Curriculum for the Master's Programme in

Chemical Engineering

The Faculty of Engineering and Science
Aalborg University
2011

PREFACE:

Pursuant to Act 754 of June 17, 2010 on Universities (the University Act) with subsequent changes, the following curriculum for the Master's programme in Chemical Engineering is stipulated. The programme also follows the Framework Provisions and the Examination Policies and Procedures for the Faculty of Engineering and Science and The Faculty of Medicine.

Table of Contents

Chapter 1: Legal Basis of the Curriculum, etc.

1.1 Basis in ministerial orders
The Master's programme in Chemical Engineering **is** organised in accordance with the Ministry of Science, Technology and Innovation's Ministerial Order no. 814 of June 29, 2010 on Bachelor's and Master's Programmes at Universities (the Ministerial Order of the Study Programmes) and Ministerial Order no. 857 of July 1, 2010 on University Examinations (the Examination Order) with subsequent changes. Further reference is made to Ministerial Order no. 233 of March 24, 2011 (the Admission Order) and Ministerial Order no. 250 of March 15, 2007 (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 for Biotechnology, Chemical and Environmental Engineering.

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

2.1 Admission

Admission to the Master's programme in Chemical Engineering requires a Bachelor's degree in Chemistry and Biotechnology, Biotechnology, Chemical Engineering, Environmental Engineering or the like.

Students enrolled at the programme in European Master of Environmental Technology and Management can be admitted to the Master's programme in Chemical Engineering and get credit for courses passed as students in European Master of Environmental Technology and Management.

Students with another Bachelor's degree, upon application to the Board of Studies, will be admitted after a specific academic assessment if the applicant is deemed to have 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's programme in Chemical Engineering entitles the graduate to the designation civilingeniør, cand.polyt. (candidatus/candidata polytechnices) i kemiteknik. The English designation is: Master of Science (MSc) in Engineering (Chemical Engineering).

2.3 The programme's specification in ECTS credits

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

2.4 Competence profile on the diploma

The following competence profile will appear 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 programme can perform highly qualified functions on the labour market on the basis of the educational programme. Moreover, the graduate has prerequisites for research (a Ph.D. programme). Compared to the Bachelor's degree, the graduate of the Master's programme has developed her/his academic knowledge and independence, so that the graduate can independently apply scientific theory and method in both an academic and occupational/professional context.

2.5 Competence profile of the programme in Chemical Engineering

The graduate of the Master's programme in Chemical Engineering:

Knowledge	• has knowledge that is based on the highest international research in one or more subject areas within chemical engineering:
	  o Bio energy
	  o Environmental technology
	  o Polymer technology
	  o Ceramics and photocatalysis
	  o Spectroscopy and data analysis
	• can understand and, on a scientific basis, reflect over the above mentioned knowledge and identify scientific problems

Skills	• masters the scientific methods, the tools and general skills related to employment within chemical engineering • can evaluate and select among scientific theories, methods, tools and general engineering skills and, on a scientific basis, advance new analyses and solutions • can communicate research-based knowledge and discuss professional and scientific problems with both peers and non-specialists
Competencies	• can manage work and development situations that are complex, unpredictable and require new solutions. • can independently initiate and implement discipline-specific and interdisciplinary cooperation and assume professional responsibility. • can independently take responsibility for 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, which aims to give students a set of professional skills within a fixed time frame specified in ECTS credits, and concluding with one or more examinations within specific exam periods. Examinations are defined in the curriculum.

The programme is based on a combination of academic, problem-oriented and interdisciplinary approaches and organised based on the following work and evaluation methods that combine skills and reflection:

- lectures
- classroom instruction
- project work
- workshops
- exercises (individually and in groups)
- teacher feedback
- reflection
- portfolio work

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	Assessment	Exam	Exam form
1st	Process Analysis *(Procesanalyse)*		15	7-point scale	Internal	Oral based on project
	Fluid Mechanics *(Strømningslære)*		5	7-point scale	Internal	Oral or written
	Colloid and Interface Science *(Kolloid og grænsefladekemi)*		5	7-point scale	Internal	Oral
	Chemometrics *(Kemometri)*		5	Pass/Fail	Internal	written
2nd	Process Modelling *(Procesmodellering)*		15	7-point scale	External	Oral based on project
	Process Simulation *(Processimulering)*		5	Pass/Fail	Internal	Oral based on mini project
	Water Treatment *(Teknisk vandbehandling)*		5	7-point scale	Internal	Oral
	Polymers and Properties of Polymers *(Polymere og polymeres egenskaber)*		5	7-point scale	Internal	Oral or written
3rd	Elec-tives	Bio Energy *(Bioenergi)*	30	7-point scale	Internal	Oral based on project
		Environmental Technology *(Miljøteknologi)*				
		Polymer Technology *(Polymerteknologi)*				
		Ceramics, Sol-gel Processes and Photocatalysis *(Keramiske materialer, sol-gel processer og fotokatalyse)*				
		Spectroscopy and Data Analysis *(Spektroskopi og dataanalyse)*				
		External Studies* *(Udlandsophold)*				
		Long Master's Thesis *(Langt afgangsprojekt*				
4th	Master's Thesis *(Kandidatspeciale)*		30	7-point scale	External	Oral based on project
Total			120			

* Plans for external studies must be approved by the study board in advance.

3.2 Descriptions of 1st semester modules

3.2.1 Process Analysis

English title Danish	**Process Analysis** (Procesanalyse)
Placement	1st semester Chemical Engineering
ECTS	15
Prerequisites	
Objectives	**Students who complete the module:** Knowledge • Must have knowledge about which theoretical, numerical and experimental tools are available to solve the selected problem in process analysis • Must be able to understand the physical, chemical and mathematical theory behind the selected tools Skills • Must be able to apply instruments, equipment, data sampling systems, instrumental chemical analysis to solve the problem. • Must be able to evaluate which kind of theory and or equipment gives the fastest and most robust answer to the question arised. Competencies • Must have competences to transfer the obtained theory and methodology to other problems involving process analysis.
Content	The student selects an industrial or research based process and by help of discussions with the tutor or group of tutors the initial problem is developed. The project limitation is a result of the size of the project group, limited time and limits of project money.
Type of instruction	Project work. Discussions and ad hoc study circles. Instruction in laboratory.
Exam format	Oral examination based on a written report and the project closing
Evaluation criteria	Are stated in the Framework Provisions

3.2.2Fluid Mechanics

English title Danish	**Fluid Mechanics** Strømningslære
Placement	1st semester Chemical Engineering 1st semester Oil and Gas Technology
ECTS	5
Prerequisites	Fundamental Chemical Engineering and Thermodynamics at B.Sc. 2nd semester Fundamental Fluid Mechanics and Heat Transfer at B.Sc. 5th semester

Objectives	**Students who complete the module must:** Knowledge • Have comprehension of the fundamental basis for the formulation and analysis of the statics and dynamics of the flow of viscous fluids • Have knowledge about fluid kinematics • Have knowledge about stresses in fluids, equation of motion, constitutive models and Navier-Stokes equations • Have knowledge and understanding of Reynolds averaging and turbulence models • Be able to describe turbulent and laminar boundary layers including understanding of momentum equation for boundary layers • Have knowledge and comprehension of the basic phenomena involved in multiphase flows. • Have knowledge to plan and design and make experiments and to choose measurements methods suitable to the characteristics of the fluid. Skills • Be able to determine and apply appropriate experimental methods to fluid flows • Be able to apply appropriate analytical, semi-empirical and numerical methods for mathematical description of fluid dynamic problems • Be able to apply multiphase flow models Competencies • Independently be able to define and analyse scientific problems within the area of fluid dynamics. • Independently be able to be a part of professional and interdisciplinary development work within the area of fluid dynamics
Content	
Type of instruction	The course is taught by a mixture of lectures, workshops, exercises, mini-projects and self-studies.
Exam format	Written or oral examination
Evaluation criteria	Are stated in the Framework Provisions

3.2.3 Colloid and Interface Science

English title Danish	**Colloid and Interface Science** (Kolloid og grænsefladekemi)
Placement:	1st semester Chemical Engineering 1st semester Oil and Gas Technology
ECTS	5
Prerequisites	
Objectives	**Students who complete the module:**

	Knowledge • Must have knowledge about different disciplines in which the theory of colloid and interface science are beneficial for understanding details of products or processes • Must be able to understand the importance of size and interparticle forces that result in macroscopic properties of substances. Skills • Must be able to apply general theory of colloid science in combination with experimental tools • Must be able to evaluate which kinds of experimental tools that preferable can be used to enhance the physico-chemical understanding of a given process or product. Competencies • Must have competences to be able detailed to explain models of colloids and interfaces that can be used for the description and understanding of different colloid systems. This involves physical equations, diagrams, drawings and images.
Content	Description of different types of colloids. Charges in colloidal systems and their measurements. Stability of colloidal systems. Intercolloidal surface forces. Surfactants. Adsorption at interfaces. Microemulsions and emulsions. Wetting. Scattering techniques. Electron Microscopy. Laboratory problems in the colloid laboratory.
Type of instruction	Lectures, laboratory problems and theoretical exercises
Exam format	Oral examination
Evaluation criteria	Are stated in the Framework Provisions

3.2.4 Chemometrics

English title Danish	**Chemometrics** (Kemometri)
Placement	1st semester Chemical Engineering
ECTS	5
Prerequisites	
Objectives	**Students who complete the module:** Knowledge • Must have knowledge about general methods for multivariate data analysis (principal component analysis, multiple linear regression, principal component regression, projection on latent structures, soft independent modelling of class analogy). • Must have knowledge about methods for data preprocessing (centering, scaling, non-linear and spectroscopic preprocessing, orthogonal signal correction). • Must know basic methods for variable selection (loading-weights, VIP, interval PLS, jack-knife).

	• Must understand the theoretical background of these methods, their advantages and limitations as well as possible applications. Skills • Must be able to explore multivariate data, find groups and trends, detect and remove outliers. • Must be able to calibrate and do proper validation of multivariate regression models, use these models for prediction. • Must be able to evaluate if data need a preprocessing and which method to apply. • Must be able to calibrate and evaluate models for data classification. • Must be able to compare different regression and classification models and find which is the best Competencies • Must be able to use multivariate methods for analysis of real data from different applications.
Content	Introduction. Data representation. Explore data with statistics and plots Principal component analysis Linear regression and validation Multivariate regression Data preprocessing and variable selection Pattern recognition Multivariate classification Non-linear methods for regression and classification Introduction to multivariate curve resolution Hyperspectral imaging and multivariate image analysis
Type of instruction	Lectures, classroom instruction
Exam format	Written examination (computer class)
Evaluation criteria	Are stated in the Framework Provisions

3.3 Descriptions of 2nd semester modules

3.3.1 Process Modelling

English title Danish	**Process Modelling** (Procesmodellering)
Placement	2nd semester Chemical Engineering
ECTS	15
Prerequisites	
Objectives	**Students who complete the module:** Knowledge • Must have knowledge about one or more advanced programmes for numerical calculations of complex and/or big amounts of data. • Must be able to understand the theory behind the programmes Skills

	• Must be able to apply one of the programmes for numerical calculation of a selected process that maybe also is going on in laboratory or pilot scale. • Must be able to evaluate the results of the calculations and eventually find and correct wrong input data. Competencies • Must have competences to be able to present the setup of the model, the calculations and estimations of the results and to propose further work based on the results of calculation.
Content	Project work
Type of instruction	Project work Discussions and ad hoc study circles. Instruction in laboratory
Exam format	Oral examination based on a project report
Evaluation criteria	Are stated in the Framework Provisions

3.3.2 Process Simulation

English title Danish	**Process Simulation** (Processimulering)
Placement	2nd semester Chemical Engineering 2nd semester Oil and Gas Technology
ECTS	5
Prerequisites	Working knowledge of thermodynamics and unit operations
Objectives	**Students who complete the module:** Knowledge • Must be able to understand the principles of process simulation. • Must have knowledge about optimization in process simulation. • Must have knowledge about software programmes for advanced simulations Skills • Must be able to convert a process diagram to a working process simulation. • Must be able to perform both static and dynamic simulations if applicable in the given simulation software. • Must be able to apply one or more programmes in a simulation of a selected process in a specified scale. • Must be able to evaluate the results of the simulations as well as identifying and correcting the cause of erroneous results. Competencies • Must be able to create a process simulation of a given process and add controls to this simulation if applicable in the given simulation software. • Must be able to investigate a given case using simulation tools. • Must be able to present the results of the simulations and propose a further course of action.

	• Must be able to apply existing methods or software on computational chemistry to specific chemical questions.
Content	• Introduction to process simulation • Creating processes in simulation software • Using built-in evaluation tools • Static and dynamic simulation (if applicable in given software) • Students make a mini project using advanced software to model or simulate a chemical process or structure
Type of instruction	Lectures with exercises, mini-project.
Exam format	Oral examination based on mini-project
Evaluation criteria	Are stated in the Framework Provisions

3.3.3 Water Treatment

English title Danish	**Water Treatment** (Teknisk vandbehandling)
Placement	2nd semester Chemical Engineering 2nd semester Oil and Gas Technology
ECTS	5
Prerequisites	
Objectives	**Students who complete the module:** Knowledge • Must have knowledge about different water bodies in the society and its surroundings. • Must have knowledge of different kinds of natural and antropogenic pollutants and their origin. • Must have knowledge about which chemical compounds are normally present in groundwater and at which levels. Skills • Must be able to describe a normal Danish drinking water treatment system. • Must be able to understand and select a methodology from an array of advanced oxidative and reductive processes that separately or in common can solve a given recalcitrant water pollution problem. Alternatively, estimate which kind of normal water treatment methods from drinking water treatment plants or municipal waste water treatment plants will be able to solve the problem. • Must have ideas to solve problems with lakes and streams on their way to become eutrophic. Competencies • Must be able to apply proper terminology in oral, written and graphical communication and documentation within water treatment technology.
Content	Drinking water systems. Waste water systems. Groundwater systems. Lakes and

	streams. Pollutants and remediation technologies. Cases.
Type of instruction	Lectures supplemented with project work, workshops, presentation seminars, lab tests. Cases
Exam format	Individual oral examination
Evaluation criteria	Are stated in the Framework Provisions

3.3.4 Polymers and Properties of Polymers

English title Danish	**Polymers and Properties of Polymers** (Polymere og polymeres egenskaber)
Placement	2nd semester Chemical Engineering
ECTS	5
Prerequisites	
Objectives	**Students who complete the module:** Knowledge • Polymerisation processes • Influence of segments in polymers on the properties • About viscosity of polymers • Solubility parameters for polymers • Analysis of polymers • Degradation of polymers • Permeability and migration in polymers • Additives and their influence on the properties Skills • Must be able to understand a polymer system • Can analyse or describe analytical methods to receive the knowledge about the polymer system and of the properties for the system • Can apply the obtained knowledge about polymers to describe the properties of a polymer system Competencies • Must be able to apply proper terminology in oral, written and graphical communication and documentation within polymers and properties of polymer systems
Content	Properties of polymers Viscosity of polymers Solubility parameters and their use for polymer systems Polymerization processes Additives in polymers Fiber reinforcement of polymers
Type of instruction	Lectures supplemented with project work, workshops, presentation seminars, lab tests
Exam format	Oral or written examination on basis of a given problem

Evaluation criteria	Are stated in the Framework Provisions

3.4 Descriptions of 3rd semester modules

3.4.1 Bio Energy

English title Danish	**Bio Energy** (Bioenergi)
Placement:	3rd semester Chemical Engineering
ECTS	30
Prerequisites	
Objectives	**Students who complete the module:** Knowledge • Must have knowledge and comprehension within the field of bio energy, e.g. biogas, bio ethanol, biodiesel, bio fuel, bio refinery etc. at a very high level. • To select an area of bio energy in which laboratory facilities are present. • Must be able to understand the main processes within the selected field and its respective strengths and weaknesses. • Must be able to critically evaluate knowledge and results • Must be able to understand the implications and ethics involved in the processes with regards to society. Skills • Independently explain the reasoning behind choices of experimental and theoretical methods. • Must be able to apply analytical methods as part of experimental work, and fully explain the choice of analytical technique. • Must be able to estimate possibilities for numerical modelling of the system. • Must be able to critically review the methods used and results gained during the project work. Competencies • Must be able to work independently on a project concerning bio energy. • Must be able to independently identify key aspects of the problem/process and apply the appropriate theory to this problem/process. • Must be able to evaluate the progress of the project and include any needed literature or data to maintain a scientific basis. • Must be able to utilize advanced scientific methods to solve problems. • Must be able to communicate the results of the project work in a project report.
Content:	Project work

Type of instruction	Project work with supervision.
Exam format	Oral examination based on a written report and the project closing
Evaluation criteria	Are stated in the Framework Provisions

3.4.2 Environmental Technology

English title Danish	**Environmental Technology** (Miljøteknologi)
Placement	3rd semester Chemical Engineering
ECTS	30
Prerequisites	Colloid and Interface Science
Objectives	**Students who complete the module:** Knowledge • Must have knowledge of general natural systems and be able to identify a polluted area of soil, water or air and possible transport processes between the different phases. Skills • Must be skilled in system analysis so the experience can be used to identify and limit a system of investigation. • Must be skilled in selecting possibly remediation procedures and / or selecting methods for further investigations. Competencies • Must be able to show fully understanding of an environmental problem and its possible solution involving also life cyclus analysis (LCA), cost benefit analysis (CBA) and multi criteria assessments (MCA).
Content	Project work based on a case study or a research program
Type of instruction	Discussions and ad hoc study circles. Instruction in laboratory
Exam format	Oral examination based on a written report and the project closing
Evaluation criteria	Are stated in the Framework Provisions

3.4.3 Polymer Technology

English title Danish	**Polymer Technology** (Polymerteknologi)
Placement	3rd semester Chemical Engineering
ECTS	30

Prerequisites	
Objectives	**Students who complete the module:** Knowledge • Must have knowledge of polymers and the properties of polymers Must be able to identify a polymer system applying different analytical methods • Must have knowledge about the some methods for producing polymers • Must have knowledge about application of the described polymer system Skills • Must be skilled in selection of analytical methods for the chosen polymer system • Independently explain the reasoning behind choices of experimental and theoretical methods. • Must be able to apply analytical methods as part of experimental work, and fully explain the choice of analytical technique. • Must be able to estimate possibilities for numerical modelling of the system. • Must be able to critically review the methods used and results gained during the project work. Competencies • Must be able to work independently on a project concerning polymers. • Must be able to independently identify key aspects of the problem/process and apply the appropriate theory to this problem/process. • Must be able to evaluate the progress of the project and include any needed literature or data to maintain a scientific basis. • Must be able to utilize advanced scientific methods to solve problems. • Must be able to communicate the results of the project work in a project report.
Content:	Project work
Type of instruction	Project work with supervision
Exam format	Oral examination based on a written report and the project closing
Evaluation criteria	Are stated in the Framework Provisions

3.4.4 Ceramics, Sol-gel Processes and Photocatalysis

English title Danish	**Ceramics, Sol-gel Processes and Photocatalysis** (Keramiske materialer, sol-gel processer og fotokatalyse)
Placement	3rd semester Chemical Engineering
ECTS	30

Prerequisites	Colloid and Interface Science
Objectives	**Students who complete the module:** Knowledge • Must have knowledge about fundamentals of sol gel processes methods • Must have knowledge about different methods and procedures of coating. • Must have knowledge about functional groups that can participate in sol-gel processes. • Must have knowledge about possibly aggregates for producing coating mixtures. • Must have basic knowledge of photocatalysis. • Must have knowledge about laboratory techniques for analysis and characterization of nanoparticles and sol-gel coatings. Skills • Must be able to identify areas where coatings and eventual photocatalysis can be applied. • Must be able to apply laboratory methods for production of functional nanoparticles and/or coatings. • Must be able to evaluate the functionality of nanoparticles and/or coated areas. Competencies • Must be able to evaluate the situations where sol-gel methods, coatings and eventual photo catalysis or catalysis in general can be applied and make right selection for the production of the material. •
Content	Research program including study and experimental work
Type of instruction	Project work
Exam format	Oral examination based on a written report and the project closing
Evaluation criteria	Are stated in the Framework Provisions

3.4.5 Spectroscopy and Data Analysis

English title Danish	**Spectroscopy and Data Analysis** (Spektroskopi og dataanalyse)
Placement	3rd semester Chemical Engineering
ECTS	30
Prerequisites	Chemometrics
Objectives	**Students who complete the module:** Knowledge • Must have knowledge about basic principles of spectroscopy in general and vibrational spectroscopy in particular.

	• Must have knowledge about equipment and principles used to acquire spectra. • Must have knowledge about spectral preprocessing methods. • Must have knowledge about how to analyse spectral data. Skills • Must be able to acquire and collect spectra using various spectrometers • Must be able to interpret different types of spectra and compare them • Must be able to detect and remove unwilling effects in spectral data (baseline correction, scatter effects, etc.) • Must be able to explore and analyse spectra with chemometrics methods, to find which part of spectra are important for a particular problem. Competencies • Must be able to use spectroscopy and data analysis for solving real problems — determination of concentration of chemical components, classification of samples based on chemical and physical properties and similar.
Content	Project work
Type of instruction	Project work with supervision, including discussions, short study blocks, seminars and laboratory instructions.
Exam format	Oral examination based on a written report and the project closing
Evaluation criteria	Are stated in the Framework Provisions

3.5 Descriptions of 4th semester

3.5.1 Master's Thesis

English title Danish	**Master's Thesis** Kandidatspeciale
Placement	4th semester Chemical Engineering
ECTS	30
Prerequisites	1st - 3rd semester completed
Objectives	**Students who complete the module:** Knowledge • Must have knowledge and comprehension within the field of the specialization at the highest international level • Must be able to critically evaluate knowledge and identify new scientific problems within the field of the specialization • Must understand implications within the related research area including research ethics Skills • Independently explain choice of scientific theoretical and/or

	experimental methods • During the project and when finalising it make an independent and critical estimation of the chosen theories and methods as well as the analyses, results and conclusions • Be able to apply a wide range of engineering methods in research and development in the field of specialization • Be able to communicate relevant scientific and professional aspects of project work in a clear and systematic way both to specialists and the public Competencies • Be able to work independently with a project on a specific problem within the fields of the specialization at the highest international level • Independently be able to define and analyse scientific problems and based on that make and state the reasons for the decisions made • Be competent to solve new and complicated technical problems by the use of advanced mathematics, scientific and technological knowledge • Be able to evaluate the progress of the project independently and select and include additional literature, experiments or data when needed in order to maintain a scientific basis for the project • Be able to control complex and unexpected working situations and be able to develop new solutions • Must be able to communicate the results of the project work in a project report
Content	The project work can be part of an ongoing research at the university or done in cooperation with an external partner. The theme of the project can be within the same area as the theme of the 3rd semester project, or it can be a new one. The supervisor and the project coordinator must approve the project proposal.
Type of instruction	Project work with supervision, supplemented with instructions, workshops, presentation seminars, lab tests.
Exam format	Oral examination based on a written report and the project closing
Evaluation criteria	Are stated in the Framework Provisions

3.5.2 Long Master's Thesis

English title Danish	**Master's Thesis** kandidatspeciale
Placement	3rd and 4th semester Chemical Engineering
ECTS	60
Prerequisites	1st - 2rd semester completed A project proposal with a considerable amount of experimental scientific work can be chosen as a long Master's Thesis if the supervisor and project coordinator approve
Objectives	**Students who complete the module:**

	Knowledge • Must have knowledge and comprehension within the field of the specialization at the highest international level • Must be able to critically evaluate knowledge and identify new scientific problems within the field of the specialization • Must understand implications within the related research area including research ethics Skills • Independently explain choice of scientific theoretical and/or experimental methods • During the project and when finalising it make an independent and critical estimation of the chosen theories and methods as well as the analyses, results and conclusions • Be able to apply a wide range of engineering methods in research and development in the field of specialization • Be able to communicate relevant scientific and professional aspects of project work in a clear and systematic way both to specialists and the public Competencies • Be able to work independently with a project on a specific problem within the fields of the specialization at the highest international level • Independently be able to define and analyse scientific problems and based on that make and state the reasons for the decisions made • Be competent to solve new and complicated technical problems by the use of advanced mathematics, scientific and technological knowledge • Be able to evaluate the progress of the project independently and select and include additional literature, experiments or data when needed in order to maintain a scientific basis for the project • Be able to control complex and unexpected working situations and be able to develop new solutions • Must be able to communicate the results of the project work in a project report
Content	The project work should be part of an ongoing research project at the university
Type of instruction	Project work with supervision, supplemented with instructions, workshops, presentation seminars, lab tests.
Exam format	Oral examination based on a written report and the project closing
Evaluation criteria	Are stated in the Framework Provisions

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 2011

Students who wish to complete their studies under the previous curriculum from 2008 must conclude their education by the summer examination period 2012 at the latest, since examinations under the previous curriculum are not offered after this time.

In accordance with the Framework Provisions and the Handbook on Quality Management for the Faculty of Engineering and Science at Aalborg University, the curriculum must be revised no later than 5 years after its entry into force.

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

In the individual case, 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 Framework Provisions 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 Completion of the Master's programme
The Master's programme must be completed no later than four years after it was begun.

5.6 Rules and requirements for the reading of texts
It is assumed that the student can read academic texts in his or her native language as well as in English and use reference works etc. in other European languages.

5.7 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.