The Faculty of Engineering and Science
The Board of Studies for Industry and Global Business Development

AALBORG UNIVERSITET

Curriculum for the Master's Programme in Global Systems Design

(Cand.tech.)

Aalborg University

September 2017

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dekan

Campus Copenhagen

The Faculty of Engineering and Science
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Preface

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

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Chapter 1: Legal Basis of the Curriculum, etc.

1.1 Basis in Ministerial Orders

The Master's programme in Global Systems Design is organised in accordance with the Ministry of Higher Education and Science's Order no. 1328 of November 15, 2016 on Bachelor's and Master's Programmes at Universities (the Ministerial Order of the Study Programmes) and Ministerial Order no. 1062 of June 30, 2016 on University Examinations (the Examination Order). Further reference is made to Ministerial Order no. 111 of January 30, 2017 (the Admission Order) and Ministerial Order no. 114 of February 3, 2015 (the Grading Scale Order) with subsequent changes

1.2 Faculty Affiliation

The Master programme falls under The Faculty of Engineering and Science, Aalborg University.

1.3 Board of Studies Affiliation

The Master programme falls under the Board of Studies for Industry and Global Business Development under the School of Engineering and Science.

1.4 Body of External Examiners

The Master's programme falls under the Body of External Examiners for Engineers (Ingeniøruddannelernes landsdækkende censorkorps (Maskin)).

Chapter 2: Admission, Degree Designation, Programme Duration and Competence Profile

2.1 Admission

Applicants with a legal claim to admission (retskrav):

- None

Applicants without legal claim to admission:

- Bachelor of Science (BSc) in Engineering (Manufacturing and Operations Engineering), Aalborg University

Students with another Bachelor degree may, upon application to the Board of Studies, be admitted following a specific academic assessment if the applicant is considered as having comparable educational prerequisites. The University can stipulate requirements concerning conducting additional exams prior to the start of study.

2.2 Degree Designation in Danish and English

The Master programme entitles the graduate to the Danish designation Cand.tech. (candidatus/candidata technologiae) i globalt systemdesign. The English designation is: Master of Science (MSc) in Technology (Global Systems Design).

2.3 The Programme's Specification in ECTS Credits

The Master programme is a 2-year, research-based, full-time study programme. The programme is set to 120 ECTS credits.

2.4 Competence Profile on the Diploma

A graduate of the Master's programme has competencies acquired through an educational programme that has taken place in a research environment. The graduate of the Master's program can perform highly qualified functions in the application areas of autonomous systems in relevant industry/business context, on basis of the educational programme in Global System Design. Moreover, the graduate has prerequisites for research (a PhD programme). The graduate in Global System Design can identify and implement potentially disruptive innovations in the area of autonomous systems. Compared to the Bachelor's degree, the graduate of the Master's programme in Global System Design has developed her/his academic knowledge and independence, so that the graduate is able to independently apply scientific theory and method in both an academic and occupational/professional context.

2.5 Competence Profile of the Programme

<u>The graduate of the Master programme:</u>

Knowledge

- Has attained thorough understanding of a broad range of theoretical, numerical and experimental techniques within the area of designing and applying autonomous systems.

- Has thorough knowledge of the concepts and key elements of autonomous systems, as well as the fundamental technologies that enable systems to be intelligent and autonomous.
- Has knowledge in one or more selected subject areas of autonomous systems and global systems design that is based on the highest international research.
- Has in-depth knowledge about the effects of autonomous systems on the way that related operations are conducted In the area of Global System Design, and has insights into the potentials and limitations of such systems when applied in a specific case.
- Demonstrate an understanding of research work and be able to become a part of a research environment.
- Demonstrate insight into the implications of research work, including research ethics.

Skills

- Be able to analysze a given use-case problem and design suitable autonomous systems and solutions by applying scientific methods and tools, general skills related to problem solving and systems design.
- Be able to apply a wide range of technologies and an engineering approach for solving problems within the domain of designing globally functioning systems.
- Be able to evaluate and select among scientific theories, methods and tools for the conception, design, implementation and operation of autonomous systems.
- Be able to apply theories, methods and concepts in different organizational and empirical settings in order to solve complicated technical problems in a societal context.
- Be able to participate in the development and implementation of novel and innovative technology-based concepts, systems and solutions.
- Can disseminate and communicate research-based knowledge and discuss professional and scientific problems within the domain of designing autonomous systems in a global context with both peers and non-specialists.

Competencies

- Be able to manage work and development in complex and unpredictable situations requiring new solutions.
- Be able to take part in technical development and research.
- Can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility within the area of Global System Design.
- Be able to direct the technical management of development projects within the industry.
- Be able to independently take responsibility for own professional development and specialization.

Chapter 3: Content and Organisation of the Programme

The Master's programme in Global Systems Design aims at providing graduates with competences to solve complex problems related to the design and deployment of autonomous systems and has been developed to build both theoretical understanding and practical experience of students enrolled in the programme. The programme focuses on topics as: Systems Engineering & Validation, Modelling and Control of Mechatronic Systems, Optimization Scheduling and routing, Sensing and Perception, Machine Learning and Big Data, and Networks of Autonomous Systems. Those topics can be applied across industrial sectors in order to provide flexible autonomous solutions to problems ranging from classical manufacturing to service production

The programme is structured giving the graduate the opportunity to specialise within specific areas of autonomous systems; ranging from e.g. autonomous solutions in Automation and Robotics to autonomous operation of Logistics systems. The specialisation is carried out through the project work.

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 aim 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 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)
- Teacher feedback
- Reflection
- Portfolio work.

The 3rd Semester offers different ways of organisation – depending on the student's choice of content; traditional project work at Aalborg University, study visit at an educational institution in Denmark or abroad, voluntary internship with project work at a company in Denmark or abroad, or a Semester programme that comprises cross-disciplinary programme elements composed by the student. The total work load of the Semester must be equivalent to 30 ECTS, of which up to 15 ECTS may be elective courses. The project may be finalised with a project report or in the form of a scientific paper, or, if the project is continued on the 4th Semester, with a midterm evaluation. For further information about the organisation of the module, please see the Joint programme regulations, chapter 2.3.

On the 4th Semester, the Master's Thesis is completed. The Master's Thesis may be combined with the 3rd Semester in an extended Master's Thesis.

3.1 Overview of the Programme

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

Semester		Module	ECTS	Grading	Exam
1.		Engineering of Autonomous Systems	15	7-point scale	Internal
		Systems Engineering & Validation	5	7-point scale	Internal
		Modelling and Control of Mechatronic Systems	5	7-point scale	Internal
		Optimization, Scheduling and Routing	5	7-point scale	Internal
2.		Intelligent Autonomous Systems	15	7-point scale	External
		Sensing and Perception	5	7-point scale	Internal
		Machine Learning and Big Data	5	7-point scale	Internal
		Networks of Autonomous Systems	5	7-point scale	Internal
3.	A	Autonomous Systems in Practice	30	7-point scale	Internal
	B	Academic Internship	30	7-point scale	Internal
4.		Master's Thesis	30, possible 60	7-point scale	External

3.2 Global Systems Design, 1st Semester

3.2.0 Problem Based Learning and Project Management

Title:

Problem Based Learning and Project Management (Problembaseret læring og projektledelse)

Objective:

The objective is to make newly started Master students coming from institutions other than AAU prepared to enter the problem based learning environment at AAU and manage study projects in close collaboration with peers.

Type of instruction:

Three half day workshops centered around the individual student working with an individual challenge or curiosity in relation to using a PBL approach. Peer learning is also a hallmark, since the students will discuss and reflect their individual challenges/curiosities in a peer learning group.

Learning outcomes: After completion of the course the student should be able to

Day 1:

- describe and discuss the Aalborg PBL model based on the three key words: group work, project work, problem orientation
- identify an initial individual challenge when using a PBL approach

Day2:

- develop and practice peer feedback skills
- practice collaborative learning in a group
- design a plan of action to deal with an initial individual PBL challenge or curiosity

Day 3:

- practice presentation skills
- practice critical skills when giving feedback to peers
- reflect on own and peer skills in relation to PBL practice

Form of examination:

Internal assessment during the course/class participation according to the rules in the Examination Policies and Procedures of Faculty of Engineering and Science, Aalborg University. In this case the assessment is primarily based on the oral performance during the course, which means that the student has to be active during the course time and participate in discussions. The course is an integrated part of the project for those not acquainted to the Aalborg PBL model, and is a precondition for participation in the project examination. In this way there will be no diploma for the course and it will not be visible on the academic transcripts.

Evaluation criteria:

Passed/not passed as stated in the Joint Programme Regulations.

3.2.1 Engineering of Autonomous Systems (15 ECTS)

Title: **Engineering of Autonomous Systems**

(Udvikling af autonome systemer)

Objectives: Students who complete the module are expected to:

Knowledge

- Have knowledge on how to use system engineering tools to model, investigate and select new solutions to the specific problems.
- Must have knowledge about how to optimize the operations of an autonomous systems in a deterministic or stochastic environment using Operations Research methods and tools.
- Must have knowledge about how to model and implement a control solution in a given problem to improve the management and performance of an individual autonomous system.

Skills

- Is able to use the major system engineering tools to model an autonomous system.
- Is able to design autonomous systems and motivate the choices using system design methods.
- Is able to document the design and the developments using system engineering methods.

Competencies

- Is able to apply project- and team-based learning to complete a team project, including preparation of problem definition, coherent analysis and writing of a technical report with clear formulation of results and conclusions, and with proper use of source references.

Teaching Method: The module is carried out as group-based, problem-oriented project work. The group work is carried out as an independent work process in which the students themselves organise and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 6 members.

Form of examination: Oral examination based on a written report.

Evaluation criteria: As stated in the Joint Programme Regulations.

3.2.2 Systems Engineering and Validation (5 ECTS)

Title: **Systems Engineering and Validation**

(System udvikling og validering)

Goal: Students who complete the module are expected to:

Knowledge

- Have knowledge of the most important system engineering tools.
- Have knowledge about tools for system modelling and simulation.
- Know of methods for simulating or emulating automated production systems to test control logic and validate broader impact of automation projects on production / logistics system performance with metrics for capacity and bottleneck utilization, material flow, inventory levels.
- Know how to proactively design for and manage system lifecycle targets.

Skills

- Understands system engineers' role and responsibilities.
- Is able to apply systems engineering tools to realistic problems.
- Develop simple simulation and emulation models to validate impact of automation projects on manufacturing / logistics systems and overall system performance using queuing theory and stochastics.
- Can formulate an effective plan for gathering and using data.

Competencies

- Must be able to rationalize and scientifically justify the use of a specific model for a given problem.
- Is able to recognize the value and limitations of modelling and simulation.
- Should be able to develop models for pre-testing various control logics.
- Should be able to communicate with rest of the organization about impact of automation / steering on metrics for production unit / logistics system.
- Should be able to develop a systems engineering plan for a realistic project.
- Should be able to judge the applicability of any proposed process, strategy, or methodology for systems engineering using the fundamental concepts from disciplines such as of probability, economics, and cognitive science.

Teaching Method: The teaching is organized in accordance with the general forms of teaching, see chapter 3.

Form of examination: Oral/written examination.

Evaluation criteria: As stated in the Joint programme regulations.

3.2.3 Modelling and Control of Mechatronic Systems (5 ECTS)

Title: **Modelling and Control of Mechatronic Systems**

(Modellering og styring af mekatroniske systemer)

Goal: Students who complete the module are expected to:

Knowledge

- Have knowledge about analytic modeling of physical systems.
- Have knowledge about control of dynamic systems and tools for analysis of a controlled system.
- Have knowledge about industrial and proportional–integral–derivative controllers.
- Have knowledge about performances of a controlled system such as transient response, steady-state accuracy, stability and robustness.
- Have knowledge about signal processing and discrete time control.
- Have knowledge about control of robots, robot control schemes and architectures.

Skills

- Be able to formulate models and apply methodologies to address and solve problems related to the dynamics of electro-mechanical systems.
- Be able to simulate the dynamic model of a system and test control methods in simulation.
- Be able to implement a control system and evaluate the system performances of a physical dynamic system.
- Be able to generalize the knowledge to the design of multi-disciplinary controlled systems.

Competencies

- Be able to rationalize and scientifically justify the use of a specific model for a given problem.
- Be able to communicate with experts about themes related to vibrations, system dynamics and control.
- Be able to identify problems in controlled systems and provide solutions to improve the performances of a controlled system.
- Be able to implement new control solutions for a given control problem.

Teaching Method: The teaching is organized in accordance with the general forms of teaching, see chapter 3.

Form of examination: Oral/written examination.

Evaluation criteria: As stated in the Joint programme Regulations.

3.2.4 Optimization, Scheduling and Routing (5 ECTS)

Title: Optimization, Scheduling and Routing

(Optimering, skedulering og routing)

Goal: Students who complete the module are expected to:

Knowledge

- Knowledge of formulating a linear optimization problem using linear equation.
- Knowledge of important algorithms such as Dijkstras shortest paths algorithm and the simplex method.
- Knowledge of the characteristics of 1-2 major metaheuristics and the concept of a heuristic.
- Knowledge of general scheduling and routing problems.

Skills

- Is able to critically evaluate advantages of different models and methods applied to a given problem.
- Can use different tools to solve realistic problems.
- Can formulate a real-life optimization problem with a mathematical programming model.
- Apply scheduling and routing models to optimize automated manufacturing and transportation / logistics systems and their operational execution to achieve desired targets for productivity, process quality etc.

Competencies

- Must be able to rationalize and scientifically justify the use of a specific solution method.
- Is able to recognize the value and limitations of a solution method.
- Should be able to communicate with experts the themes related to mathematical programming
- Should be able to develop a model for a realistic problem and to implement a solution method for the problem using the tools from the course
- Should be able to judge the applicability of the different mathematical programming models and corresponding methods.

Teaching Method: The teaching is organized in accordance with the general forms of teaching, see chapter 3.

Form of examination: Oral/written examination

Evaluation criteria: As stated in the Joint Programme Regulations.

3.3 Global Systems Design, 2nd Semester

3.3.1 Intelligent Autonomous Systems (15 ECTS)

Title: **Intelligent Autonomous Systems**

(Intelligente autonome systemer)

Prerequisites: The module adds to the knowledge obtained in 1st Semester.

Goal: Students who complete the module are expected to:

Knowledge

- Have gained knowledge and experience of how to develop autonomous solution with advanced sensing, big data, machine learning, vision and perception technologies.
- Have gained knowledge and experience of how to design intelligent autonomous systems and networks with related concepts, theories, methods and tools, based on demand characteristics in different industry/business contexts.
- Have gained knowledge and experience of how to evaluate the performance of intelligent autonomous systems and networks in a dynamic application/commercial environment.

Skills

- Be able to analyse the system demand in a real case and specify its characteristics.
- Be able to develop an intelligent autonomous solution with related technologies, aiming to meet the identified demands.
- Be able to conduct a cost and benefit analysis for the proposed solution to justify economic feasibility.
- Be able to comprehensively evaluate the performance of intelligent autonomous systems and networks in a dynamic application/commercial environment.

Competencies

- Have the ability to interpret the differences of intelligent autonomous solutions compared with conventional ones in a specific context, e.g. autonomous robots, production or transportation logistics.
- Have the ability to formulate a project to target and solve an intelligent autonomous solution in a real case, as well as planning and conducting such a project with team work.
- Have the ability to estimate and assess the achievement of logistic and economic objectives in intelligent autonomous solutions in a specific context.
- Have the ability to analyse the limitations, opportunities, and the survivability of an intelligent autonomous system/network against more complex and contested environments.

Teaching Method: The module is carried out as group-based, problem-oriented project work. The group work is carried out as an independent work process in which the students themselves organise and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 6 members.

Form of examination: Oral examination based on a written report and demonstrations.

Evaluation criteria: As stated in the Joint Programme Regulations.

3.3.2 Sensing and Perception (5 ECTS)

Title: **Sensing and Perception**

(Sensor baseret perception)

Prerequisites: The module adds to the knowledge obtained in 1st Semester.

Goal: Students who complete the module are expected to:

Knowledge

- About the theory of sensors/sensing.
- About sensor signal processing.
- About 3D Perception
- Of creation and real-time update of virtual world models
- About multi sensor integration

Skills

- Is able to design and implement perception systems required for specific applications.
- Is able to create software that process sensor data which are further employed by an integrated system.

Competencies

- Must be able to rationalize and scientifically justify the use of specific sensors for a given problem
- Is able to recognize the value and limitations of each perception method.
- Should be able to communicate with experts about themes related to sensors, signal processing and world virtualization.
- Should be able to judge the applicability of any perception system, both concerning effectiveness and cost.

Teaching Method: The teaching is organized in accordance with the general forms of teaching, see chapter 3.

Form of examination: Oral/written examination.

Evaluation criteria: As stated in the Joint Programme Regulations.

3.3.3 Machine Learning and Big Data (5 ECTS)

Title: **Machine Learning and Big Data**

(Machine Learning og Big Data)

Prerequisites: The module adds to the knowledge obtained in 1st Semester.

Goal: Students who complete the module are expected to:

Knowledge

- Of the most important machine learning techniques.
- About tools for applying machine learning solutions.
- About characteristics of big data.
- About programming models and tools for big data analysis.

Skills

- Understand the types of machine learning algorithms, such as supervised, unsupervised and reinforcement learning.
- Understand the different classes of tasks where machine learning can be applied, including classification, regression and clustering problems.
- Apply machine learning algorithms in a given problem.
- Understand big data characteristics, such as volume, velocity, variety, veracity, valence, and value and explain how they can influence big data analysis.
- Create data models that suit the characteristics of given data.
- Design and develop autonomous systems that exploit machine learning and big data.

Competencies

- Is able to compare, choose, or develop the most appropriate machine learning algorithm in a given problem.
- Can identify the type of task and required machine learning algorithm in a given application.
- Can identify what are big data problems.
- Must have the competency to compare and choose the most appropriate data model that suits the characteristics of given data.
- Is able to compare and assess the use of techniques and tools for issues that include collecting, storing, organizing, analyzing and using big data.

Teaching Method: The teaching is organized in accordance with the general forms of teaching, see chapter 3.

Form of examination: Oral/written examination

Evaluation criteria: As stated in the Joint Programme Regulations.

3.3.4 Networks of Autonomous Systems (5 ECTS)

Title: **Networks of Autonomous Systems**

(Netværk af autonome systemer)

Prerequisites: The module adds to the knowledge obtained in 1st Semester.

Goal: Students who complete the module are expected to:

Knowledge

- Have gained an understanding of typical applications of AxS in the various domains, e.g. military use, manufacturing, production and logistics.
- Have gained an understanding of autonomy classifications
- Have gained an understanding of interoperability challenges in both short- and long-term.
- Have gained an understanding of the concepts and methods of designing an AxS network.
- Have gained an understanding of methods and tools of evaluating the performance of an AxS network.

Skills

- Be able to design an AxS system or network based on a certain demand characteristics in a context e.g. manufacturing, production and logistics.
- Be able to evaluate the performance of an AxS system or network in a dynamic application environment.
- Be able to assess both technological and economic feasibility of an AxS system or network in a specific application/commercial context.

Competencies

- Have gained awareness and a holistic understanding on the impacts of AxS in an running business or industrial context.
- Have gained the insights and tools of employing AxS systems or networks in a specific facility.
- Be able to conduct a comprehensive performance/risk analysis in a quantitative manner, by identifying the stochastic characteristics of application .context/environment, based on which should be able to judge the applicability of any AxS systems or networks.

Teaching Method: The teaching is organized in accordance with the general forms of teaching, see chapter 3.

Form of examination: Oral/written examination.

Evaluation criteria: As stated in the Joint Programme Regulations.

3.4 Global Systems Design, 3rd Semester

3.4.1 Autonomous Systems in Practice (30 ECTS)

Title: **Autonomous Systems in Practice**

(Anvendelse af autonome systemer)

Prerequisites: The module adds to the knowledge obtained in 1st and 2nd Semester.

Goal: Students who complete the module are expected to:

Knowledge

- Must have knowledge about the advantages and practical limitations of autonomous systems deployed in at least one application area.
- Must have knowledge of the scientific basis and possible engineering solutions for the specific application area.

Skills

- Must be able to make a requirement specification for the implementation of autonomous systems in a given situation.
- Must be able to seek out and develop a solution and present it in the form of sketches, diagrams, drawings and virtual, as well as physical, prototypes.
- Must be able to justify the benefits of a developed solution
- Must be able to independently plan and carry out a development on basis of a given problem.
- Must be able to choose and apply relevant methods and tools.

Competencies

- Must be able to devise how a relatively complex autonomous system can be specified, designed, managed and implemented, and in a professional manner to prove this.
- Must have the ability to assess important impacts, such as material flows, equipment or asset utilization, and other economic aspects, of the solution.
- Must be able to demonstrate engineering skills within the implementation and/or deployment of autonomous systems and to display their ability to perform engineering work.
- Must be able to take responsibility for their own professional development.

Teaching Method: The project work is carried out as an independent work process in which the students themselves organise and coordinate their workload in collaboration with a supervisor. The project may be carried out individually or in groups. The project may be finalized with a project report or in the form of a scientific paper with supporting appendices.

Form of examination: Oral examination based on a written report.

Evaluation criteria: As stated in the Joint Programme Regulations.

3.4.2 Internship (30 ECTS)

Title: **Academic Internship**
(Projektorienteret forløb I en virksomhed**)**

Prerequisites: The module adds to the knowledge obtained in 1st and 2nd Semester.

Goal: Students who complete the module are expected to:

Knowledge

- Must have knowledge about the advantages and practical limitations of autonomous systems deployed in at least one application area.
- Must have knowledge of the scientific basis and possible engineering solutions for the specific application area.

Skills

- Must be able to make a requirement specification for the implementation of autonomous systems in a given situation.
- Must be able to seek out and develop a solution and present it in the form of sketches, diagrams, drawings and virtual, as well as physical, prototypes.
- Must be able to justify the benefits of a developed solution
- Must be able to independently plan and carry out a development on basis of a given problem.
- Must be able to choose and apply relevant methods and tools.

Competencies

- Must be able to devise how a relatively complex autonomous system can be specified, designed, managed and implemented, and in a professional manner to prove this.
- Must have the ability to assess important impacts, such as material flows, equipment or asset utilization, and other economic aspects, of the solution.
- Must be able to demonstrate engineering skills within the implementation and/or deployment of autonomous systems and to display their ability to perform engineering work.
- Must be able to take responsibility for their own professional development.

Teaching Method: The student is included in the company's daily work. Concurrent to the work in the company, the student makes a report which is evaluated after ending the internship ependent on student's choice of content and organisation of the Semester;

Form of examination: Oral examination based on a written report.

Evaluation criteria: As stated in the Joint Programme Regulations.

3.5 Global Systems Design, 4th Semester

3.5.1 Master's Thesis (30 or 60 ECTS)

Title: **Master's Thesis**
(Kandidatspeciale)
The master thesis can be conducted as a long master thesis using both the 3rd and 4th Semester. If choosing to do a long master thesis, it has to include experimental work and has to be approved by the study board. The amount of experimental work must reflect the allotted ECTS.

Goal: Students who complete the module are expected to:

Knowledge

- Must have knowledge of how to provide solutions to problems that require innovative solutions rather than current industry approaches.
- Must have knowledge of how to apply interdisciplinary methods in order to exceed the limits of current solutions.

Skills

- Must be able to acquire and demonstrate new in depth knowledge related to selected topics.
- Must be able to find the connection with technologies related to other topics.
- Must be able to plan and carry out a research study based on a specific problem.
- Must be able to justify the decisions as well as to analyse benefits and limitations of the selected solution.
- Must be able to communicate problems, methods and results within the scientific area, in writing and discuss professional and scientific problems with peers.

Competences

- Must be able to demonstrate scientific skills within the subject of autonomous systems and to display their ability to perform scientific work in the area of Global Systems Design.
- Must be able to take responsibility for their own professional development.

Teaching Method: In this module, the Master's project is carried out. The module constitutes independent project work and concludes the program. Within the approved topic, the Master's project must document that the level for the program has been attained.

Form of examination: Oral examination with participation of an external examiner.

Evaluation criteria: As stated in the Joint Programme Regulations.

Chapter 4: Entry into Force, Interim Provisions and Revision

The curriculum is approved by the Dean of the Faculty of Engineering and Science and enters into force as of September 2017.

Students who wish to complete their studies under the previous curriculum from 2016 must conclude their education by the summer examination 2018 at the latest, since examinations under the previous curriculum are not offered after this time.

Chapter 5: Other Provisions

5.1 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 spelling and formulation 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 Board of Studies 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.[1] If the project is written in English, the summary must be in Danish.[2] The summary must be at least 1 page and not more than 2 pages. The summary is included in the evaluation of the project as a whole.

5.2 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 Board of Studies can approve successfully completed (passed) programme elements from other Master's programmes in lieu of programme elements in this programme (credit transfer). The Board of Studies can also approve successfully completed (passed) programme elements from another Danish programme or a programme outside of Denmark at the same level in lieu of programme elements within this curriculum. Decisions on credit transfer are made by the Board of Studies based on an academic assessment. See the Joint Programme Regulations for the rules on credit transfer.

5.3 Rules for examinations

The rules for examinations are stated in the Examination Policies and Procedures published by The Technical Faculty of IT and Design, The Faculty of Engineering and Science, and the Faculty of Medicine on their website.

5.4 Exemption

In exceptional circumstances, the Board of Studies study can grant exemption from those parts of the curriculum that are not stipulated by law or ministerial order. Exemption regarding an examination applies to the immediate examination.

[1] Or another foreign language (upon approval from the Board of Studies.
[2] The Board of Studies can grant exemption from this.

5.5 Rules and requirements for the reading of texts

At programmes taught in Danish, it is assumed that the student can read academic texts in modern Danish, Norwegian, Swedish and English and use reference works, etc., in other European languages. At programmes taught in English, it is assumed that the student can read academic text and use reference works, etc., in English.

5.6 Additional information

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