AALBORG UNIVERSITY
DENMARK

The Faculty of Engineering and Science
The Study Board of Industry and Global Business Development

Curriculum for the Master's Programme in Operations and Innovation Management

(Cand.polyt.)

Aalborg University

September 2017

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dekan

Campus Aalborg

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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's programme in Operations and Innovation Management is stipulated. The programme also follows the Joint Programme Regulations and the Examination Policies and Procedures for the Faculties of Engineering and Science, The Technical Faculty of IT and Design, and The Faculty of Medicine.

Contents

Chapter 1: Legal Basis of the Curriculum, etc.

1.1 Basis in Ministerial Orders

The Master's programme in Operations and Innovation Management 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's programme falls under the Faculty of Engineering and Science, Aalborg University.

1.3 Board of Studies Affiliation

The Master's programme falls under the Board of Studies of 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 (Ingeniørernes landsdækkende censorkorps (maskin)).

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

2.1 Admission

Applicants with a legal claim to admission (retskrav):

Applicants with one of the following degrees are entitled to admission:

- Bachelor of Science in Global Business Engineering, Aalborg University

Applicants without legal claim to admission:

Applicants with one of the following degrees meet the admission requirements:

- Bachelor of Engineering in Export, IHK
- Bachelor of Engineering in Global Business Development, VIA
- Bachelor of Science in Manufacturing and Operations Engineering, Aalborg University
- Bachelor of Engineering in Export Technology, Aalborg University
- Bachelor of Science in Information Technology, 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

Students completing the master's programme are entitled to the Danish designation Civilingeniør, cand.polyt. i værdikæder og innovationsledelse. The English designation is: Master of Science (MSc) in Engineering (Operations and Innovation Management).

2.3 The Programmes' 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 exhibits the following characteristics:

Knowledge

- Have international-level knowledge, based on state-of-the-art research in the field of Operations and Innovation Management, in particular disciplines that take a management engineering perspective on the analysis of complex problems in complex industrial systems, and the design and implementation of innovative solutions to such problems, based on an integration of technological, organizational and managerial aspects. These disciplines include organization/enterprise analysis, engineering and design; operations strategy; business intelligence and performance management; and innovation and change management
- Understand and are able to reflect, on a scientific basis, on the technological, organizational, managerial, industrial and competitive aspects of Operations and Innovation Management problems and solutions.

Skills

- Are skilled management engineers who are able to:
    - Work systematically, analytically and solution design-oriented
    - Apply a deep understanding of the technological, organizational, managerial, industrial and competitive aspects of Operations and Innovation Management in analyzing complex problems and designing and implementing solutions in a wide range of empirical settings, in particular industrial and professional service settings
    - Evaluate, select among, and apply scientifically-based management engineering knowledge, methods and tools related to Operations and Innovation Management to analyze problems and design and implement solutions, alone as well as in a collaborative context, e.g. cross-functional projects
- Can communicate research-based knowledge, methods and tools and discuss professional and scientific problems and solutions with both peers and non-specialists.

Competencies

- Can manage work and development in complex and unpredictable situations requiring innovative solutions
- Can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility within the area of Operations and Innovation Management
- Can independently take responsibility for own professional development and specialisation.

Chapter 3: Content and Organisation 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 aiming 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 that are defined in the curriculum. Each semester has an overall theme which serves a focal point in both modules and the project work. 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 is allocated to gaining practical international experience. The semester will enable students to appreciate theoretical reflective work practice and cultural challenges. The aim of the semester is to

1. Gain practical experience within the subject field
2. Analyse and reflect on educational experiences and professional practice
3. Clarify the Master's Thesis topic.

The third semester offers different ways of organisation – depending on the student's choice of content; 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 has to be equivalent to 30 ECTS, of which up to 15 ECTS can be elective courses. The project may be finalized with a project report or in the form of a scientific paper, or, if the project is continued at 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

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.		Organisation Analysis and Design	5	7-point scale	Internal
		Enterprise Engineering and Design	5	7-point scale	Internal
		Operations Development and Strategy	5	7-point scale	Internal
		Integrated Solutions - Designing Global Business Systems and Value Chains	15	7-point scale	External
2.		Innovation and Change Management	5	7-point scale	Internal
		Global Business Performance	5	7-point scale	Internal
		Business Intelligence and Analytics	5	7-point scale	Internal
		Global Implementation	15	7-point scale	Internal
3.	A	Operations and Innovation Management	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 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, The Technical Faculty of IT and Design, and The Faculty of Medicine, 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 Organisation Analysis and Design (5 ECTS)

Title: Organisation Analysis and Design
(Organisationsanalyse og design)

Objective: Upon completion of the module, the student can:

Knowledge

- Account for theories and their paradigmatic underpinning on the design of industrial and professional service organisations
- Describe the impact of corporate and operations strategies, technologies and (competitive) environments on the design of such organisations

Skills

- Identify organizational design problems in industrial and professional service organization
- Operationalize these problems and collect relevant information concerning the industrial/competitive, strategic, technological, and organization design aspects describing these problems
- Analyse, evaluate and (re)design organisational designs in their contexts
- Apply concepts and theories to cases and (real-life) examples.

Competencies

- Visualize in, for example, exercises and cases of:
  - The paradigms in organisation theory
  - The principles of organisation design, including division and coordination of labour, and the impact of key contextual characteristics (including strategy, technology and environment) on organisation design parameters
  - Decision making, and the role of power, politics, control and conflicts in organisations
  - The similarities and differences between designing and managing start-ups, mature, expert-based, innovative, diverse, networked and virtual organisations
  - The needs, challenges, dilemmas, dualities and paradoxes in combining exploration and exploitation.
- Take the lead in diagnosing and solving problems in organization designs of various types of industrial and professional service companies

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

Exam format: Oral/written examination

Evaluation criteria: Are stated in the Joint Programme Regulations.

3.2.2 Enterprise Engineering and Design (5 ECTS)

Title: Enterprise Engineering and Design
(Virksomhedsudvikling)

Justification: This course is aimed at methodologies for analysis, modelling, simulation, design, realization and implementation of large integrated enterprise systems as solution to complex business situation.

Objective: Upon completion of the module, the student can:

Knowledge

- Describe and classify theories, methods and tools related to enterprise engineering and design
- Identify feasible approaches and frameworks for integrated business solutions
- Understand enterprise architectures and typology
- Explain theoretical and methodological foundations for analysis, modelling, simulation, design and evaluation of integrated business solutions
- Design conceptualisation processes and orchestrate concept development in operations and supply chains
- Recommend strategies for realization and implementation of solutions.

Skills

- Apply enterprise engineering and design
- Simulate and evaluate integrated solutions in operations and supply chain
- Relate enterprise solutions to corporate strategies and development goals
- Demonstrate proof of concepts, mock-ups and demonstrator models.

Competencies

- Conceive and communicate complex solutions.
- Analyse and reflect on own practice and approaches
- Assess the need for synthesizing new knowledge

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

Exam format: Oral/written examination

Evaluation criteria: Are stated in the Joint Programme Regulations.

3.2.3 Operations Development and Strategy (5 ECTS)

Title: Operations Development and Strategy
(Global produktionsudvikling og –strategi)

Objective: Upon completion of the module, the student can:

Knowledge

- Understand configuration and design of operations systems in the manufacturing and service environments and demonstrate an in-depth knowledge of related theories and practices
- Describe and explain operations system performance objectives (cost, quality, flexibility, speed and dependability) and their change over time.
- Account for various perspectives on performance of operations systems (including focus, trade-off and synergies perspectives)
- Describe and explain structural and infrastructural decisions of operations systems design, including process technology, technology development and transformative effects of technology on operations systems
- Understand and demonstrate the importance of alignment between performance objectives and operations systems design through operations strategy matrix tool

Skills

- Use and evaluate appropriate methodologies and approaches to operations system conception, design, implementation and operation (CDIO)
- Analyze and evaluate different choices for strategic design of global operations systems and operations development strategies
- Initiate operations systems improvement and re-organizations processes and their implementation in the context of contemporary global operations

Competencies

- Diagnose problems in operations systems designs both in the manufacturing and service environments
- Conceive and design operations systems and their continuous development
- Take responsibility for the implementation and control of operations systems development

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

Exam format: Oral/written examination (for further information, please see the programme's study guide).

Evaluation criteria: Are stated in the Joint programme regulations.

3.2.4 Integrated Solutions - Designing Global Business Systems and Value Chains (15 ECTS)

Title: Integrated Solutions - Designing Global Business Systems and Value Chains
(Integrerede løsninger - Design af globale forretningssystemer og værdikæder)

Objective: Upon completion of the project module, the student can:

Knowledge

- Account for the relationships between theories on operations strategy/development and organization/enterprise analysis, engineering/design operations
- Understand the role for and the deployment of strategic and technological choices in the design of (global) companies, supply chains and production networks
- Show how to operationalize theoretical contributions to practical settings

Skills

- Analyze and develop an integrated solution to a practical problem, usually in the form of a project developed in and together with a company. The project theme is integrated solutions and normally requires:
    - Demarcation and analysis of the empirical background to the problem
    - Development of an operationalization of a relevant and researchable research problem/project objective, using theory taught on this semester, but usually going beyond that.
    - Development of an adequate research/project design, including the elements mentioned next
- Write a well-structured project report, written with clear arguments including the following elements:
    - A critically exploration of the empirical problem and account for the choice of theories and approaches analyze and solve the problem under investigation,
    - Detailed questions/objectives
    - An account of the data collection and data validation methods, data sources
    - An account of the analytical methods used and methods used to validate the findings
    - An account of the (design) methods used to develop recommendations/solutions to resolve the research problem / achieve the project objective.
    - Presentation and validation of data
    - Presentation, validation and discussion of analytical findings
    - Presentation and validation of recommendations/solutions
    - Evaluation of the findings and recommendations/solutions, methods and, if relevant, considerations regarding the limitations and generalizability of the study.

Competencies

- Operationalize theoretical contributions on organization/enterprise analysis, design and engineering, operations strategy and development as well as other relevant scientific fields in a practical setting

- Work together as a team to analyze and develop integrated and feasible solution(s) to a practical organizational problem
- Work together with an organization in an academically yet practically adequate manner.

Type of instruction:	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 organize and coordinate their workload in collaboration with a supervisor. The project is carried out in groups with normally no more than 6 members.
Exam format:	Oral examination based on a written report.
Evaluation criteria:	Are stated in the Joint Programme Regulations.

3.3 2nd Semester

3.3.1 Innovation and Change Management (5 ECTS)

Title: Innovation and Change Management
(Innovations- og forandringsledelse)

Prerequisites: This module is based on knowledge obtained in 1st Semester

Objective: Upon completion of the module, the student can:

Knowledge

- Understand the role of technology, and various forms of innovation and change (including incremental/radical, business process redesign/continuous improvement, product/process/position/paradigm, business model) in established and emerging businesses
- Understand the characteristics and drivers of innovation and change, as well as the practical means of handling them in a business context
- Understand the range, scope and complexity of challenges related to the management of technology, innovation and change
- Understand organizing for and management/leadership of innovation and change, including aspects of culture, power and politics, enablers of and barriers to change, factors of innovation success and failure

Skills

- Describe, analyze and redesign innovation and change management processes
- Identify and analyze the field of innovation and change management including the value position of stakeholders; customers, suppliers and other network partners
- Design, evaluate and audit the innovative and change capabilities of a business organization
- Apply principles of business model innovation and risk management to suggest redesign and improvement of business models

Competencies

- Realize and implement innovation- and change management initiatives, including the design, implementation and execution (management/leadership) of innovation and change management projects in companies, supply chains and networks, as well as relating practical innovation and change management experiences to conceptual understanding of innovation leadership and change management

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

Exam format: Oral/written examination

Evaluation criteria: Are stated in the Joint Programme Regulations

3.3.2 Global Business Performance (5 ECTS)

Title: Global Business Performance
(Præstationsmåling og -vurdering af globale forretningsprocesser)

Prerequisites: This module is based on knowledge obtained in 1st Semester

Objective: Upon completion of the module, the student can:

Knowledge

- Understand various perspectives and theories that inform the formation and functioning of contemporary extended enterprise which consist of the focal company and its suppliers
- Understand complexity management principles and tool kits based on systems science and systems methodology
- Account for various orientations of companies' operations systems (technology, innovation, cost, quality, flexibility) and can explain how these orientations affect performance management and control
- Understand risk types (both internal and external) and their impacts in extended enterprises
- Understand the principles of value stream costing, using value stream mapping and business process re-engineering
- Understand and can explain value engineering, target costing and chained target costing in cooperation between the focal company and its 1st, 2nd, etc. tier suppliers
- Understand total cost of ownership (TCO), differentiated on the basis of product-/supplier type, techniques in the form of 'Monetary-based method' (Activity Based Cost Systems), 'Cost-ratio/value-based method' and 'Mathematical programming decision model'
- Understand and can explain supply chains financial and non-financial performance and its sensitivity as a function of the market and selected divide between push and pull operations
- Understand and can explain conflicting and colliding cases of Lean and the company's financial management and reporting, as well as possible solutions, including financial reporting that complies with Lean's seven waste categories

Skills

- Conduct analysis and evaluation of operations performance in the context of extended enterprises
- Use tools and techniques for measuring and managing performance of activities that cross both geographical and organizational boundaries
- Initiate performance improvement programs and their implementation in contemporary extended enterprises

Competencies

- Identify and diagnose problems with performance management systems in contemporary extended enterprises
- Conceive appropriate performance management system designs
- Take responsibility for implementation and control of operations performance management systems in contemporary extended enterprises

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

Exam format: Written/oral examination

Evaluation criteria: Are stated in the Joint Programme Regulations.

3.3.3 Business Intelligence and Analytics (5 ECTS)

Title: Business Intelligence and Analytics
(Business Intelligence og analytiske metoder)

Prerequisites: This module is based on knowledge obtained in 1st Semester

Objective: Upon completion of the module, the student can:

Knowledge

- Account for Business Intelligence (BI) concepts, theories and methods including:
  - Creation of knowledge from either people/employees/"experts" or from analysing existing data
  - Knowledge representation
  - Traditional BI handling systems such as expert systems, knowledge base systems, decision support systems and executive information systems.

Skills

- Make decisions about the optimal use of the BI concepts, theories, methods and selected systems for identification of needs, development of alternative solutions, evaluation selection and implementation
- Use BI in disciplines such as enterprise engineering/modelling, business analytics, data mining, etc.

Competences

- Apply knowledge and skills in relation to business intelligence development projects and thereby apply the knowledge handling activities: knowledge acquisition, knowledge verification, knowledge representation and knowledge engineering.

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

Exam format: Written/oral examination

Evaluation criteria: As stated in the Joint Programme Regulations.

3.3.4 Global Implementation (15 ECTS)

Title: Global Implementation
(Global implementering)

Prerequisites: This module is based on knowledge obtained in 1st Semester. Furthermore, this project builds on the three courses taught in the 2nd Semester

Objective: Upon completion of the module, the student can:

Knowledge

- Demonstrate understanding of the theories, concepts, methods and tools taught in this semester.

Skills

- Demonstrate the skills to choose among and apply in practice the theories, concepts, methods and tools taught in this semester.
- Analyze, and develop an integrated solution to a practical problem, usually in the form of a project developed in and together with an organization. The project theme is global implementation, and normally requires:
  - Demarcation and analysis of the empirical background to the problem
  - Development and operationalisation of a relevant and researchable research problem/project objective using theory taught on the semester, but usually going beyond that
  - Development of an adequate research/project design, including:
    - Detailed questions/objectives
    - An account of the data collection and data validation methods, data sources
    - An account of the analytical methods used and methods used to validate the findings
    - An account of the (design) methods used to develop recommendations/solutions to resolve the research problem / achieve the project objective.
  - Presentation and validation of data
  - Presentation, validation and discussion of analytical findings
  - Presentation and validation of recommendations/solutions
  - Evaluation of the findings and recommendations/solutions, methods and, if relevant, considerations regarding the limitations and generalizability of the study.

Competencies

- Work together as a team to analyze, and develop integrated and feasible solution(s) to a practical organisational problem
- Work together with an organization in an academically yet practically adequate manner.

Type of instruction: 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.

Exam format:	Oral examination based on a written report.
Evaluation criteria:	Are stated in the Joint Programme Regulations.

3.4 3rd Semester

3.4.1 Operations and Innovation Management (30 ECTS)

Title: Operations and Innovation Management
(Værdikæder og innovationsledelse)

Prerequisites: This module is based on knowledge obtained in 1st and 2nd Semester

Objective: Upon completion of the module (project or academic internship), the student can:

Knowledge

- Deep knowledge of the subject matter in the specific area of the project

Skills

- Solve complex business problems using operation and innovation management theory and concepts and management engineering methods and tools
- Evaluate and choose among potentially relevant theories, concepts and methodologies applied in the analysis and solution design of a practical business engineering problem
- Evaluate the relevance and limitations of the theories, concepts, methods and tools actually applied in the project
- Account for any choices made during the problem analysis and solution development
- Develop solution alternatives and evaluate the performance, strategic, organizational, managerial and other relevant prerequisites for and consequences of solution alternatives and make a well-informed choice based on that
- Plan, execute and report an extensive individual research project within an agreed time frame
- Write a well-structured project report, which meets all the usual requirements of an academic work, including:
    - Empirical background
    - Research problem/project objective
    - Relevant theory
    - Research design:
        - Detailed questions/objectives
        - An account of the data collection and data validation methods, data sources
        - An account of the analytical methods used and methods used to validate the findings.
        - An account of the methods used to develop recommendations/solutions to resolve the research problem/achieve the project objective
    - Presentation and validation of data
    - Presentation, validation and discussion of analytical findings
    - Presentation and validation of recommendations/solutions
    - Evaluation of the project; i.e., findings, methods and, if relevant, considerations regarding the limitations and generalizability of the study.

- specific for internship: a personal reflection is required, a reflection on: how was it to work alone, full-time in a company, and, if applicable, in a different country with a different culture, language, industrial structure, etc.

Competences

- Analyze and solve an actual problem of industrial relevance through application of systematic research and development processes, including advanced analytical, experimental, and/or numerical methods and models.
- Work together with a manufacturing or service organization and identify operations and/or innovation management problems and finally develop data driven and robust solutions using technologies.
- Operationalize theoretical contributions in a practical setting
- Compare and critically evaluate the results of the project in relation to existing knowledge and accepted theories within the subject area
- Consider economic and other consequences of the proposed solutions
- Communicate a balanced view of the results and conclusions of the project in well-organized written and oral presentation

Organization:	The project work is carried out as an independent work process in which the students themselves organize 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.
Exam Format:	Oral examination based on a written report
Evaluation criteria:	As stated in the Joint Programme Regulations.

3.4.2 Academic Internship (30 ECTS)

Title: Academic Internship
(Projektorienteret forløb i en virksomhed)

Prerequisites: This module is based on knowledge gained on the 1st and 2nd Semester

Objective: Upon completion of the module (project or academic internship), the student can:

Knowledge

- Deep knowledge of the subject matter in the specific area of the project

Skills

- Solve complex business problems using operation and innovation management theory and concepts and management engineering methods and tools
- Evaluate and choose among potentially relevant theories, concepts and methodologies applied in the analysis and solution design of a practical business engineering problem
- Evaluate the relevance and limitations of the theories, concepts, methods and tools actually applied in the project
- Account for any choices made during the problem analysis and solution development
- Develop solution alternatives and evaluate the performance, strategic, organizational, managerial and other relevant prerequisites for and consequences of solution alternatives and make a well-informed choice based on that
- Plan, execute and report an extensive individual research project within an agreed time frame
- Write a well-structured project report, which meets all the usual requirements of an academic work, including:
    - Empirical background
    - Research problem/project objective
    - Relevant theory
    - Research design:
        - Detailed questions/objectives
        - An account of the data collection and data validation methods, data sources
        - An account of the analytical methods used and methods used to validate the findings.
        - An account of the methods used to develop recommendations/solutions to resolve the research problem/achieve the project objective
    - Presentation and validation of data
    - Presentation, validation and discussion of analytical findings
    - Presentation and validation of recommendations/solutions
    - Evaluation of the project; i.e., findings, methods and, if relevant, considerations regarding the limitations and generalizability of the study.
    - specific for internship: a personal reflection is required, a reflection on: how was it to work alone, full-time in a company, and, if applicable, in a different country with a different culture, language, industrial structure, etc.
    -

Competences

- Analyze and solve an actual problem of industrial relevance through application of systematic research and development processes, including advanced analytical, experimental, and/or numerical methods and models.
- Work together with a manufacturing or service organization and identify operations and/or innovation management problems and finally develop data driven and robust solutions using technologies.
- Operationalize theoretical contributions in a practical setting
- Compare and critically evaluate the results of the project in relation to existing knowledge and accepted theories within the subject area
- Consider economic and other consequences of the proposed solutions
- Communicate a balanced view of the results and conclusions of the project in well-organized written and oral presentation

Organization:	The student is included in the company's daily work and carry out independent project work on an industrial problem relevant for the company. Concurrent to the work in the company, the student makes a project report, which is evaluated after the ending of the internship.
Exam Format:	Oral examination based on a written report
Evaluation criteria:	As stated in the Joint Programme Regulations.

3.5 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.

Goal: Upon completion of the project the student can:

Knowledge

- Deep knowledge of the subject matter in the specific area of the project

Skills

- Plan, execute and report an extensive individual research project within an agreed time frame
- Apply scientific methodology in solving a wide variety of problems within the field of specialisation
- Perform scientific work in relevant topics of the field of the specialisation
- Apply a wide range of technologies and engineering methods in research and development projects in the field of specialization
- Write a well-structured project report, written with clear arguments including the following elements:
    - Develop and delimit an original formulation of the problem being investigated,
    - Critically explore and apply relevant theories and analytical approaches to the problem under investigation,
    - Assemble and process valid and reliable data, relevant to the problem and sub-problems under scrutiny,
    - Make a thorough, systematic, and comprehensive analysis of the problem under investigation
- Participate in or lead projects within the fields of the specialisation.

Competences

- Plan, execute and report an extensive individual research project within an agreed time frame
- Conduct technological development and research, and solve complicated technical problems using scientific methods
- Work independently with a project on a complex problem within their field of interest on the highest possible level within their specialisation
- Take part in both discipline-specific and interdisciplinary cooperation to solved complex problems

- Compare and critically evaluate the results of the project in relation to existing knowledge and accepted theories within the subject area
- Consider economic consequences and impact on society, environmental and safety issues related to the project
- Communicate a balanced view of the results and conclusions of the project in well-organized written and oral presentation

Teaching Method: In this module, the Master's Thesis is carried out. The module constitutes independent project work and concludes the programme. Within the approved topic, the Master's Thesis must document that the level of the programme 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 may 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.[1] If it is written in English, the summary must be in Danish.[2] 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

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 Faculty of Engineering and Science on their website.

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

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 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 English and use reference works, etc., in other European languages.

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 and exams.