Bring Ideas to Life
VIA University College

August 2021

Curriculum

Programme section

Bachelor of Engineering
Climate and Supply Engineering

Applicable to students enrolled in August 2021 and later.

Students enrolled in August 2018-2019 will follow the structure and subjects of the curriculum 2017.
Students enrolled in August 2020 will follow the structure and subjects of the curriculum 2020.
In case of delay in a student's study programme, the design of a personal study plan may lead to a transition to this curriculum.

CONTENTS

Introduction

In accordance with the Executive Order on Bachelor of Engineering, the purpose of Bachelor of Engineering is to qualify the students to carry out the following professional functions nationally and internationally:

- Transpose technical research results as well as scientific and technical knowledge to practical use in development tasks and in solving technical problems
- Critically acquire new knowledge within relevant engineering areas
- Independently solve common engineering tasks
- Plan, implement and manage technical and technological facilities, including being able to involve social, economic, environmental and occupational health consequences in the solution of technical problems
- Participate in collaborative and managerial functions and contexts at a qualified level with people who have different educational, linguistic and cultural backgrounds

In addition, the education must qualify students to participate in further studies.

VIA Engineering programmes work on the basis of a common graduate profile. The graduate profile is a common profile for all VIA Engineers. The graduate profile is to be combined with the identity of the specific engineering programme.

At VIA Engineering, we are practice-oriented, project-oriented and world-focused. This is put into practice in the form of qualified new graduates obtained through targeted teaching, relevant research and development, as well as collaboration and ongoing dialogue with the business community. The programmes must qualify graduates to handle practical and development-oriented business functions.

Programmes in English as well as admission of international students are hallmarks of our engineering programmes. This profile creates a unique opportunity to educate students who can act in a Danish context in an increasingly global market. Our lecturers have vast and solid practical experience and know how to anchor theory in practice through lab work, company visits and projects for and in collaboration with companies.

1 Identity of the programme

We educate and train the future engineers to handle climate change through sustainable solutions within supply of water and district heating as well as wastewater treatment.

The aim of the programme is to educate engineers with basic knowledge of climate change and sustainability within design and management of projects for

- Drinking Water Production
- Wastewater Treatment
- Distribution of water, wastewater and district heating

The degree programme focuses on the use of digital tools for the design and simulation of processes and systems.

The aim of the programme is also to educate independent and problem-oriented graduates with competencies in applying the profession's methodologies, communicating with stakeholders and in a multidisciplinary manner, as well as being part of national and international teams.

2 Graduate profile for VIA Engineers

Purpose
The newly graduated VIA engineer works problem-oriented, project- and team-based and contributes to advising, developing, inventing and quality-assuring products and solutions. The VIA engineer creates innovative, digital, sustainable and workable solutions to and for current and future societal and engineering challenges worldwide.

Skills
VIA Engineering educate holistic-thinking engineers who, through societal insight and personal development, can exploit the full potential of technology. Therefore, the skills of the VIA engineer range from highly specialised engineering skills to personal skills and the skills of the outside world.

Professional engineering skills

- Masters and applies – with critical reflection – highly specialised engineering knowledge.
- Works challenge-driven, innovative and problem-oriented when developing engineering results.
- Integrates engineering and scientific knowledge, skills and methods in solving engineering challenges.
- Designs, plans, simulates, manages, implements and evaluates engineering solutions and products using digital and technological tools.
- Implements and operates solutions that match engineering needs within the industry.

Organisational skills

- Organises and manages projects and processes based on both risk assessment and market and business understanding.
- Collaborates inter-professionally with a global view and respect for the organisation, culture and methods of businesses and stakeholders.
- Involves knowledge of sustainability and circular economy in the development and implementation of new solutions.

Personal skills

- Works consistently with a curious and innovative mindset and seeks out, critically acquires and brings new knowledge into play throughout life.
- Communicates effectively and collaborates professionally with colleagues and people of different educational and cultural backgrounds.

3 Teaching and working methods

The engineering programme's priority focus areas within Digitalisation, Sustainability and Innovation and Entrepreneurship are integrated into relevant courses, so that together they constitute learning streams for all three areas.

Active and practice-oriented learning is supported by:

- Dialogue-based teaching with a high degree of active participation from students.
- Lectures in subjects where there is a large proportion of knowledge transfer. Lectures are usually combined with practice sessions with a student tutor.
- Project work and problem-oriented learning (PBL) are an essential part of the teaching, as the academic elements of the education programme are integrated into application-oriented engineering projects with emphasis on methodological problem solving.
- Projects being carried out in groups within the programme and in an interdisciplinary collaboration with other engineering programmes.
- Collaborating with research environments and businesses in connection with the implementation of the teaching.
- Offering an international study environment, where parts of the study can be completed abroad and where several courses are held in English for Danish and foreign students alike.
- The student's engineering internship being actively used to bring about the exchange of knowledge and experiences between VIA and the profession.

Application- and practice-oriented skills are primarily achieved by utilising VIA's facilities within laboratories, manufacturing workshops and library.

The reading of the study material requires English on level B in order to complete the programme.

Online/virtual elements can be included in the teaching.

4 Structure and content

The programme is organised as an ordinary full-time higher education programme.
The structure and progression including exams is stated in the overview on the next page.

The official duration of the degree program is 3½ years, divided into 7 semesters of 30 ects, corresponding to 210 ECTS points in total.

The scope of each course or project is documented in the form of ECTS points (European Credit Transfer System). 1 ECTS point corresponds to a workload of 27.5 hours for a student, an academic year of 60 ects thus corresponds to 1,650 hours of work for the student.

New students are admitted every year in August.

The study includes:

- Compulsory courses and projects
- Elective courses
- Internship
- Bachelor project
- Workshops

One semester consists of 3-4 delimited courses. One course may have a volume of 5 to 10 ECTS points, and a project may have a volume of 10 to 20 ECTS points.

The course purpose, scope, learning objectives and exams are described in this curriculum.

There are 5 workshops associated with the Climate and Supply Engineering programme.

The programme is structured as illustrated below:

Semester Theme	Course	Course	Course	Course/project	Course
7. Electives	Elective course	Elective course	Elective course	SE-BPR2 Bachelor project	
6. Electives	CE-CMP2 Construction Management and Planning (compulsory)	Elective course	Elective course	SE-BPR1 Preparation of Bachelor Project	SE-SEP6 Semester Project Innovation and Entrepreneurship
5. Internship	SE-INP1 Internship				
4. Urban Infrastructure and Climate Adaptation	SE-MAL1 MATLAB	CE-SUD1 Sustainable Drainage	SE-PNM1 Pipe Network Modelling	SE-MSC1 Materials Science and Corrosion	SE-SEP4 Semester Project
3. Process Engineering	SE-TER1 Thermo-dynamics and Particle Dynamics	SE-HYD2 Pressurized Closed Systems	SE-PRO1 Process Engineering	SE-CMI1 Chemistry and Microbiology	SE-SEP3 Semester Project
2. Climate Change Adaptation and Supply Infrastructure	CE-SCI2 Calculus, Linear Algebra and Dynamics	SE-HYD1 Basic Hydraulic	CE-GEA1 Engineering Geology and Geotechnical Engineering	CE-INF1 Infrastructure in Rural Areas	SE-SEP2 Semester Project
1. Sustainable Urban Development	CE-SCI1 Mathematical Analysis	SE-CCS1 Climate Change and Sustainability	SE-BUD1 Basic Utility Design	SE-UTS1 Utility Sector	SE-SEP1 Semester Project

The 5 workshops are structured as illustrated below:

Semester Theme	Course
3. semester *During the semester*	**PWS5** Workshop 5: Water Sampling
2. semester *During the semester*	**PWS4** Workshop 4: Soil Contamination
2. semester *During the semester*	**PWS2** Workshop 2: Land Surveying
1. semester *During the semester*	**PWS3** Workshop 3: Welding
1. semester *During the semester*	**PWS1** Workshop 1: Company visits

5 Compulsory elements of the education programme, 1st-4th semester

All courses and projects in the first four semesters are compulsory.

The 1st-4th semesters all contain a semester project amounting to 10 ECTS. Within these 10 ECTS, there will be input in the form of video, online lectures, learning paths, etc. covering up to 2.5 ECTS credits, which are expected to be completed and discussed together with the supervisor(s). The amount of input will vary from semester to semester

The overall purpose of the semester project is to link the semester's courses to a whole. Study techniques, project management, methodology, theory of science, research methods and teamwork will be introduced as input throughout the study in connection with the semester projects.

Each semester is themed. Knowledge and skills are acquired through the courses, while competencies are acquired and can be tested in the project – Problem-oriented learning.

1. Semester: Sustainable Urban Development
2. Semester: Climate Change Adaptation and Supply Infrastructure
3. Semester: Process Engineering
4. Semester: Analysis of a Supply District Area

5.1 1st semester: Sustainable Urban Development

The overall theme of the 1st semester is 'Introduction to climate change and sustainable supply'.

Expanding cities are a challenge – how can we accommodate that growth in a sustainable way?

In this context the semester project focuses on turning a green field into an environmentally friendly residential area. The amount of water, wastewater and district heating must be forecasted in order to balance supply and demand. Additionally, storm water must be handled locally.

Purpose, ECTS and assessment:

Mathematical Analysis (CE-SCI1) – 5 ECTS	**Assessment**
The course aims to prepare the student for further studies in Climate and Supply Engineering. Furthermore, the purpose is to enable the student to read and interpret technical literature, which use mathematics.	Individual written exam, 4 hours Allowed tools: At 20-40% of the exam, the use of CAS programs is not allowed. For the rest of the exam, the use of CAS programs is permitted. External assessment Danish 7-step-scale Re-exams: Conducted as the ordinary exam
Climate Change and Sustainability (SE-CCS1) – 5 ECTS	
Climate changes are one of our biggest agendas in the world today. In this course you will work with climate and climate changes and sustainable energy systems. We will take two approaches; climate change adaption and mitigation.	Ongoing assessment of 3 assignments during the semester and a final exam in the form of a written test, each weighing 25%. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral examination Internal assessment

Basic Utility Design (SE-BUD1) – 5 ECTS	
Humans are dependent on clean drinking water, clean energy and removal of contaminants from waste water. This course gives a basic introduction to the resources the demand calculations and main processes in drinking water, waste water and heating utility companies.	Ongoing assessment of 3 assignments during the semester and a final exam in the form of a written test, each weighing 25%. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral examination Internal assessment
Utility Sector (SE-UTS1) – 5 ECTS	
Supply of water and energy and handling of waste water and storm water is managed by utility companies. The performance of these utilities depends on the legal framework, their organisation and economy and their strategies in relation to important issues such as sustainability.	Ongoing assessment of 3 assignments during the semester and a final exam in the form of a written test, each weighing 25%. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral examination Internal assessment
Semester Project (SE-SEP1) – 5 ECTS	
The aim of the project is to: - Make academic competencies useful in a problem-based context. - Solve engineer academic issues on the basis of courses of the current semester. - Demonstrate the ability to prioritise issues and work in the detail with selected issues. The focus of the teaching in SEP1 is: Study techniques and team-based project work. Theme: Learning to learn	Prerequisite: Submission of written group assignment before deadline. Oral group exam with individual assessment. Group presentation appr. 20 minutes, examination appr. 20 minutes per student. Internal assessment. Grading based on the Danish 7-point scale Re-exams: Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Grade is given on the basis of the updated or new project without oral defense.

The learning objectives of the courses (knowledge, skills and competencies) can be found in Appendix 1.

ECTS credits: 30

5.2 2nd semester: Climate Change Adaptation and Supply Infrastructure

The overall theme of the 2nd semester is “Sustainable infrastructural Planning.”
The students will complete a project, where they must plan an infrastructural project assignment.

The project aims to provide students with the understanding of a basic concept of planning and distribution of supply lines for drinking water and district heating supply, and for a management of wastewater and rainwater. Besides, students will use basic concepts for designing road cross section and engineering geology methods used for road construction.

Purpose, ECTS and assessment:

Calculus, Linear Algebra and Dynamics (CE-SCI2) – 5 ECTS	**Assessment**
The course aims to prepare the student for further studies in Climate and Supply Engineering. Furthermore, the purpose is to enable the student to read and interpret technical literature, which use mathematics.	Prerequisites: Upload in WISEflow of selected course assignments solved during course, approximately one week before the oral exam. Individual oral exam, 20 minutes, no aids allowed. Internal assessment Grading based on the Danish 7-point scale Re-exams: Conducted as the ordinary exam
Basic Hydraulics (SE-HYD1) – 5 ECTS	
The course aims to provide students with understanding of basic hydraulics and to teach them how to use this knowledge in design of both urban sewer systems and sewer systems in rural areas.	Individual assessment of 1 written group assignment Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral exam Internal assessment
Engineering Geology and Geotechnical Engineering (CE-GEA1) – 5 ECTS	
The course aims to introduce engineering geology and geotechnical engineering.	Ongoing assessment of 3 written individual/ group assignments, 4 sub-exams in the form of individual written assignments, weighing 25% and a final exam consisting of a written individual course assignment, weighing 25%. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral exam, 20 minutes Internal assessment
Infrastructure in Rural Areas (CE-INF1) – 5 ECTS	
The course aims to provide the student with an understanding of the basic concepts of road construction, including the planning of a road construction project in rural areas.	Individual oral exam, 20 minutes Internal assessment Grading based on the Danish 7-point scale Re-exams: Conducted as the ordinary exam
Semester project (SE-SEP2) – 10 ects	
The aim of the project is to: - Make academic competencies useful in a problem-based context. - Solve engineer academic issues on the basis of courses of the current and previous semesters. - Demonstrate the ability to prioritise issues and work in the detail with selected issues. The focus of the teaching in SEP2 is: Study techniques and team-based project work. Theme: Cooperation	Prerequisite: Submission of written group assignment before deadline. Oral group exam with individual assessment. Group presentation appr. 20 minutes, examination appr. 20 minutes per student. External assessment. Grading based on the Danish 7-point scale Re-exams: Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Grade is given on the basis of the updated or new project without oral defense.

The learning objectives of the courses (knowledge, skills and competencies) can be found in Appendix 1

ECTS credits: 30

5.3 3rd semester: Process Engineering

The overall theme of the 3rd semester is processes in water, wastewater and energy supply systems.

The students will complete a project with focus on analyses and calculations of processes related to optimising an existing supply process (drinking water, wastewater or district heating).

Purpose, ECTS and assessment:

Thermodynamics and Particle Dynamics (SE-TER1) – 5 ECTS	**Assessment**
The course aims to provide the students with a basic theory within particle dynamics and basic thermodynamics.	Prerequisites: Upload in WISEflow of selected course assignments solved during course, approximately one week before the oral exam. Individual oral exam, 20 minutes, no aids allowed Internal assessment Grading based on the Danish 7-point scale Re-exams: Conducted as the ordinary exam
Pressurised Closed Systems (SE-HYD2) – 5 ECTS	
The course aims to give an understanding of hydraulics in pressurised systems for distribution of water, wastewater and district heating.	Individual oral exam, 20 minutes External assessment Grading based on the Danish 7-point scale Re-exams: Conducted as the ordinary exam
Process Engineering (SE-PRO1) – 5 ECTS	
The course aims to give an understanding of material processes and fundamentals of process engineering disciplines in the fields of drinking water, waste water and district heating including suggestions for optimizations.	Prerequisite: Course attendance incl. lab exercises min 75% Assessed on the basis of two oral assignments and one written assignment during the course and one final test in the form of a written course assignment. All four weighing equally. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral exam. Internal assessment
Chemistry and Microbiology (SE-CMI1) – 5 ECTS	
The course aims to provide the students with a background in basic chemistry and microbiology which can be applied to the fields of drinking water, wastewater and district heating.	Two sub-exams in the form of multiple choice tests, 30 minutes, each weighing 15% One individual written exam, 4 hours, weighing 70% External assessment Grading based on the Danish 7-point scale Re-exams: Conducted as the ordinary exam.

Semester project **(SE-SEP3) – 10 ECTS**	
The aim of the project is to: - Make academic competencies useful in a problem-based context. - Solve engineer academic issues on the basis of courses of the current and previous semesters. - Demonstrate the ability to prioritise issues and work in the detail with selected issues. Theme: self-dependent application of knowledge	Prerequisite: Submission of written group assignment before deadline. Oral group exam with individual assessment. Group presentation appr. 20 minutes, examination appr. 20 minutes per student. External assessment. Grading based on the Danish 7-point scale Re-exams: Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Grade is given on the basis of the updated or new project without oral defense.

The learning objectives of the courses (knowledge, skills and competencies) can be found in Appendix 1

ECTS credits: 30

5.4 4th semester: Urban Infrastructure and Climate Adaptation

The overall theme for the 4th semester is "Urban Infrastructure and climate adaptation".

Project work is being carried out to focus on upgrading of intersections in urban areas with associated design, adaptation and modelling of the supply pipelines as well as planning of the execution of selected construction constructions.

The project will be conducted in a multidisciplinary manner together with the Danish and International Climate and Supply Engineering as well as the Civil Engineering programmes.

Purpose, ECTS and assessment:

MATLAB **(SE-MAL1) – 5 ECTS**	**Assessment**
The course aims to introduce the students to MATLAB APP creation with applications on graphics, audio and Excel data transport and for PDF and CDF characteristics of statistical data. The APPs are targeted for the design and operation of supply engineering facilities.	Ongoing assessment of written assignments weighing 20% in total, and a final exam in the form of a mini project, weighing 80%. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral exam. Internal assessment
Sustainable Drainage **(CE-SUD1) – 5 ECTS**	
The course aims to provide the students with knowledge on how to implement sustainable solutions to handle an increase of rain/raise of sea water in urban areas.	Ongoing assessment of written assignments, in total weighing 30% and final exam in the form of a major written assignment weighing 70%. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral exam with an internal examiner, 20 min.

Pipe Network Modelling (SE-PNM1) – 5 ECTS	
The course aims to enable the student to set up pipe network models for pressurized and gravity systems and analyse the systems. Analyse heat losses in a district heating network.	Ongoing assessment of written assignments, weighing 75% in total, and a final exam in the form of a written assignment, weighing 25%. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral exam. Internal assessment
Materials Science and Corrosion (SE-MSC1) – 5 ECTS	
The course aims to provide the student with a basic knowledge of materials and products used in the supply industry and their degradation mechanisms.	Prerequisite: Course attendance min 75% Assessed on the basis of two oral assignments and one written assignment during the course and one final test in the form of a written course assignment. All four weighing equally. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral exam. Internal assessment
Semester project (SE-SEP4) – 10 ECTS	
The aim of the project is to: - Make academic competencies useful in a problem-based context. - Solve engineer academic issues on the basis of courses of the current and previous semesters. - Demonstrate the ability to prioritise issues and work in the detail with selected issues. Theme: Interprofessional cooperation	Prerequisite: Submission of written group assignment before deadline. Oral group exam with individual assessment. Group presentation appr. 20 minutes, examination appr. 20 minutes per student. External assessment. Grading based on the Danish 7-point scale Re-exams: Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Grade is given on the basis of the updated or new project without oral defense.

The learning objectives of the courses (knowledge, skills and competencies) can be found in Appendix 1

ECTS credits: 30

6 Internship, 5th semester

SE-INP1

The internship comprises a semester of 30 ECTS and timewise is placed in the 5th semester of the programme. As a general rule the internship period is paid and settled in a private or public company in Denmark or abroad. Student must be on an internship for a minimum of 20 full weeks excluding holidays, etc.

The purpose of the internship is for the student to acquire insight into practical common engineering work corresponding to engineering assistant work, combined with the integrated application of the acquired concepts, methods and techniques of the discipline in the first four semesters.

The student will find an internship, which must be approved by VIA, who appoints a supervisor for the intern.

In collaboration with the company, the student prepares a plan for the internship with appertaining formulated assignments.

The basis for assessment of the internship is an ongoing report from the student to VIA, feedback from the internship company and a presentation where the supervisor can ask elaborating questions about the content of the internship.

If the engineering internship is interrupted before the end of the agreed internship period, the internship supervisor must, in consultation with the head of the education programme, assess whether the internship has been of sufficient length and content for there to be grounds for passing the internship present.

The internship is graded as passed/not passed. Internal assessment.

7 6th-7th semesters

On 6th and 7th semester, students may specialise their education by choosing elective courses within the same subject area. Alternatively, they can choose freely between all subject areas.

Compulsory courses/projects are listed in section 7.1.

The content of the specialisations is described in section 7.3-7.6.
Choosing a specialization is not mandatory.

A detailed description of the individual courses can be found in the course-descriptions.

Students may choose one course of 5 ECTS among elective courses offered by VIA's other programmes. However, this does not apply to courses where the main content consists of material from the student's previous course of study. Any choice of course from another study programme must be approved by an Engineering student counsellor, in order to secure the relevance and an increasing academic level. Courses listed in section 7.2 are exempt from this rule.

7.1 Compulsory courses and projects

Compulsory courses at 6./7. Semester, for all students on Climate and Supply Engineering programme.

Purpose, ECTS and assessment:

Title (code)	Purpose / Content	Scope	Assessment
Construction Management and Planning (CE-CMP2)	The aim of the course is to introduce Construction Management and Planning.	5 ECTS	Oral test Grading based on the Danish 7-point scale External assessment

Semester project (SE-SEP6)	A compulsory cross-sectoral semester project with the purpose to develop and document a cross-organisational innovation project in collaboration with a company or institution. It is also possible to have a cross-sectoral semester project where work is done on an entrepreneurial process.	10 ECTS	Prerequisite: Submission of written group assignment before deadline. Oral group exam with individual assessment Group presentation, 20 min., assessment approx. 20 min./stud. External assessment Grading based on the Danish 7-point scale Re-exams: Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Grade is given on the basis of the updated or new project without oral defence.
Bachelor project preparation course (SE-BPR1)	Developing a Project Description for the Bachelor Project (SE-BPR2) that is in accordance with VIA Engineering Guidelines.	5 ECTS	Assessed on the basis of project description for BPR2 Approved / not approved Internal assessment
Bachelor project (SE-BPR2)	Carrying out the project including follow up on the time schedule and completion of the planned activities. Documentation of time used according to the project record. Application of computational technology relevant to the project. Documentation and promotion of the project result in a report. Planning of the oral presentation of the project.	15 ECTS	Prerequisite: Submission of written group assignment before deadline. Oral group exam with individual assessment Group presentation, 20 min., assessment approx. 20 min./stud. External assessment Grading based on the Danish 7-point scale Re-exams: Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. The project is assessed at an oral exam.

The learning objectives of the courses (knowledge, skills and competencies) can be found in Appendix 1.

7.2 Electives

The Climate and Supply Engineering programme provides a selection of the following electives.

Electives run if there are sufficient number of registered students.

Purpose, ECTS and assessment:

Title (code)	Content	Scope	Assessment
Advanced Water Treatment (SE-AWT1)	Through information retrieval, discussions, presentations and laboratory exercises to provide the student with knowledge in and hands-on experience with current topics related to drinking water quality. The focus will be on drinking water treatment methods more advanced than the traditional aeration and bio-sand filter. The methods may be filtration, sorption, precipitation, disinfection, etc.	5 ECTS	Ongoing assessment of 4 written assignments, and a final written assignment. All weighing 20% Grading based on the Danish 7-point scale Internal assessment
Applied Drinking Water Quality (SE-ADW1)	Through information retrieval, discussions, presentations and laboratory exercises to provide the student with knowledge in and hands-on experience with current topics related to drinking water quality.	5 ECTS	Oral exam Grading based on the Danish 7-point scale Internal assessment
Applied Wastewater Quality (SE-AWW1)	Through information retrieval, discussions, presentations and laboratory exercises to provide the student with knowledge in and hands-on experience with current topics related to wastewater quality.	5 ECTS	Oral exam Grading based on the Danish 7-point scale Internal assessment
Design & Simulation of District Heating System (SE-DSD1)	The student will obtain knowledge of energy storage systems and be able to make analysis/simulations of thermal energy storage and non-stationary energy systems.	5 ECTS	Oral exam Grading based on the Danish 7-point scale Internal assessment
Design of Energy Systems (ME-DES1)	The student will obtain knowledge and calculation practice of refrigeration and heat pump systems in order to be able to design an efficient, environmentally friendly energy plant.	5 ECTS	Assessed throughout the course in form of 2 tests, each weighing 20% and a final oral test on the basis of a mini project, weighing 60%. Grading based on the Danish 7-point scale Internal assessment
Design of Wastewater Treatment Plant (SE-DWT1)	Through information retrieval, discussions, presentations and laboratory exercises to provide the student with knowledge in planning establishment and design a proper waste water treatment plant (WWTP) for achieving a current wastewater quality.	5 ECTS	Assessed throughout the course in form of 1 written test weighing 20% and a final written test, weighing 80%. Grading based on the Danish 7-point scale Internal assessment
Design of Wastewater Treatment 2 (SE-DWT2)	To create an understanding of the activated sludge process and advanced wastewater treatment. Through information retrieval, discussions, presentations, and group works to provide the student with knowledge current topics related to biological treatment of wastewater.	5 ECTS	Assessed on the basis of a written mini project, weighing 100% Grading based on the Danish 7-point scale Internal assessment

Geophysics and Pump Test (SE-GPT1)	Prepare the students to be able to address the geophysical and hydrological questions related to establishing a new source location or protection of an existing location.	5 ECTS	Oral exam Grading based on the Danish 7-point scale Internal assessment
Geothermal Systems (SE-STS1)	The student will gain knowledge about geothermal systems as a sustainable energy source and to obtain an understanding of the physical design, dimensions, functions and operation of these systems.	5 ECTS	Oral exam Grading based on the Danish 7-point scale Internal assessment
Life Cycle Assessment (SE-LCA1)	Introduction to UNs Sustainable Development Goals, Circular Economy and LCA. Methods for Life Cycle Assessment (LCA) Impacts from use and reuse of resources and materials Use of cases to evaluate alternative materials and technologies based on environmental and climate impact	5 ECTS	Individual written exam 48 hours Grading based on the Danish 7-point scale Internal assessment
Renewable Energy (ME-ENE1)	The purpose of the course is to ensure that the student will understand the design and calculation of renewable energy plants with focus on energy production, energy savings and storage and environmental conditions	5 ECTS	Oral exam Grading based on the Danish 7-point scale Internal assessment
Sludge Management (SE-SLM1)	To create an understanding of the sludge management techniques and their origin. Through information retrieval, discussions, presentations and laboratory exercises to provide the student with knowledge in and hands-on experience with current topics related to sludge management.	5 ECTS	Ongoing assessment of 4 experimental reports handed as a group work and one final exam in form of an individual presentation. Each weighing 20% Grading based on the Danish 7-point scale Internal assessment
Tool Box Drinking Water (SE-TBD1)	Toolbox Drinking Water is a string of seminars on diversified drinking water related topics, that either digs a bit deeper in known areas, are new but important or are relevant for bachelor projects.	5 ECTS	Oral exam Grading based on the Danish 7-point scale Internal assessment

The learning objectives of the courses (knowledge, skills and competencies) can be found in Appendix 1

7.3 Water Supply

Contents
The following 55 ects are compulsory for the specialisation:
− Applied Drinking Water Quality (SE-ADW1)
− Toolbox Drinking Water (SE-TBD1)
− Advanced Water Treatment (SE-AWT1)
− Geophysics and Pump Test (SE-GPT1)
− Planning and Construction Management (CE-CMP2)
− 6. semester project (SE-SEP6): Innovation and Entrepreneurship
− Bachelor project (SE-BPR1+2): Project within Water Supply

In addition, the following elective is recommended:
− Life Cycle Assessment (SE-LCA1)

7.4 Waste Water Supply

Contents
The following 55 ects are compulsory for the specialisation:
− Applied Wastewater Quality (SE-AWW1)
− Design of Wastewater Treatment Plant (SE-DWT1)
− Sludge Management (SE-SLM1)
− Design of Wastewater Treatment 2 (SE-DWT2)
− Planning and Construction Management (CE-CMP2)
− 6. semester project (SE-SEP6): Innovation and Entrepreneurship
− Bachelor project (SE-BPR1+2): Project within Waste Water Supply

In addition, the following elective is recommended:
− Life Cycle Assessment (SE-LCA1)

7.5 District Heating

Contents
The following 55 ects are compulsory for the specialisation:
− Design of Energy Systems (ME-DES1)
− Renewable Energy (ME-ENE1)
− Design and Simulation of District Heating System (SE-DSD1)
− Shallow Geothermal Systems (SE-STS1)
− Planning and Construction Management (CE-CMP2)
− 6. semester project (SE-SEP6): Innovation and Entrepreneurship
− Bachelor project (SE-BPR1+2): Project within District Heating

In addition, the following elective is recommended:
− Life Cycle Assessment (SE-LCA1)

8 Workshops

Workshops are practice-related courses of one week's duration (outside of ECTS credits). The courses are completed parallel to the 1st-4th semesters. These are the following five courses:

PWS1 1st semester Company visits
PWS2 2nd semester Land Surveying
PWS3 1st Semester Welding
PWS4 2nd semester Soil Contamination
PWS5 3rd semester Water Sampling

The learning objectives of the courses (knowledge, skills and competences) and form of exam can be found in Appendix 1.

9 Bachelor project

SE-BPR1
SE-BPR2

The programme concludes with a bachelor project (SE-BPR2), which accounts for 15 of the education programme's total 210 ECTS and concludes with an exam. The bachelor project commences in the 6th semester (SE-BPR1) with a choice of subject and preparation of a project description.

The bachelor project must demonstrate independent critical reflection within the chosen topic, and must document the student's ability to apply engineering theories and methods. The bachelor project must also reflect the student's ability to express themselves in an academic and structured manner within their subject.

BPR1 is expected to be approved before BPR2 begins.
The condition for assessment of the bachelor project, BPR2, is that the student has passed all other courses.

The Bachelor project is prepared in groups of at least three persons, unless otherwise agreed with the head of programme.

The bachelor project includes an independent experimental, empirical and/or theoretical treatment of a practical problem in connection with the central topics of the education programme.

The project must be documented in the form of a report containing a project basis, solution description, calculations, drawings, etc. If the report is a group assignment, it must be clear who wrote which sections of the report.

The students are examined in the project by oral exam/group test with individual assessment in accordance with the programme's overall goals as described in Section 1 of the Curriculum. The basis for exam is the bachelor project. It is a prerequisite for participation in the exam that the bachelor project is submitted within the stipulated deadline and meets the described criteria for the project.

Exams can take place at the earliest when all the other exams of the programme, including internships, have been passed. The exam is assessed according to the 7-point scale and with the participation of an external examiner.

See also section 7.1.

10 Title and issue of degree

Graduates who have completed the programme of study according to this curriculum + joint regulations, are entitled to use the title Bachelor of Engineering in Climate and Supply Engineering.

It is also possible to obtain the following special designations:
− Water Supply
− Waste Water Supply
− District Heating

For completed education programmes, VIA University College issues a diploma, specifying the title and, if applicable, special designation. Furthermore, information is provided on the scope of the sub-elements in ECTS, the result of the assessments achieved as well as the subjects of the project in the 6th semester and the bachelor project.

If the programme is withdrawn, VIA issues a certificate for the completed/passed courses.

The diploma is sent to the graduates e-Boks no later than 5 working days after graduation.

11 Appendix 1: Courses Climate and Supply Engineering Programme

Code	Title	ECTS-points	Knowledge	Skills	Competences
CE-SCI1	Mathematical Analysis	5	The student will get knowledge about: • Differentiation • Trigonometric functions • Exponential functions • Integration • Vectors in space • Vector functions in space	After the completion of the course, the student will be able to: • Identify and make simple calculation on selected transcendental functions • Identify and make simple calculation on the branch of infinitesimal calculation, which deals with finding the derivative of functions with one variable, including different applications thereof • Identify and make simple calculation on the branch of infinitesimal calculation, which deals with integration of functions with one variable and different applications thereof • Analyse vectors and motion in space and perform calculations based on vector operations. IT is used in a pedagogical method in the course. The aim is that IT will support the learning process of the students and their understanding of the engineering professional possibilities in, for example, the application of modelling, simulation, etc.	After completing the course, the student can: • Perform a basic understanding for Calculus. • Use their acquired skills and knowledge to study more advanced Calculus and Algebra courses on their Engineering programme. • Use a commercial mathematical software to solve and perform serial technical calculations.
SE-BUD1	Basic Utility Design	5	Upon completion of the course, the student has gained knowledge of: - Components of water, wastewater and district heating systems followed by quality requirements for consumption and discharge - Energy and mass balance as tools for optimization and analysing the physical systems	Upon completion of the course, the student has gained skills for: - Digital tools usage (GIS, Heat Roadmap Europe and Scalgo-live) and basic laboratory analyses - Calculations of system demands and loading rates	Upon completion of the course, the student will be able to apply knowledge and skills to: - Suggest treatment processes for drinking water, wastewater and district heating - Analyse demand and/or flows for a given area and relate those demands for the quality of existing legislations
SE-CCS1	Climate Change and Sustainability	5	Upon completion of the course, the student has gained knowledge of:	Upon completion of the course, the student will be able to:	Upon completion of the course, the student will be able to apply knowledge and skills to:

Code	Title	ECTS-points	Knowledge	Skills	Competences
			Climate and weather systems Climate changes and impacts on society and the utility sector Climate change adaptions	Identify suitable processes for handling surface water	Evaluate and suggest solutions for sustainable urban drainage Identify areas of synergy between climate change adaption, heating supply, water supply and wastewater supply
SE-SEP1	Semester project 1	10	The students must obtain an understanding of planning and design of sustainable infrastructural constructions and climate change adaptation in urban area. The students must gain basic knowledge in the processes for producing drinking water, treating wastewater and producing heating.	Through the design of a sustainable urban supply structure, the student must become familiar with organisation/stakeholders basic understanding of all 3 utility types in terms of resource, production, processes (plant), consumption/demand, understand the interconnectedness of the 3 utilities (and synergies). Through completion of the project, group cooperation, report writing and presentation technique will be put into practice.	At the end of the semester, the students must be able to: Analyse and design supply systems for a small urban area using competencies, skills and knowledge obtained in the individual courses including • Applying sustainability as a concept • Analyse and calculate demands for supply • Identify resources for water and energy supply. • Identify wastewater treatment solutions • Stormwater handling • Include basic economic and technical aspects
SE-UTS1	Utility Sector	5		Upon completion of the course, the student will be able to: - understand the utility framework and legislation in Denmark - identify stakeholders in the utility sector - describe the legal framework concerning utility companies - understand the differences between private, state and community/publicly owned utilities - identify stakeholders and their roles in relation to utilities Basic understanding of economy in utilities	
CE-GEA1	Engineering Geology and Geotechniques	5	After completion of the course, the student must have knowledge about: Engineering Geology: - The important geological processes and resulting materials in Denmark - The different types of geological maps and borehole information's and how this	After completion of the course, the student must be able to: Engineering Geology: - Recognize and describe the most common types of soil. - Carry out a hand drilling, collect samples, and perform common laboratory tests.	Engineering Geology: - Evaluate expected soil layers and ground water conditions for a given area/site and conclude related consequences for the given construction project on the site. Management: - Understand the complexity of planning in

Code	Title	ECTS-points	Knowledge	Skills	Competences
			information is obtained digital and how they are used in consideration of expected soil layers in a given area. - The most common soil types and their Geotechnical characteristics as well as potential for re-use. - Ground water and ground water flow - Climate change - Contaminated soil: classification of sites and its and influence on soil handling. Construction Management and Planning: - Basic planning methods - Most common planning tools including IT-tools - The relationship between manpower, machinery and materials - Planning and execution of soil works	- Gather geological information about a given area and draw a cross section from given boreholes and illustrate expected soil layers between boreholes. - Develop a cross section showing the potential for re-use of soil. - Use databases and maps for preliminary screening of a given area for contaminated soil - Assessment of soil handling on the basis of contamination risk and area classification Construction Management and Planning: - Divide a process into activities and estimate their time consumption. - Identify processes and links between activities. - Analyse, choose and apply appropriate planning tools. - Document and carry out resource planning through MS Project - Calculate quantities and define duration of soil works tasks	general. - Planning of soil works in connection with a road construction project
CE-INF1	Infrastructure - Road Design in rural Areas	5	After completion of the course, the student must have the knowledge of: • Road types and planning	After completion of the course, the student must have the skills to: • Perform analyses and road planning in rural areas • Determine design parameters for a road project • Propose relevant design of horizontal and vertical alignments, as well as, cross sections • Use MicroStation and InRoads for geometrical design of roads and to draw out quantities from the 3D model	After completion of this course, the student must have the competences to: • Determine road lay-out in regards to Danish Roads Standards and surrounding environment • Design a bypass road in 3D using MicroStation and OpenRoads Designer.
CE-SCI2	Calculus, Linear Algebra and Dynamics	5	The student will get knowledge about: • Application of integration • Matrixes and matrix algebra • Linear equation systems • Polar coordinates • Complex numbers • Ordinary differential equations of the 1st	After completing the course, the student will be able to: • Identify Area, Centroid and Moments of Inertia for a plane region in an x-y coordinate system. • Identify and solve Linear equations systems.	After completing the course, the student will be able to: • Identify which parts of the acquired knowledge and skills that's relevant to a given, simple mathematical or simple real-world particle dynamic problem. • Model simple real-world problems

Code	Title	ECTS-points	Knowledge	Skills	Competences
			and 2nd order • Physical quantities and units • Reference systems • Kinematics of particles • Kinetics of particles • Vehicle dynamics	• Identify Area, Centroid, Moments of Inertia for a plane region and length of a curve in a polar-coordinate system. • Make simple calculations on complex numbers. • Describe simple problems and solve Ordinary differential equations of the 1st and 2nd order • Identify kinematic relations in the description of motion particles in different reference systems. • Set up and perform serial calculations by using the Laws of Newton. • Analyse the motion of a vehicle treated a particle.	especially particle dynamics problems. • Use their acquired skills and knowledge to study more advanced Calculus, Algebra and Dynamics courses on the Engineering programme. • Use a commercial mathematical software to solve and perform serial technical calculations.
SE-HYD1	Hydraulics 1	5	After completion of the course, the student must have the knowledge of: • The physics of basic hydraulics • The design of separate rainwater and wastewater system	After completion of the course, the student must have the skills to: Basic Hydraulics: • usage of basic hydraulic equations for determination of type of flow, losses of the system and estimation of energy and hydraulic grade line Separate sewer system design: • design and dimension wastewater and rainwater pipelines by diameter and material selection, estimation of their location and minimum required slopes	After completion of this course, the student must have the competences to: • Understand basic hydraulic problems • Plan and dimensioning of separate sewer systems
SE-SEP2	Semester project 2	10	Students must obtain an understanding of roads planning and furthermore, they must be skilled in the execution of projects within this area. The student must obtain knowledge on climate adaptation, possibilities and solutions. The student must obtain the necessary insight to be able to solve climate change problems in a local area to prevent flooding of buildings and other value constructions or infrastructure.	To show understanding of the entire project complexity • To use the gained theoretical knowledge in practical activities • To analyse and use data • To set up, describe and interpret the collected data, including the development of individual competencies • To describe and complete a report, including presentation material • To present the project material	After the semester project, the student will be able to apply knowledge and skills to: Plan and design a road construction and supply lines Use required It-tools to make necessary dimensions of roads and dewatering systems Perform laboratory analyses within soil contamination Analyse, choose and apply appropriate planning tools

Code	Title	ECTS-points	Knowledge	Skills	Competences
			The student will be able to use basic hydraulic principles to select and design supply lines to solve the existing problem. The student will use geological knowledge to plan and execute engineering projects.		Assess data for the structural design in a climate adaptation project Combine/select different solutions for a project and assess the final result Setup drawings (plans, cross sections, longitudinal profiles) Construct a local solution to prevent flooding evaluate the solution
SE-CMI1	Chemistry and Microbiology	5	- Describe basic chemical reactions as equilibrium, solubility, acid, bases and buffers, redox, etc. - Describe the structure, development and function of biofilms in water systems. - Describe the most important microbiological processes in drinking water and wastewater treatment (nitrification, denitrification, degradation of organic matter, etc.) and give examples of the involved bacteria.	- Evaluate results of chemical kinetics by calculating and graphing various reaction orders. - Compare and evaluate chemical and microbiological methods to address issues related to processes of drinking water, wastewater and district heating. - Contrast beneficial, pathogenic and indicator organisms and give examples of microorganisms in each group in water systems.	None.
SE-HYD2	Pressurized Distribution Systems	5		Upon completion of the course, student have acquired skills within: - Pump types and purposes - Pumping media - Pump dimensioning - Structure of pressurized (including vacuum) distribution systems/pipe networks - Components of pressurized pipe networks - Head loss calculations	
SE-PRO1	Process Engineering	5	The student will become familiar with process principles, gain knowledge about specific unit operations, gain knowledge about instrumentation and components, understand industrial control systems and process optimization.	After completion of the course the student will be able to: Prepare Piping and Instrumentation Diagrams for an existing plant Demonstrate skills in calculating mass balances Identify relevant sensors and instruments in the process system. Calculate residence time distribution in reactors. Make design decisions and evaluate alternative designs. Analyse acquired data and suggest optimizations. Calculate key parameters of heat exchangers. Build simple model of automation in praxis or/and Simulink	After completion of the course the student will be able to: Analyse processes in a supply plant. Suggest potential optimization initiatives

Code	Title	ECTS-points	Knowledge	Skills	Competences
SE-SEP3	Semester project 3	10	After completing this course, the student has knowledge on how to: - Describe the major subjects in process engineering - Identify various units of a supply plant - Describe the function of each unit	After completing this course the student will be able to: - Illustrate a supply plant by construction of a simple Piping and Instrumentation Diagram (P&ID) - Demonstrate material balances for the overall process and for one or more specific compounds - Hydraulics: 1) Make a flow diagram for a supply plant, 2) Calculate head/pressure loss, 3) Calculate retention time - Setup a simple model for a supply plant in MATLAB - Present names of microorganisms using correct nomenclature - Describe beneficial or harmful effects of one or more groups of microorganisms - Present chemical reactions with correct notification - Setup chemical reactions for one or more relevant processes - Evaluate if the supply plant meets water quality requirements for one or more parameters - Describe instrumentation and components relevant for the supply plant - Plan, write and review a Project Report and a Process Report - Prepare and carry out an oral presentation	After completing this course, the student will be able to apply knowledge and skills to: - Analyse a supply plant - Suggest potential process optimizations - Cooperate in a group effort
SE-TER1	Thermodynamics and Particle Dynamics	5	The students will get knowledge about: The basis of thermodynamics, ideal gases and reversible processes, the second law of thermodynamics and entropy, real substances, steam power plants, refrigeration and heat pumps systems, heat transfer/heat exchangers. Kinematics of a particle and kinetics of a particle, steady flow of a fluid stream and work and energy.	After completing the course, the student will be able to: Analyse a particle dynamic system and/or a simple thermodynamic system and identify and select relevant theory so the student is able to perform serial mathematical calculations on variables and main capacities for the system. Solve simple technical problems on the basis of fundamental calculus and dynamic or thermodynamic laws.	After completing the course, the student can: Identify which parts of the acquired knowledge and skills that´s relevant to a given simple real-world particle dynamic or thermodynamic problem. Relate the acquired knowledge and skills to create simple mathematical models of real-world particle dynamic or thermodynamic problems. Use their acquired skills and knowledge to study more Dynamics and Thermodynamic courses on the Supply Engineering education.

Code	Title	ECTS-points	Knowledge	Skills	Competences
				Follow simple procedures with different techniques of stating and solving dynamic or thermodynamic problems. IT is used in a pedagogical method in the course. The aim is that IT will support the learning process of the students and their understanding of the engineering professional possibilities in, for example, the application of modelling, simulation, etc.	Use a commercial mathematical and other software to solve and perform serial technical calculations.
CE-SUD1	Sustainable Drainage	5	The purpose of the course is to provide the students with knowledge on how to implement sustainable solutions to handle an increase of rain/raise of sea water in urban areas.	After the completion of the course the student must have knowledge about: • Climate change, precipitation, sea water level. • Methods to handle rain water locally. • Reuse of rain water. • Green roofs. • Infiltration basins. • Open channels • Use of Scalgo	The student will be able to communicate with students, engineers and companies about sustainable drainage and outline proposals for projects involving new and sustainable methods of handling rainwater.
SE-MAL1	MATLAB	5	After completion of the course the students have gained knowledge on the following: - Describe and differentiate the different types of graphical objects in MATLAB. - Explain how graphical object creation functions operate. - Explain the principle of the dot notation for graphical objects. - Explain how parameters can be set on objects - Describe various parameter values that affect the variables. - Carry out data transport between Excel and MATLAB. - Carry out characteristics of probability density functions and their cumulative distribution functions for random variables, such as mean, variance, standard deviation and coefficient of variation and modus, median and other percentiles. - Use MATLAB built-in statistics functions incl.: pdf, cdf and others - Carry out the programmatic layout of an	After completion of the course the student will be able to: - Layout the graphical user interface for an APP - Identify the graphical objects to undertake the tasks and operation - Combine the objects so that the graphics and the engineering numeric can interact via callback objects - Create an APP with a dedicated user interface; however, with a limited scope.	After completion of the course the students will have introductory competences in programmatic APP creation that meets latest APP development features of the MATLAB environment.

Code	Title	ECTS-points	Knowledge	Skills	Competences
			APP by a MATLAB function. - Use the object types: figure, uipanel, uicontrol, axes, line, text and patch for the programmatic creation of the graphical user-interface. - Define sub-functions with varargin & varargout capabilities. - Define event handler functions (callbacks) for uicontrol objects. - Handle the updating of objects programmatically by event handlers. - Combine structural APP elements such as INIT, EVAL, EVENT, LOAD & SAVE. - Analyse error messages and adjust and optimize codes accordingly. - Create dedicated APPs that can undertake a small task within the field of supply engineering.		
SE-MSC1	Material Science and Corrosion	5	After completion of the course the student must be able to: - Demonstrate basic knowledge about metals and polymers - Apply standard test methods - Explain deformation, stresses and fracture in tension-loaded materials - Be familiar with the topics Corrosion Management and Failure Analysis	After completion of the course the student must be able to: - Select a suitable material for the manufacture of components in the supply industry - Carry out common test methods for materials - Explain the relation between deformation, stresses and fracture in tension-loaded materials - Explain relevant degradation mechanisms of materials specific to the supply industry - Carry out corrosion investigation of selected materials/components from the supply industry	After completion of the course the student must be able to: - Participate in development tasks covering the design and/or evaluation and improvement of components for the supply industry - Combine data from various sources for developing an improved corrosion management strategy - Analysed corrosion failures and link to corrosion industry standards Furthermore, the student should be capable of seeking, validating and implementing additional knowledge within the subject, on his or her own
SE-PNM1	Pipe Network Modelling	5	Identify the elements of a pipe network and describe their relations. Collect and critically assess the data for the model. Understand the function of a pipe network mode. Understand how to calibrate a pipe network model. Data input and operation of Aquis. Data input and operation of MIKE Urban. Data input and operation of Energis	Build and calibrate pipe network models in Aquis, Energis and MIKE Urban. Use the models for analysing a pipe network. Suggest optimizations of a network based on the model results. Create and analyse scenarios. Use the model tools to propose solutions for a given network problem	Ability to create and analyse scenarios in the modelling tools Aquis, Energis and MIKE Urban Ability to critically assess an existing pipe network and suggest improvements. Ability to critically assess data validity. Ability to design and dimension pipe networks in new supply areas. Ability to analyse the influence of

Code	Title	ECTS-points	Knowledge	Skills	Competences
					thermal storages in a district heating network.
SE-SEP4	Semester project 4	10	The project is based on an analysis of a supply district area. The area is analysed in terms of utility, consumer patterns, local plans and supply potential and forecasting of changing supply needs and suggestions for correcting and expansion of the pipeline network. Academically it is based on the overall well-known and well-defined methods and with a close relationship to the way land development is carried out today in practice. The training will be based on the latest knowledge and application of current theory and principles.	• To show understanding of the entire project complexity • Skills in applying learned knowledge to the solving of practical project work. • The ability to plan and complete practical project works. • Skills in communication of the project results to the client. • To use the gained theoretical knowledge in practical activities • To analyse and use data • To set up, describe and interpret the collected data, including the development of individual competencies • To describe and complete a report, including presentation material • To present the project material The course includes IT as a pedagogical method. The purpose is to support the students' learning processes and their understanding of the engineering opportunities, which is part of e.g. the use of modelling, simulation etc. Analyses of the team on basis of a Belbin test. Group formation and analyses of the strength and weaknesses of the group. You must put out a contract for the group. At the end of the project period, the group must reflect on the cooperation in the group, on basis of the teams Belbin profile.	
SE-INP1	Engineering Internship (SE-)	30	The student must: • gain knowledge of theory, methodology and practice within a profession or one or more fields of study • be able to understand and reflect on theories, methodology and practice • be aware of non-technical – societal, health and safety, environmental, economic and industrial – implications of engineering practice.	The student must: • be able to apply the methodologies and tools of one or more fields of study and to apply skills related to work within the field/fields of study or profession • be able to assess theoretical and practical problems and to substantiate and select relevant solutions • be able to communicate professional issues.	The student must: • be able to handle complex and development oriented situations in study or work contexts • be able to independently participate in professional and interdisciplinary collaboration with a professional approach • be able to identify own learning needs and to organise own learning in different learning environments

Code	Title	ECTS-points	Knowledge	Skills	Competences
					• promote an engineering-oriented approach during the remaining semesters on the Bachelor programme • develop personal skills required for the professional career as engineer • form the basis for developing personal/professional network
CE-CMP2	Project and Construction Planning and Management	5	The student will obtain knowledge of requirements for project management and project planning, get knowledge of building projects phases, organizational and contractual relationship. The student will obtain a basic knowledge of procurement and tender legislation in Denmark, the EU, and internationally. Furthermore, the student will obtain a basic knowledge of process management, risk management, Last Planner System and Lean Construction.	Upon completion of the course the student should: • Be able to perform planning analyses and communication strategies for stakeholder management. • Possess knowledge of project phases and their contents related to contractual issues in according to the Danish AB18 – system and FIDIC. • Possess knowledge of a building projects contracting and subcontracting relationships. • Be able to perform a tendering procedure using legislation and processes for national (Danish), and international (EU) tenders. The course will thus enhance the student's ability to participate in the daily work of planning and operating within the contracting, consulting and client corporation in terms of knowledge of the juridical and legal framework and procurement. • Posses knowledge of process management, risk management, Last Planner System and Lean Construction.	
SE-ADW1	Applied Drinking Water Quality	5	- Understand principles of drinking water sampling - Understand basic laboratory analyses for drinking water (physical, chemical and microbiological) - Have knowledge of drinking water quality criteria (Danish/European drinking water legislation, and supplemental parameters) - Describe aspects of deterioration of drinking water quality (physical, chemical	- Collect samples for analysis of drinking water quality (water, backwash water and/or filter medium) - Practice basic laboratory methods and equipment (pipettes, scales, dilution, calibration, safety) - Perform laboratory analyses for documentation of drinking water quality (physical, chemical and microbiological parameters)	- Analyse results of laboratory experiments, discuss the results and relate the results to the scientific papers and other literature - Analyse a situation with undesirable drinking water quality including: How to collect data and select the appropriate analyses. How to cope with the consumers and the legislation, etc.

Code	Title	ECTS-points	Knowledge	Skills	Competences
			and microbiological) - Explain causes of different contamination scenarios - Understand the use of extended water treatment methods	- Obtain and evaluate empirical data from laboratory experiments - Report results from laboratory analyses in text, figures and tables - Compare and evaluate the application of physical, chemical and microbiological drinking water analyses	
SE-AWW1	Applied Wastewater Quality	5	- Usage and application of basic laboratory equipment - Possible methods for characterization of wastewater quality and their application - Sampling and analytical techniques methods - Composition of wastewater and its significance in wastewater treatment - Recognition of wastewater properties in assignation for different wastewater treatment methods - Ability to find the dependency between tested parameters - Basic characteristics of different treatment methods considering selected technologies	- Calibration methods of electrodes and pipettes - Advanced application of Hach-Lange cuvettes for indication of different parameters in wastewater quality - Calculation of dilution factors and concentration levels for different samples and chemicals - Standards for wastewater characterization - Analytical methods in indication of wastewater properties - Principles and application of characterization methods - Reading of the wastewater discharge quality reports for different industries	- Analyse a situation with undesirable wastewater discharge quality or improving existing method for control and treatment, including: How to collect data and select the appropriate analyses, How to cope with the consumers and the legislation, etc. - Indicate wastewater streams for different industries and its production lines - Characterize wastewater samples with respect to physical, chemical and microbiological parameters - Obtain and evaluate empirical data from laboratory experiments - Report results from laboratory analyses - Compare and evaluate the application of physical, chemical and microbiological wastewater analyses - Assign wastewater stream to a given wastewater treatment method
SE-BPR1	Bachelor-project Preparation course	5	At the successful completion of the course, students will be able to: Recognize forms of bias. Distinguish between primary and secondary research	At the successful completion of the course, students will be able to: Identify a good project topic in a systematic way. Create and execute search strategies to find relevant literature. Construct an experimental design for the coming project. Preparation and delivery of oral presentations. Write a Project Description following the VIA Engineering guidelines including the following parts: 1. Background description, 2. Definition of purpose, 3. Problem statement, 4. Delimitation, 5. Choice of models and methods (experimental design), 6. Time schedule, 7. Risk assessment and 8. Sources of information (reference list).	At the successful completion of the course, students will be able to: Communicate with an external partner. Extract the essence of a project and defend this clearly through oral presentation. Make effective use of feedback/feedforward from a supervisor. Work together in the project group as a team

Code	Title	ECTS-points	Knowledge	Skills	Competences
SE-DSD1	Design & Simulation of District Heating System	5	Know the design and structure for energy storage and carry out energy balance for the system. Calculate main dimensions, capacities and losses for storage of thermal energy. Make energy analysis and calculate temperature changes for non-stationary heat flow processes. Carry out computer simulations for changes in different energy systems like storage charging and discharging, mixing of flows, changing of thermodynamic cycle and optimize energy streams.	The student will be able to analyse the correlation between energy consumption, storage and production and to evaluate storage solutions, calculate storage capacities and carry out software simulations for renewable and industrial thermal energy systems.	The course will give the student competences in designing a thermal solar system including short term and seasonal storage. Furthermore, the student will be able to communicate and collaborate with energy engineers about storage and operation of energy systems.
SE-DWT1	Design of Wastewater Treatment Plant	5	Knowledge of designing basic treatment facilities in order to remove grease and oil, sand and gravel, suspended solids, organic matter and ammonia. Establishing of a simple flow diagram and understanding of the internal relations between functions. Knowledge of hydraulic demands within the individual cleaning functions as well as the whole plant. Composition of wastewater and its significance in wastewater treatment. Recognition of wastewater cleaning methods related to the different wastewater treatment methods. Ability to find the right design of WWTP according to the actual outlet demands and geological conditions. Possible cleaning achievement from the different treatment methods and systems.	Able to design a mechanical – chemical and biological WWTP. Able to describe necessary supervision and control of a WWTP. Calculation of volume of sand and grease trap. Calculation of primary settlement tank. Calculation of biological tank with nitrification Calculation of secondary settlement tank	Knowledge about treatment methods and their depending of previous treatments of the wastewater. Comparing different treatment systems and able to choose the right one for the actual case. Design treatment functions applying methods in order to reduce energy consumption. Use optimal hydraulic design in order to avoid unwanted settlement within the system. Analyse a specific wastewater flow and outlet demands in order to establish the necessary treatment plant. Explain the design criteria from an environmental point of view, create a flow diagram, and plan drawing of the WWTP according to this.
SE-LCA1	Circular Economy and LCA	5	Students completing this course will be familiar with: - The international guidelines for LCA analyses (ISO standards 14040 and 14044). - The step-by-step working process that must be followed when carrying out an LCA analysis. - The principles behind defining functional units, system boundaries and time scopes for LCA analyses.	- Define functional units, system boundaries and time scopes for LCA analyses according to the guidelines. - Carry out LCA analyses for simple production or service system scenarios according to the guidelines. - Compare competing production or service systems based on an LCA analysis. - Present and interpret results of LCA analyses and discuss these in relation to decision-making.	Students completing this course will be able to: - Define comparable scenarios for competing production/service systems in order to analyse the respective environmental impacts of these - Relate results from LCA analyses with the ideas of CE to suggest sustainable choices in given situations - Discuss how working towards fulfilling the SDGs requires individual as well as a political change of behaviour

Code	Title	ECTS-points	Knowledge	Skills	Competences
			- Chosen data sources providing data for LCI´s and LCIA´s. - Different environmental impact categories. - The common way to graphically present end results of LCA analyses. - How the UN system influences global development within CE. - The UN SGDs	- Search for and identify relevant data for Life Cycle Inventories (LCI). - Prepare simple Life Cycle Inventories (LCI) and carry out Life Cycle Impact Assessments (LCIA) based on these, according to the guidelines. - Graphically present the results of LCA analyses and explain how these are related to the former steps of the analyses. - Carry out an LCA by using the program “LCABYG”. - Identify barriers to change of CE development. - Identify opportunities for CE business development. - Make a simple business model. - Formulate individual change of behaviour to promote CE. - Evaluate business cases in relation to fulfilling the SDG. - Promote circular economy as an innovation tool for companies.	- Reflection about business models and product development in CE.
SE-SEP6	Semester project 6	10	After completing this course, the student has knowledge on how to: Plan the work process in problem solving Identify the data relevant for clarifying the problem in question Collect the data from the existing sources such as databases, literature, fieldwork, lab work, interviews, etc. Critically asses and analyse the collected data.	After completing this course, the student must be able to: Demonstrate overview and structure in problem solving Collect and analyse data in order to support a work hypothesis Show source criticism Draw conclusions based on the data analysis carried out, combined with the knowledge acquired in the previous semesters and practical placement. Put the results of the work in perspective and give recommendations for actions and/or further investigations • Illustrate the results with relevant diagrams • Plan, write and review a project report • Prepare and carry out an oral presentation	After completing this course, the student will be able to apply knowledge and skills to: • Analyse a complex problem • Draw scientifically based conclusions • Demonstrate an independent and self-governed work process
SE-STS1	Geothermal Systems	5	The student will gain knowledge about geothermal systems as a sustainable energy source and to obtain an	After the completion of the course, the student must be able to: • Describe the thermal properties of rock	

Code	Title	ECTS-points	Knowledge	Skills	Competences
			understanding of the physical design, dimensions, functions and operation of these systems.	and soil. • Explain the working principle of a heat pump. • Calculate thermal conductivity from thermal response test data. • Dimension a geothermal system using the professional software EED. • Calculate COP for a heat pump by measuring produced and spent energy in a system. • Describe the construction of a borehole heat exchanger and identify critical areas. • Identify the various conflicts of interest in relation to ground source heating and cooling.	
SE-TBD1	Tool Box Drinking Water	5	Understand complex drinking water treatment technologies. Combine information from different sources. Reflect on researchers' findings, policies, legislation etc.	Critical review of scientific papers. Compile and give presentations based on a number of papers with opposing views on a given topic. Analyse information from different sources and present a structured summary Argue the pros and cons of the presented topic	Ability to apply critical thinking to scientific papers, reports, legislation. Ability to reflect on the implications of applying a given technology, law or approach in a given situation. Ability to compare different technologies, policies etc., in different settings.
ME-DES1	Design of Energy Systems	5	The student will acquire knowledge in, * Refrigeration plants * Heat pumps * Refrigerants * Energy efficiency and impact on the environment * Cooling load * Air conditioning processes	The student will be able to analyse the thermal load for an energy plant and on this basis combine process theory and common dimensioning practice to design an energy efficient cooling plant or heat pump with low environmental impact.	The student will obtain competences to communicate about designs of different types of energy plants. Furthermore, the student will be able to design simple energy plants in a methodical way and more complex systems in co-operation with energy engineers.
ME-ENE1	Renewable energy	5	The student will acquire knowledge in, – Energy savings – Thermal solar heating and simulating of energy storage systems using TRNSYS 17 – Other thermal energy system (Packed-bed storage, storage wall and phase change energy storage) – Biomass and biogas – District heating and district heating network – Geothermal energy	Analyse the consumption of town or building and evaluate possible energy savings. Calculate the energy production from renewable sources with the integration of various energy storage scenarios. Calculate the eventually needs for supplementary fossil fuel production and the saving of CO2 emission.	The student will be able to communicate with students, engineers and companies about renewable energy and outline proposals for renewable energy supply.

Code	Title	ECTS-points	Knowledge	Skills	Competences
			Renewable energy management (e.g. tax structures, costs for energy production, cost analyses, environmental issues)		
SE-AWT1	Advanced Water Treatment	5	Describe various aspects of deterioration of drinking water quality (physical, chemical and microbiological). Describe different contamination scenarios. Have knowledge of drinking water quality criteria (Danish/European drinking water legislation, and supplemental parameters). Understand principles of drinking water sampling. Understand principles of drinking water analyses (physical, chemical and microbiological) Understand the use of extended water treatment methods	Sample and characterize drinking water samples with respect to physical, chemical and microbiological parameters. Obtain and evaluate empirical data from laboratory experiments. Report results from laboratory analyses. Compare and evaluate the application of physical, chemical and microbiological drinking water analyses. Retrieve relevant information on current topics related to drinking water quality such as softening, pesticides, etc. Extract and evaluate data of drinking water analyses from the Jupiter database	Analyse a situation with undesirable drinking water quality including: How to collect data and select the appropriate analyses, How to cope with the consumers and the legislation, etc. Design methods for advanced drinking water treatment depending on a given water types chemical composition and challenges. . Design laboratory experiments to analyse the applicability of a proposed treatment method. Economic assessment of proposed methods.
SE-BPR2	Bachelor Project	15	After the completion of the project work, the student must be able to: - Describe a given (chosen) engineering problem, list relevant tools (formulas, methods, software, etc.) to clarify the problem, apply the tools, reflect and conclude. - Understand how the conclusion/solution to the given problem influences connected areas theoretically and/or technically.	After the completion of the project work, the student must be able to: - Apply engineering theories and methods within chosen subjects and independently be able to plan and carry out experiments or practical measurements as appropriate. - Acquire new knowledge critically within relevant engineering fields. - Apply quality assurance/critically review data and results. - If relevant, make financial estimates for the project/solution. - Present all relevant information in report and appendix, using references and sources of information correctly. - Extract the essence of the project and communicate this clearly orally and in writing.	After the completion of the project work, the student must be able to: - Analyse a given (chosen) problem, collect data, select appropriate methods of analysis, put the results into perspective and conclude. - Plan and carry out the project and related activities according to self-defined time schedule.
SE-DWT2	Design of Wastewater Treatment 2	5	Concepts and assessment methods involved in providing basic understanding of activated sludge process and the possibility of achieving biological cleaning of wastewater. Usage and application of design models and constructions. Knowledge of the impact on the biological process from outside factors. Ability to find	Able to calculate an activated sludge process tank with removal of organic matter, nitrogen and phosphor. Standards for sludge characterization. Analytical methods in identifying needed treatment of the wastewater. Principles and application of advanced as well as simple treatment	Characterize different treatment methods with respect to physical, chemical and microbiological parameters. Evaluate wastewater data and from this being able to describe a suitable cleaning method. Present results to the actual client in a clear and simplified way. Analyse a situation with inefficient treatment and find a way of

Code	Title	ECTS-points	Knowledge	Skills	Competences
			needed constructions and process to create the wanted level of treatment.	methods. Functioning skills necessary to get a satisfying profit from working in groups	improving this using learned treatment methods and skills.
SE-GPT1	Geophysics and Pump Test	5	By the end of the course the student must be able to explain - how to design a well site including relevant geophysical preinvestigations. - the purpose and possible outcomes of well tests. - what risks must be addressed in order to protect the source location and safely extract water.	After completion of the course, the student must be able to: - calculate and analyse flow and pressure variations for simple groundwater models. - from the target and expected geophysical properties of soils in an area to plan geophysical preinvestigations for ground water mapping. - explain principles and applications of geoelectrical and electromagnetic geophysical methods and to discuss results and uncertainties. - list other geophysical methods and their applications as alternatives to geoelectrical and electromagnetic methods. - plan and interpret well tests for a specific problem. - describe drilling methods and completion of water wells. - discuss what to focus on in risk assessments related to ground water extraction. - estimate the long term influence of ground water extraction - identify relevant parameters to evaluate for planning of sustainable water extraction.	The student will be able to occupy a position in a utility, municipality or engineering company where the cur-rent course will give them capabilities on a general level to plan investigations of possible source locations and/or to make a quality assessment of a suggested survey.
SE-SLM1	Sludge Management	5	Concepts and assessment methods involved in providing basic understanding of sludge management techniques and their application in relation to kind of sludge and its origin Usage and application of basic laboratory equipment. Possible methods for characterization of sludge quality and their application. Ability to find dependency between analytical results (sludge composition) and sludge management techniques. Quality criteria definitions for possible management technique	Standards for sludge characterization. Analytical methods in indication of sludge properties. Principles and application of characterization methods. Sludge management techniques for different kinds and origins of the sludge. Quality criteria (Danish/ European regulations and legislations)Experimental reports and literature retrieval related to sludge management techniques	Characterize different sludge sources with respect to physical, chemical and microbiological parameters. Obtain and evaluate empirical data from laboratory experiments. Report results from laboratory analyses. Create, compare and evaluate the feasibility of different sludge management techniques based on sludge origin. Analyse a situation with inefficient sludge management technique and find way of improving existing management method, including how to collect data and select the appropriate analyses, etc.