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

AALBORG UNIVERSITY
DENMARK

Curriculum for Master's program in Manufacturing Technology

Aalborg University
September 2017

Campus Aalborg

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 Manufacturing Technology is stipulated. The programme also follows the Joint programme regulations and the Examination Policies and Procedures for the Faculties of Engineering and Science.

Table of Contents

Chapter 1: Legal Basis of the Curriculum, etc.

1.1 Basis in Ministerial Orders
The Master programme in Manufacturing Technology is organised in accordance with the Ministry of Science, Innovation and Higher Education's Order no. 1328 of November 15, 2016 on Bachelor's and Master's Programs at Universities (the Ministerial Order of the Study Programs) 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's programme falls under the Faculties 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 Board of External Examiners
The Master's programme falls under the Body of External Examiners for Engineers (Ingeniørernes landsdækkende censorkorps (Maskin)).

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

2.1 Admission
Applicants with a legal right of admission (retskrav):

- Aalborg University offers no bachelor's programmes with a legal right of admission to this Master's program.

Applicants without a legal right of admission:
Bachelor's programmes qualifying students for admission:

- Bachelor of Science in Mechanical Engineering and Manufacturing, Aalborg University
- Bachelor (BSc) in Robotics, 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 civilingeniør, cand.polyt. (candidatus/candidata polytechnices) i virksomhedsteknologi. The English designation is: Master of Science (MSc) in Engineering (Manufacturing Technology).

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
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 on the basis of 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.

2.5 Competence Profile of the Programme

The graduate of the Master programme:

Knowledge

- Has an understanding of the basic elements and concepts involved in industrial manufacturing
- Has an understanding of how the elements interact locally as well as globally
- Has a deep understanding of the interface and structure of a limited manufacturing system
- Has attained an understanding for methods of analysing a manufacturing system
- Has attained an understanding of how to identify relevant actions as well as sketch and verify solutions
- Understands the fundamental principles of product design and development
- Has an understanding of the relationship between product design and manufacturing (design for manufacturing)
- Understands the use of modelling and simulation tools with regards to planning and implementing new manufacturing systems
- Understands the assumptions and limitations of the modelling and simulation tools used in the projects
- Is able to understand and use innovation models which speed up the innovation process, reduce the risk of failure and/or improve the business or societal value
- Has an in-depth knowledge of a selected manufacturing technology
- Is able to acquire new knowledge required to solve an industrial or scientific problem within manufacturing engineering and technology.

Skills

- Is able to identify and map causal relations between items such as the manufacturing equipment, the flexibility of the production facility, organisation, economy, the working environment, sustainability and the likes
- Is able to analyse technical issues with relation to manufacturing processes and production in a production facility
- Is able to formulate operational objectives for the performance of a production facility
- Is able to develop solutions for improving a production facility based on the analysis

- Is able to perform a sensitivity analysis of solutions in relation to the defined operational objectives
- Is able to develop a requirements specification for a manufacturing system through an analysis of customer needs
- Is able to develop solution concepts that satisfy the requirements specification
- Is able to identify critical elements of proposed solution concepts
- Is able to use appropriate modelling and simulation tools for development of solutions
- Is able to formulate a plan for the project's continuation. Is able to use innovation models in solution of an industrial problem
- Is able to perform an assessment of different options to solve a problem
- Is able to explain commercial relevance of a proposed solution
- Is able to assess limitations of the concepts, theories and methodologies applied in solution of a problem
- Is able to scout for new products, materials or manufacturing technologies
- Is able to demonstrate engineering and/or scientific skills within the line of specialisation and to perform engineering and/or scientific work.

Competencies

- Is able to analyse any given manufacturing system and prescribe measures to improve the efficiency of the facility
- Is able to interact and communicate with the participants involved in the design, development and operation of manufacturing systems
- Has the foundation to analyse and improve large scale manufacturing systems
- Is able to professionally participate in development of new products and manufacturing systems, focusing on evaluation, selection and implementation of relevant technologies
- Is able to establish the foundation for applying advanced and relevant simulation tools to future research and development activities
- Is able to participate in technological innovation activities
- Is able to work independently with a project on a specific problem within his/her field of interest at the highest possible level within his/her specialisation.

Chapter 3: Content and Organisation of the Programme

The MSc programme in Manufacturing Technology aims at providing graduates with competences to solve complex production-related problems and is designed to develop both theoretical understanding and practical experience. The programme focuses on design, development and implementation of products, manufacturing and control systems; primarily in relation to development, planning and implementation of industrial production.

The programme is structured giving the graduate the opportunity to specialise within specific areas; e.g. virtual product- and process development, material- and process technology and operation and robot technology. 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 traineeship 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, and the study guide for the MSc programme in Manufacturing Technology.

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 *or* Pass/Fail. 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.		Manufacturing Technology	15	7-point scale	Internal
		Non-linear Finite Element - Applied on Materials Processing[1]	5	Pass/fail	Internal
		Technology and Operations Management	5	7-point scale	Internal
		Design for Manufacturing	5	7-point scale	Internal
		Machine Learning[1]	5	Pass/fail	Internal
2.		Development of Manufacturing Systems	15	7-point scale	External
		Robot Vision[2]	5	7-point scale	Internal
		Engineering Optimisation – Concepts, Methods and Applications	5	7-point scale	Internal
		Product Development and Modelling	5	7-point scale	Internal
		Digital Manufacturing[2]	5	7-point scale	Internal
3.	A	Technological Innovation	30	7-point scale	Internal
	B	Academic Internship	30	7-point scale	Internal
4.		Master's Thesis	30, 60	7-point scale	External

[1] Students having a bachelor within Mechanical Engineering and Manufacturing or similar, follow the course Non-linear Finite Element – Applied on Materials processing. Students having a bachelor in Robotics or similar follow the course Machine Learning.

[2] Students having a bachelor within Mechanical Engineering and Manufacturing or similar, follow the course Robot Vision. Students having a bachelor in Robotics or similar follow the course Digital Manufacturing.

3.2 Manufacturing Technology, 1st Semester

3.2.0 Problem Based Learning and Project Management

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

Prerequisites:
None, but the course is compulsory for students not acquainted to the Aalborg PBL model

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:
The criteria for the evaluation are specified in the Joint programme regulations..

3.2.1 Manufacturing Technology (15 ECTS)

Title: **Manufacturing Technology**
(Produktionsteknologi)

Goal: Students who complete the module are expected to:

Knowledge

- Have an understanding of the basic elements and concepts involved in the technical aspects of industrial manufacturing
- Have attained an understanding of how to analyse manufacturing systems in order to identify potential areas of improvements
- Have attained an understanding of how to select and use suitable models for improving a particular manufacturing process or manufacturing system

Skills

- Be able to analyse technical issues with relation to manufacturing processes and production in a production facility
- Understand the influence on a process or series of processes in a system context. Either specific (process, geometry material) or using system design theory.
- Be able to formulate operational objectives for the performance of a manufacturing process or production facility
- Be able to use existing modelling techniques to model and improve a manufacturing process and/or a manufacturing system
- Be able to validate the chosen model

Competencies

- Be able to analyse any given manufacturing system and to prescribe measures to improve the efficiency of the facility
- Be able to formulate suitable models to improve either a specific manufacturing process or a manufacturing system.
- Have the ability to design and evaluate a technical solution.

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: Internal, oral examination.

Evaluation criteria: As stated in the Joint programme regulations.

3.2.2 Non-linear Finite Element - Applied on Materials Processing (5 ECTS)

Title: **Non-linear Finite Element - Applied on Materials Processing**
(Non-linear finite element – anvendt på materiale processering)

Goal: Students who complete the module are expected to:

Knowledge

- Have an understanding of how careful modelling and a profound understanding of the numerical methodology can help an engineer in producing reliable and precise simulations for a wide variety of problems
- Have knowledge of element technology, such as bar, beam, solid and shell elements
- Be able to apply nonlinear finite element methods including solution of systems of nonlinear equations, geometrically nonlinear problems, contact problems and nonlinear material models
- Have an understanding of the non-linear nature of certain manufacturing processes
- Have an understanding of material modelling:
  - Plasticity and viscoelasticity
  - Non-linear properties of engineering materials such as steel and polymers
  - Methods to obtain material characteristics.

Skills

- Be able to solve engineering problems using a commercial finite element programme
- Demonstrate a basic understanding of concepts, theory and applications of finite element analysis from an engineering point of view
- As every simulation is a compromise between precisions and cost, the student must be able to judge the advantages and disadvantages of the different software options available
- Be able to model certain manufacturing processes using the finite element theory
- Be able to model a material based on test results
- Be able to conduct a systematic assessment of results.

Competencies

- Use finite element tools to model, simulate and interpret issues related to product and/or process design
- Be able to judge the opportunities and limitations of finite element simulations with regard to product and/or process design.

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

Form of examination: Internal, oral/written examination

Evaluation criteria: As stated in the Joint programme regulations.

3.2.3 Technology and Operations Management (5 ECTS)

Title: **Technology and Operations Management**
(Teknologi- og driftsledelse)

Goal: Students who complete the module are expected to:

Knowledge

- Understand the fundamental principles of operations management in setups where technology is seen as an essential driver
- Have an understanding of the relationship between technology maturity and operations management
- Understand the use of comprehensive manufacturing concepts that include both mechanical and IT based elements
- Understand the assumptions and limitations of the modelling and simulation tools in the process of planning and implementing

Skills

- Be able to develop a requirements specification for a manufacturing system with a high degree of technological uncertainty
- Be able to develop solution concepts that include both mechanical and IT based elements
- Be able to identify critical elements of proposed solution concepts.
- Be able to use appropriate modelling and simulation tools for developing solutions
- Be able to formulate a plan for a project's implementation

Competencies

- Be able to professionally participate in the development of new manufacturing systems, focusing on the evaluation, selection and implementation of relevant technologies
- Establish the foundation for applying advanced and relevant simulation tools for future research and development activities.

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

Form of examination: Internal, oral/written examination

Evaluation criteria: As stated in the Joint programme regulations.

3.2.4 Design for Manufacturing (5 ECTS)

Title: **Design for Manufacturing (DFM)**
(Udvikling med produktionshensyn)

Goal: Students who complete the module are expected to:

Knowledge

- Have gained an in-depth understanding of:
  - Concepts, theories and methods regarding models for disposition of specific product design features according to needs and wants from other organizational functional areas
  - Technologies and systems that can support the development of such dispositions.
- Have gained knowledge about the relationships between the knowledge elements in regards product design features and their impact on other organizational areas. Among these are financial aspects.

Skills

- Be able to use of the theories and methods in design of specific DFM systems
- Be able to use relevant technologies and systems in solving specific product design problems in practice
  Be able to evaluate theoretic and practical needs for DFM
  and to select and substantiate economical attractive solutions
- Be able to communicate such problems and solution models to other participants in development projects.

Competences

- Be able to apply knowledge and skills in relation to complex development projects
- Be able to contribute constructively and professionally in multidisciplinary projects
- Be able to identify personal needs for additional learning and an appropriate approach

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

Form of examination: Internal, oral/written examination

Evaluation criteria: As stated in the Joint programme regulations.

3.2.5 Machine Learning (5 ECTS)

Title: **Machine Learning**
(Maskin læring)

Recommended academic prerequisites:
This module is based on knowledge gained on the 1st Semester of the MSc in the Manufacturing Technology programme.

Goal: Students who complete the module are expected to:

Knowledge

- Must have knowledge about supervised learning methods including K-nearest neighbors, decision trees, linear discriminant analysis, support vector machines, and neural networks.
- Must have knowledge about unsupervised learning methods including K-means, Gaussian mixture model, hidden Markov model, EM algorithm, and principal component analysis.
- Must have knowledge about probabilistic graphical models, variational Bayesian methods, belief propagation, and mean-field approximation.
- Must have knowledge about Bayesian decision theory, bias and variance trade-off, and cross-validation.
- Must be able to understand reinforcement learning.

Skills

- Must be able to apply the taught methods to solve concrete engineering problems.
- Must be able to evaluate and compare the methods within a specific application problem.

Competences

- Must have competencies in analyzing a given problem and identifying appropriate machine learning methods to the problem.
- Must have competencies in understanding the strengths and weaknesses of the methods.

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

Form of examination: Internal, oral/written examination.

Evaluation criteria: As stated in the Joint programme regulations.

3.3 Manufacturing Technology, 2nd Semester

3.3.1 Development of Manufacturing Systems (15 ECTS)

Title: **Development of Manufacturing Systems**
(Udvikling af produktionssystemer)

Recommended academic prerequisites:
This module is based on knowledge gained on the 1st Semester of the MSc in the Manufacturing Technology programme.

Goal: Students who complete the module are expected to:

Knowledge

- Understand the fundamental principles of product design and development
- Have an understanding of the relationship between product design and manufacturing (design for manufacturing)
- Understand the use of modelling and simulation tools with regards to planning and implementing new manufacturing systems
- Understand the assumptions and limitations of the modelling and simulation tools used in a project.

Skills

- Be able to develop a requirements specification for a manufacturing system through an analysis of customer needs
- Be able to develop solution concepts that satisfy requirements specification
- Be able to identify critical elements of proposed solution concepts.
- Be able to use appropriate modelling and simulation tools for developing solutions
- Be able to formulate a plan for a project's continuation.

Competencies

- Be able to professionally participate in the development of new products and manufacturing systems, focusing on the evaluation, selection and implementation of relevant technologies
- Establish the foundation for applying advanced and relevant simulation tools for future research and development activities.

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 with participation of an external examiner.

Evaluation criteria: As stated in the Joint programme regulations.

3.3.2 Robot Vision (5 ECTS)

Title: **Robot Vision**
(Robot vision)

Recommended academic prerequisites:
This module is based on knowledge gained on the 1st Semester of the MSc in the Manufacturing Technology programme.

Goal: Students who complete the module are expected to:

Knowledge

- Have gained an understanding of relevant technologies enabling the design of adaptive production machines
- Have gained an understanding of machine vision and how this is integrated into robotic solutions
- Have gained an understanding of how to simulate advanced robotic solutions
- Have knowledge about the business potential of robotic vision solutions.

Skills

- Be able to integrate various technologies to provide manufacturing systems with intelligent capabilities (e.g. reasoning, planning, communication, perception and the ability to move and manipulate objects)
- Be able to integrate and implement machine vision into a small and limited manufacturing system.
- Be able to simulate robotic solutions.

Competencies

- Be able to professionally participate in projects aiming at developing advanced robotic cells.
- Establish the foundation for applying vision and relevant simulation tools for future research and development activities.

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

Form of examination: Internal, oral/written examination

Evaluation criteria: As stated in the Joint programme regulations.

3.3.3 Engineering Optimisation – Concepts, Methods and Applications (5 ECTS)

Title: **Engineering Optimisation – Concepts, Methods and Applications**
(Ingeniørmæssig optimering – begreber, metoder og anvendelser)

Recommended academic prerequisites:
This module is based on knowledge gained on the 1st Semester of the MSc in the Manufacturing Technology programme.

Goal: Students who complete the module are expected to:

Knowledge

- Have gained an in-depth understanding of important concepts and methods of optimisation for efficient solution of optimisation problems within different areas of engineering, including design optimisation of mechanical systems.

Skills

- Have developed skills and expertise in proper formulation
- Have developed skills and expertise in the modelling of engineering optimisation problems as well as in selecting or developing appropriate techniques for numerical solutions to such problems.

Competencies

- Be able to apply the concepts, theories and methods for solution of engineering optimisation problems
- Be able to account for the considerations involved in the process of formulating and modelling an engineering optimisation problem, choosing an advantageous method of solution and implementing it in practice.

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

Form of examination: Internal, oral/written examination

Evaluation criteria: As stated in the Joint programme regulations.

3.3.4 Product Development and Modelling (5 ECTS)

Title: **Product Development and Modelling**
(Produktudvikling og -modellering)

Recommended academic prerequisites:
This module is based on knowledge gained on the 1st Semester of the MSc in the Manufacturing Technology programme.

Goal: Students who complete the module are expected to:

Knowledge

- Have an understanding of the fundamental principles of product design and development
- Have an understanding of the relationship between product design and manufacturing (design for manufacturing)
- Have an understanding of product modelling and product configuration and its implications for manufacturing

Skills

- Be able to use basic system theory, methods, models and approaches, including the domain theory for design of manufacturing systems
- Be able to use product modelling in support of design and as a means of integration
- Be able to use various design for X methods
- Be able to use systematic methods for specification and development of product modules and platforms

Competencies

- Have the ability to systematically develop new products, in particular new manufacturing systems
- Have improved the ability to interact with product designers, enabling design for manufacturing.

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

Form of examination: Internal, oral/written examination

Evaluation criteria: As stated in the Joint programme regulations.

3.3.5 Digital Manufacturing (5 ECTS)

Title: **Digital Manufacturing**
(Digitalt understøttet fremstilling**)**

Goal: Students who complete the module are expected to:

Knowledge

- Have an understanding of how integrated computer-based systems can be used to develop product and manufacturing process definitions simultaneously.
- Have gained knowledge about systems and tools (e.g. modelling tools, simulation tools, 3D visualization tools, and collaboration tools) that can support this development.
- Have knowledge of how the digital information is created and distributed
- Have an in-depth understanding of the basic functionality of existing and emerging systems for digital manufacturing.
- Have an understanding of generic interfaces between systems for digital manufacturing.

Skills

- Be able to demonstrate a basic understanding of digital manufacturing.
- Be able to solve problems related to the simultaneous development of products and manufacturing.
- Be able to conduct a systematic assessment of the need for Digital Manufacturing.

Competencies

- Use digital manufacturing tools to model, simulate and visualize issues related to the simultaneous development of products and manufacturing processes.
- Be able to judge the opportunities and limitations of Digital Manufacturing.

Teaching Method: The form(s) of teaching will be determined and described in connection with planning the semester. The description will account for the form(s) of teaching and may be accompanied by an elaboration of the participants' roles. The course/project theme is performed in either English or Danish dependent of the participants' language skills.

Form of examination: Internal, oral/written examination

Evaluation criteria: As stated in the Joint programme regulations.

3.4 Manufacturing Technology, 3rd Semester

3.4.1 Technological Innovation (30 ECTS)

Title: **Technological Innovation**
(Teknologisk innovativ forretningsskabelse)

Recommended academic prerequisites:
This module is based on knowledge gained on the 2nd Semester of the MSc in Manufacturing Technology.

Goal: Students who complete the module are expected to:

Knowledge

- Be able to understand and use innovation models which speed up the innovation process, reduce the risk of failure and/or improve the business or societal value
- Have an in-depth knowledge of a selected manufacturing technology.

Skills

- Be able to use innovation models in the solution of an industrial problem
- Be able to perform an assessment of different options to solve the problem
- Be able to explain the commercial relevance of the proposed solution
- Be able to assess the limitations of the concepts, theories and methodologies applied in the solution of the problem
- Be able to scout for new products, materials or manufacturing technologies.

Competencies

- Be able to participate in technological innovation activities.

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: Internal, oral examination

Evaluation criteria: As stated in the Joint programme regulations.

3.4.2 Academic Internship (30 ECTS)

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

Recommended academic prerequisites:
This module is based on knowledge gained on the 2nd Semester of the MSc in Manufacturing Technology.

Goal: Students who complete the module are expected to:

Knowledge

- Be able to understand and use innovation models which speed up the innovation process, reduce the risk of failure and/or improve the business or societal value
- Have an in-depth knowledge of a selected manufacturing technology.

Skills

- Be able to use innovation models in the solution of an industrial problem
- Be able to perform an assessment of different options to solve the problem
- Be able to explain the commercial relevance of the proposed solution
- Be able to assess the limitations of the concepts, theories and methodologies applied in the solution of the problem
- Be able to scout for new products, materials or manufacturing technologies.

Competencies

- Be able to participate in technological innovation activities.

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

Form of examination: Internal, oral examination

Evaluation criteria: As stated in the Joint programme regulations.

3.5 Manufacturing Technology, 4th Semester

3.5.1 Master's Thesis (30, 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.

Recommended academic prerequisites:
This module is based on knowledge gained on 1st – 3rd Semester of the MSc in Manufacturing Technology.

Goal: Students who complete the module are expected to:

Knowledge

- Be able to acquire new knowledge required to solve an industrial or scientific problem within manufacturing engineering and technology.

Skills

- Be able to demonstrate engineering and/or scientific skills within the line of specialisation and to display their ability to perform engineering and/or scientific work.

Competences

- Be able to work independently with a project on a specific problem within their field of interest on the highest possible level within their specialisation.

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 period 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 in which it is written weight is also put on the student's spelling and formulation ability, in addition to the academic content. Orthographic and grammatical correctness as well as stylistic proficiency are considered 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 language performance alone; similarly, an examination cannot normally 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.[3] If it is written in English, the summary must be in Danish.[4] The summary must be at least one page and maximum two 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

In the individual case, the Board of Studies can approve successfully completed (passed) programme elements from other Master 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 Faculties of Engineering and Science 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.

5.5 Additional Information

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

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

5.6 Rules and Requirements concerning the Reading of Texts in Foreign Languages and a Statement of the Foreign Language Knowledge this Assumes

It is assumed that the student is able to read academic texts in modern Danish, Norwegian, Swedish and English and use reference works, etc., in other European languages.

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

AALBORG UNIVERSITY
DENMARK

Curriculum for Master's program in Manufacturing Technology

Aalborg University
September 2017

Godkendt d. 20/4 17

Mogens Rysholt Poulsen
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Campus Aalborg