



AALBORG UNIVERSITET

# **CURRICULUM FOR THE MASTER'S PROGRAMME IN COMPUTER ENGINEERING, 2022**

MASTER OF SCIENCE (MSC) IN ENGINEERING  
AALBORG

[Link to this studyline](#)

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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 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. 104 of January 24, 2021 (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 Civil engineering corps of external examiners.

## § 7: ADMISSION REQUIREMENTS

### 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 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 (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)

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.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

- 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, real-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).

| Offered as: 1-professional   |             |       |                       |                      |                              |          |
|--|-------------|-------|-----------------------|----------------------|------------------------------|----------|
| Specialisation: Network and Distributed Systems  |             |       |                       |                      |                              |          |
| Module name  | Course type | ECT S | Applied grading scale | Evaluation method    | Assessment method            | Language |
| <b>1 SEMESTER</b>  |             |       |                       |                      |                              |          |
| <a href="#">Communication Systems</a><br>(ESNNSDK1P2)  | Project     | 15    | 7-point grading scale | Internal examination | Oral exam based on a project | English  |
| <a href="#">Machine Learning</a><br>(ESNESK1K1)  | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam         | English  |
| <a href="#">Dependable and Secure Distributed Systems</a><br>(ESNNSDK2K4)                      | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam         | English  |
| <a href="#">Performance and Reliability Analysis of Communication Networks</a><br>(ESNNSDK1K3) | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam         | English  |
| <b>2 SEMESTER</b>  |             |       |                       |                      |                              |          |
| <a href="#">Reliability, Safety and Security</a><br>(ESNNSDK2P2)                               | Project     | 15    | 7-point grading scale | External examination | Oral exam based on a project | English  |
| <a href="#">Advanced Network Security</a><br>(ESNNSDK1K2)                                      | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam         | English  |
| <a href="#">2ND SEMESTER ELECTIVE COURSE</a><br>CHOOSE 2 COURSE MODULES                        | Course      | 10    |                       |                      |                              |          |
| <b>3 SEMESTER</b><br>Option A  |             |       |                       |                      |                              |          |
| <a href="#">AI in the Context of Computer Engineering</a><br>(ESNNSDK3P8)                      | Project     | 20    | 7-point grading scale | Internal examination | Oral exam based on a project | English  |
| <a href="#">3RD SEMESTER ELECTIVE COURSE</a><br>CHOOSE 2 COURSE MODULES                        | Course      | 10    |                       |                      |                              |          |
| <b>3 SEMESTER</b>  |             |       |                       |                      |                              |          |

| Option B  |         |    |                       |                      |                               |         |
|---|---------|----|-----------------------|----------------------|-------------------------------|---------|
| <a href="#">Project-Oriented Study in an External Organisation</a><br>(ESNNDK3P5) | Project | 20 | Passed/Not Passed     | Internal examination | Oral exam based on a project  | English |
| <a href="#">3RD SEMESTER ELECTIVE COURSE</a><br>CHOOSE 2 COURSE MODULES           | Course  | 10 |                       |                      |                               |         |
| 3 SEMESTER<br>Option C  |         |    |                       |                      |                               |         |
| <a href="#">Project-Oriented Study in an External Organisation</a><br>(ESNNDK3P6) | Project | 25 | Passed/Not Passed     | Internal examination | Oral exam based on a project  | English |
| <a href="#">3RD SEMESTER ELECTIVE COURSE</a><br>CHOOSE 1 COURSE MODULE            | Course  | 5  |                       |                      |                               |         |
| 3 SEMESTER<br>Option D  |         |    |                       |                      |                               |         |
| <a href="#">Project-Oriented Study in an External Organisation</a><br>(ESNNDK3P7) | Project | 30 | Passed/Not Passed     | Internal examination | Oral exam based on a project  | English |
| 3-4 SEMESTER<br>Option E  |         |    |                       |                      |                               |         |
| <a href="#">Master's Thesis</a><br>(ESNNDK4P6)                                    | Project | 50 | 7-point grading scale | External examination | Master's thesis/final project | English |
| <a href="#">3RD SEMESTER ELECTIVE COURSE</a><br>CHOOSE 2 COURSE MODULES           | Course  | 10 |                       |                      |                               |         |
| 4 SEMESTER  |         |    |                       |                      |                               |         |
| <a href="#">Master's Thesis</a><br>(ESNNDK4P5)                                    | Project | 30 | 7-point grading scale | External examination | Master's thesis/final project | English |

| 2ND SEMESTER ELECTIVE COURSE<br>CHOOSE 2 COURSE MODULES        |             |       |                       |                      |  |          |
|--|-------------|-------|-----------------------|----------------------|--|----------|
| Module name  | Course type | ECT S | Applied grading scale | Evaluation Method    | Assessment method                          | Language |
| <a href="#">Deep Learning</a><br>(ESNNDK2K3)                   | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam                       | English  |
| <a href="#">Numerical Scientific Computing</a><br>(ESNAVSK2K1) | Course      | 5     | Passed/Not Passed     | Internal examination | Active participation/continuous evaluation | English  |
| <a href="#">Networks and Systems</a><br>(ESNESK2K2)            | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam                       | English  |

| 3RD SEMESTER ELECTIVE COURSE<br>CHOOSE 2 COURSE MODULES |             |       |                       |                      |                      |          |
|---|-------------|-------|-----------------------|----------------------|----------------------|----------|
| Module name   | Course type | ECT S | Applied grading scale | Evaluation Method    | Assessment method    | Language |
| <a href="#">Stochastic Systems</a><br>(ESNESK1K2)       | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam | English  |

|  |        |   |                       |                      |                      |         |
|--|--------|---|-----------------------|----------------------|----------------------|---------|
| <a href="#">Image Processing and Computer Vision</a><br>(ESNAVSK1K1) | Course | 5 | 7-point grading scale | Internal examination | Written or oral exam | English |
| <a href="#">Perception and Acquisition of Data</a><br>(ESNAVSK1K3)   | 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 |
|--|-------------|------|-----------------------|----------------------|----------------------|----------|
| <a href="#">Stochastic Systems</a><br>(ESNESK1K2)                    | Course      | 5    | 7-point grading scale | Internal examination | Written or oral exam | English  |
| <a href="#">Image Processing and Computer Vision</a><br>(ESNAVSK1K1) | Course      | 5    | 7-point grading scale | Internal examination | Written or oral exam | English  |
| <a href="#">Perception and Acquisition of Data</a><br>(ESNAVSK1K3)   | 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 |
|--|-------------|------|-----------------------|----------------------|--|----------|
| <b>1 SEMESTER</b>  |             |      |                       |                      |  |          |
| <a href="#">Computer Vision</a><br>(ESNAVSK1P1)                                  | Project     | 15   | 7-point grading scale | Internal examination | Oral exam based on a project               | English  |
| <a href="#">Machine Learning</a><br>(ESNESK1K1)                                  | Course      | 5    | 7-point grading scale | Internal examination | Written or oral exam                       | English  |
| <a href="#">Perception and Acquisition of Data</a><br>(ESNAVSK1K3)               | Course      | 5    | 7-point grading scale | Internal examination | Written or oral exam                       | English  |
| <a href="#">Image Processing and Computer Vision</a><br>(ESNAVSK1K1)             | Course      | 5    | 7-point grading scale | Internal examination | Written or oral exam                       | English  |
| <b>2 SEMESTER</b>  |             |      |                       |                      |  |          |
| <a href="#">Acoustics, Sound Processing and Sound Perception</a><br>(ESNAVSK2P1) | Project     | 15   | 7-point grading scale | External examination | Oral exam based on a project               | English  |
| <a href="#">Deep Learning</a><br>(ESNNSK2K3)                                     | Course      | 5    | 7-point grading scale | Internal examination | Written or oral exam                       | English  |
| <a href="#">Numerical Scientific Computing</a><br>(ESNAVSK2K1)                   | Course      | 5    | Passed/Not Passed     | Internal examination | Active participation/continuous evaluation | English  |
| <a href="#">Fundamentals of Acoustics and Sound</a><br>(ESNAVSK2K2)              | Course      | 5    | 7-point grading scale | Internal examination | Written exam                               | English  |
| <b>3 SEMESTER</b><br>Option A  |             |      |                       |                      |  |          |



|  |         |    |                       |                      |                               |         |
|--|---------|----|-----------------------|----------------------|-------------------------------|---------|
| <a href="#">AI in the Context of Computer Engineering</a><br>(ESNNSDK3P8)          | Project | 20 | 7-point grading scale | Internal examination | Oral exam based on a project  | English |
| <a href="#">3RD SEMESTER ELECTIVE COURSES</a><br>CHOOSE 2 COURSE MODULES           | Course  | 10 |                       |                      |                               |         |
| <b>3 SEMESTER</b><br>Option B  |         |    |                       |                      |                               |         |
| <a href="#">Project-Oriented Study in an External Organisation</a><br>(ESNNSDK3P5) | Project | 20 | Passed/Not Passed     | Internal examination | Oral exam based on a project  | English |
| <a href="#">3RD SEMESTER ELECTIVE COURSES</a><br>CHOOSE 2 COURSE MODULES           | Course  | 10 |                       |                      |                               |         |
| <b>3 SEMESTER</b><br>Option C  |         |    |                       |                      |                               |         |
| <a href="#">Project-Oriented Study in an External Organisation</a><br>(ESNNSDK3P6) | Project | 25 | Passed/Not Passed     | Internal examination | Oral exam based on a project  | English |
| <a href="#">3RD SEMESTER ELECTIVE COURSES</a><br>CHOOSE 1 COURSE MODULE            | Course  | 5  |                       |                      |                               |         |
| <b>3 SEMESTER</b><br>Option D  |         |    |                       |                      |                               |         |
| <a href="#">Project-Oriented Study in an External Organisation</a><br>(ESNNSDK3P7) | Project | 30 | Passed/Not Passed     | Internal examination | Oral exam based on a project  | English |
| <b>3-4 SEMESTER</b><br>Option E  |         |    |                       |                      |                               |         |
| <a href="#">Master's Thesis</a><br>(ESNNSDK4P6)                                    | Project | 50 | 7-point grading scale | External examination | Master's thesis/final project | English |
| <a href="#">3RD SEMESTER ELECTIVE COURSES</a><br>CHOOSE 2 COURSE MODULES           | Course  | 10 |                       |                      |                               |         |
| <b>4 SEMESTER</b>  |         |    |                       |                      |                               |         |
| <a href="#">Master's Thesis</a><br>(ESNNSDK4P5)                                    | Project | 30 | 7-point grading scale | External examination | Master's thesis/final project | English |

| <b>3RD SEMESTER ELECTIVE COURSES</b><br>CHOOSE 2 COURSE MODULES                |             |       |                       |                      |                      |          |
|--|-------------|-------|-----------------------|----------------------|----------------------|----------|
| Module name  | Course type | ECT S | Applied grading scale | Evaluation Method    | Assessment method    | Language |
| <a href="#">Stochastic Systems</a><br>(ESNESK1K2)                              | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam | English  |
| <a href="#">Dependable and Secure Distributed Systems</a><br>(ESNNSDK2K4)      | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam | English  |
| <a href="#">Performance and Reliability Analysis of Communication Networks</a> | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam | English  |

|              |  |  |  |  |  |  |
|--------------|--|--|--|--|--|--|
| (ESNNSDK1K3) |  |  |  |  |  |  |
|--------------|--|--|--|--|--|--|

| 3RD SEMESTER ELECTIVE COURSES<br>CHOOSE 1 COURSE MODULE  |             |       |                       |                      |                      |          |
|--|-------------|-------|-----------------------|----------------------|----------------------|----------|
| Module name  | Course type | ECT S | Applied grading scale | Evaluation Method    | Assessment method    | Language |
| <a href="#">Stochastic Systems</a><br>(ESNESK1K2)  | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam | English  |
| <a href="#">Dependable and Secure Distributed Systems</a><br>(ESNNSDK2K4)                      | Course      | 5     | 7-point grading scale | Internal examination | Written or oral exam | English  |
| <a href="#">Performance and Reliability Analysis of Communication Networks</a><br>(ESNNSDK1K3) | 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 website.

## § 20: COMMENCEMENT AND TRANSITIONAL RULES

The curriculum is approved by the dean and enters into force as of September 1, 2022.

## § 21: AMENDMENTS TO THE CURRICULUM AND REGULATIONS

On February 11, 2022 the Pro-Dean of Education has approved that the form of assessment in the module "Project-Oriented Study in an External Organisation" on the 3<sup>rd</sup> Semester is changed from 7-point grading scale to Passed/Not Passed as of September 2022.

On April 26, 2022 the Pro-Dean of Education has approved that the the elective module "Advanced Network Security" is replaced with the module "Dependable and Secure Distributed Systems" on the 3<sup>rd</sup> Semester as of Autumn 2022.

On January 13, 2023 the Pro-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, with oral re-examination as of Spring 2023.

On February 15, 2023 the Pro-Dean of Education has approved the addition of a prerequisite for enrollment for the exam in the modules: "*Systems of Systems*", "*Reliability, Safety and Security*" and "*Acoustics, Sound Processing and Sound Perception*" on the 1<sup>st</sup> Semester, as of Spring 2023.

The prerequisite is as follows:

- *An approved PBL competency profile is a prerequisite for participation in the project exam*