical and experimental methods, for analysis, design and test of networks and distributed systems, including systems with reliability and/or timing constraints and/or security requirements.
  - **Must be able to select and apply methods of the behavior of a network, including analytical and simulation based models of traffic and queuing.**
  - Demonstrate insight in relevant theories, methods and techniques used for distribution, storage and processing of data in a distributed system
  - Demonstrate insight in real-time, performance, security and robustness aspects
- ***Specific for Radio Systems specialization:***
  - **Must be able to evaluate and select** among different multi antenna or radio system techniques for channel stabilization and capacity enhancement
  - **Must be able to characterize** propagation channel response as relevant for the wireless communications formats under investigation
  - **Must be able to choose** between and **apply** different numerical methods and theories, for the solution of electromagnetic antenna and wave propagation behaviors in wireless communication settings

Competencies

- **Must be able to formulate and hypothesize** problems of relevance to the performance of practical communication systems and critically **analyze** these on a link or system level
- **Must be able to account** for the effects of having multiple entities in a communication system in terms of for example resource scarcity, interference impact, etc.
- **Must be able to choose between and apply** relevant methods and theories for evaluation and design of specific subsystems or components of particular communication systems under investigations
- **Must be able to formulate and explain** scientific hypotheses and results achieved through scientific work

§ 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 instructio
- 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 examinatino (external grading) *or* internal examination (internal grading or by assessment by the supervisor only).

Offered as: 1-professional Specialisation: Radio Communication						
Module name	Course type	ECTS	Applied grading scale	Evaluation method	Assessment method	Language
1 SEMESTER						
Communication Systems (ESNCTK1P1)	Project	20	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
Wireless Communication Systems and Networks (ESNCTK1K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
2 SEMESTER						
Robust and High Performance Communications	Project	10	7-point grading scale	External examination	Oral exam based on a project	English

(ESNCTK2P1)						
Wireless Communication in Dynamic Settings (ESNCTK2P2)	Project	10	7-point grading scale	External examination	Oral exam based on a project	English
Dynamic Channels and Advanced Signal Processing (ESNCTK2K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
2nd Semester Elective courses (RC) Choose 1 course module	Course	5				
3 SEMESTER Option A						
Analysis and Design of Communication Technologies (ESNCTK3P1)	Project	20	7-point grading scale	Internal examination	Oral exam based on a project	English
Antennas, Propagation and RF Circuits (ESNCTK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
3rd Semester Elective courses (RC) Choose 1 course module	Course	5				
3 SEMESTER Option B						
Analysis and Design of Communication Technologies (ESNCTK3P2)	Project	25	7-point grading scale	Internal examination	Oral exam based on a project	English
Antennas, Propagation and RF Circuits (ESNCTK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
3 SEMESTER Option C						
Analysis and Design of Communication Technologies (ESNCTK3P3)	Project	30	7-point grading scale	Internal examination	Oral exam based on a project	English
3-4 SEMESTER Option D						
Master's Thesis (ESNCTK4P2)	Project	50	7-point grading scale	External examination	Master's thesis/final project	English
Antennas, Propagation and RF Circuits (ESNCTK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
3rd Semester Elective courses (RC) Choose 1 course module	Course	5				
4 SEMESTER						
Master's Thesis (ESNCTK4P1)	Project	30	7-point grading scale	External examination	Master's thesis/final project	English

2nd Semester Elective courses (RC) Choose 1 course module						
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method	Language
Robust Communications and Traffic Analysis (ESNCTK2K2)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Numerical Scientific Computing (ESNCTK2K3)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Reconfigurable and Low Energy Systems (ESNCTK2K4)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English

3rd Semester Elective courses (RC) Choose 1 course module						
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method	Language
Machine Learning (ESNSPAK3K2F)	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
Information and Coding Theory (ESNCTK3K2)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Array and Sensor Signal Processing (ESNSPAK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English

3rd Semester Elective courses (RC) Choose 1 course module						
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method	Language
Machine Learning (ESNSPAK3K2F)	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
Information and Coding Theory (ESNCTK3K2)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Array and Sensor Signal Processing (ESNSPAK3K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English

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 (ESNCTK1P1)	Project	20	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
Wireless Communication Systems and Networks (ESNCTK1K1)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
2 SEMESTER						
Robust and High Performance Communications (ESNCTK2P1)	Project	10	7-point grading scale	External examination	Oral exam based on a project	English
Distributed Systems Design (ESNCTK2P3)	Project	10	7-point grading scale	External examination	Oral exam based on a project	English
Robust Communications and Traffic Analysis (ESNCTK2K2)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Network Security (ESNCTK2K5)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
3 SEMESTER Option A						
Analysis and Design of Communication Technologies (ESNCTK3P1)	Project	20	7-point grading scale	Internal examination	Oral exam based on a project	English
3rd Semester Elective courses (NDS) Choose 2 course modules	Project	10				
3 SEMESTER Option B						
Analysis and Design of Communication Technologies (ESNCTK3P2)	Project	25	7-point grading scale	Internal examination	Oral exam based on a project	English
3rd Semester Elective courses (NDS) Choose 1 course module	Course	5				
3 SEMESTER Option C						
Analysis and Design of Communication Technologies (ESNCTK3P3)	Project	30	7-point grading scale	Internal examination	Oral exam based on a project	English
3-4 SEMESTER Option D						
Master's Thesis (ESNCTK4P2)	Project	50	7-point grading scale	External examination	Master's thesis/final project	English
3rd Semester Elective courses (NDS) Choose 2 course modules	Course	10				

4 SEMESTER						
Master's Thesis (ESNCTK4P1)	Project	30	7-point grading scale	External examination	Master's thesis/final project	English

3rd Semester Elective courses (NDS) Choose 1 course module						
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method	Language
Machine Learning (ESNSPAK3K2F)	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
Information and Coding Theory (ESNCTK3K2)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Distributed Real Time Systems (ESNCAK1K2F)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Advanced Topics in Distributed Systems (DSNDATFK103)	Course	5	7-point grading scale	Internal examination	Written or oral exam	Danish and English

3rd Semester Elective courses (NDS) Choose 2 course modules						
Module name	Course type	ECTS	Applied grading scale	Evaluation Method	Assessment method	Language
Machine Learning (ESNSPAK3K2F)	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
Information and Coding Theory (ESNCTK3K2)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Distributed Real Time Systems (ESNCAK1K2F)	Course	5	Passed/Not Passed	Internal examination	Written or oral exam	English
Advanced Topics in Distributed Systems (DSNDATFK103)	Course	5	7-point grading scale	Internal examination	Written or oral exam	Danish and 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 01.09.2019.

§ 21: AMENDMENTS TO THE CURRICULUM AND REGULATIONS

On September 14, 2020, the vice Dean has approved to add the mandatory course "*Antennas, Propagation and RF Circuits*" on 3rd semester version D valid as of September 2020.