Bring Ideas to Life
VIA University College

August 2021

Rev. August 2022

Rev. February 2023

Curriculum

Programme section

Bachelor of Engineering
Climate and Supply Engineering

Applicable to students enrolled in August 2021 and 2022.

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.

Minor changes January 2023:
Course code CE-GEA1 changed to SE-GEO1
4. semester updates (running for the first time in spring 2023)

Changes August 2023:
Clarification of exam prerequisites, 3rd to 7th semester (autumn 2023 - autumn 2025)

Changes February 2024:
Technical updates concerning the 4th to 7th semester (spring 2024 – autumn 2025)

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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:

- Translate technical research results as well as scientific and technical knowledge into 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 societal, economic, environmental and occupational health and safety 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's 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 actualised 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 projectI	
6. Electives	CE-CMP2 Construction Management and Planning (compulsory)	Elective course	Elective course	SE-BPR1 Preparation of Bachelor Project Preparation Course	ENG-IDE1 Semester Project Innovation and Entrepreneurship
5. Internship	SE-INP1 Internship				
4. Urban Infrastructure and Climate Adaptation	SE-MAL1 MATLAB	SE-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 Hydraulic 2	SE-PRO1 Process Engineering	SE-CMI1 Chemistry and Microbiology	SE-SEP3 Semester Project
2. Climate Change Adaptation and Supply Infrastructure	SE-SCI2 Calculus, Linear Algebra and Dynamics CE-SCI2 in S22	SE-HYD1 Basic Hydraulics	SE-GEO1 Basic Geology and GIS CE-GEA1 in S22	SE-INF1 Infrastructure in Rural Areas	SE-SEP2 Semester Project
1. Sustainable Urban Development	SE-SCI1 Mathematical Analysis CE-SCI1 in A21	SE-CCS1 Climate Change and Sustainability	SE-BUD1 Basic Utility Design	SE-UTS1 Utility Sector	SE-SEP1 Semester Project

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 (SE-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 External assessment Danish 7-step-scale
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 tests in the form of 3 assignments during the semester and an exam in the form of a written test, each weighing 25%. Internal assessment Grading based on the Danish 7-point scale

Basic Utility Design (SE-BUD1) – 5 ECTS	
Humans are dependent on clean drinking water, clean energy and removal of contaminants from wastewater. This course gives a basic introduction to the resources, the demand calculations and main processes in drinking water, wastewater and heating utility companies.	Ongoing tests in the form of 3 assignments during the semester and an exam in the form of a written test, each weighing 25%. Internal assessment Grading based on the Danish 7-point scale
Utility Sector (SE-UTS1) – 5 ECTS	
Supply of water and energy and handling of wastewater 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 tests in the form of 3 assignments during the semester and an exam in the form of a written test, each weighing 25%. Internal assessment Grading based on the Danish 7-point scale
Semester Project (SE-SEP1) – 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 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	Oral group exam with individual assessment. Group presentation approx. 20 minutes, exam approx. 20 minutes per student. External assessment. Grading based on the Danish 7-point scale

The learning objectives of the courses (knowledge, skills and competencies) as well as assessment are further described 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 (SE-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.	Individual oral exam, 20 minutes. Internal assessment Grading based on the Danish 7-point scale
Basic Hydraulics (SE-HYD1) – 5 ECTS	
The course aims to provide students with understanding of basic hydraulics and design urban sewer systems. Furthermore, the students learn to use Mike Urban to analyze and design sewer systems.	Ongoing tests in the form of two written assignments, each weighing 15% and final exam in the form of a major written assignment weighing 70%. Internal assessment Grading based on the Danish 7-point scale
Basic Geologi and GIS (SE-GEO1) – 5 ECTS	
The course aims to give a basic knowledge of engineering geology and geotechnics, strength in soil and deformation of soil	Ongoing tests in the form of three written individual/ group assignments, each weighing 25% and an exam consisting of a written individual course assignment, weighing 25%. Internal assessment Grading based on the Danish 7-point scale
Infrastructure – Highway Design in Rural Areas (SE-INF1) – 5 ECTS	
The course aims to provide the student with an understanding of basic concepts within road constructions, including pipe design and dimensioning. Furthermore, the students will receive introduction to CAD programs used for geometrical design of roads and other infrastructure planning.	Ongoing tests in the form of two written individual/ group assignments, each weighing 25% and an exam consisting of a written individual course assignment, weighing 50%. Internal assessment Grading based on the Danish 7-point scale
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	Oral group exam with individual assessment. Group presentation approx. 20 minutes, exam approx. 20 minutes per student. External assessment. Grading based on the Danish 7-point scale

The learning objectives of the courses (knowledge, skills and competencies) as well as assessment are further described 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.	Exam prerequisites: None Type of exam: Individual oral exam, 20 min. with internal assessment. The exam is on the basis of course assignments found by lot and without preparation. The course assignments are selected by the examiner and communicated to the students no later than the last day of teaching on VIA's intranet. Course assignments must be uploaded in WISEflow approx. 1 week before the exam. If the student does not upload the course assignments in WISEflow, the student is offered to solve the course assignments during the exam. Allowed tools: None Re-exams: Equal to the ordinary exam.
Hydraulic 2 (SE-HYD2) – 5 ECTS	
To provide the students an understanding on control and regulation of pumps, valves and gates in large hydraulic systems. Avoid floodings caused by climate based floodings. Provide the students with knowledge on how to calculate pollutions from sewer systems. Introduce the students in modelling and control of pressurized pipe network in order to reduce leaks and energy consumption.	Exam prerequisites: None Type of exam: Individually oral exam, 20 minutes, on the basis of two course assignments, handed in before deadline. Internal assessment Tools allowed: None Re-exams: Same as the ordinary exam
Process Engineering (SE-PRO1) – 5 ECTS	
The course aims to give an understanding of fundamentals of process engineering disciplines in the fields of drinking water, wastewater and district heating including suggestions for optimizations.	Exam prerequisites: None Type of exam: Ongoing tests in the form of one oral assignment and two written assignments and a final exam in the form of an oral assignment. All four weighing 25%. Internal assessment Tools allowed: N/A Re-exam: Individual oral exam, 20 minutes, 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.	Exam prerequisites: None Type of exam: Written exam in total 4 hours, composed of two parts: 1-hour multiple choice and 3 hours written exam External assessment. Tools allowed: No material aids allowed during 1-hour multiple choice exam All material aids allowed during 3-hours written exam Re-exam: Equal to the ordinary exam.
Semester project (SE-SEP3) – 10 ECTS	
The purpose is for the student to be able to analyse an existing supply process (drinking water, wastewater, district heating or climate adaptation) and to suggest optimizations. The purpose of the PBL part of the course is to promote the students' independent knowledge application, critical thinking and holistic understanding with a focus on the UN's global goals.	Exam prerequisites: Project description must be duly handed in and approved. Type of exam: Group exam with individual assessment based on project report and process report submitted before the deadline. Students' individual weighting of academic subjects must be specified in the process report. Group presentation approx. 20 minutes, followed by joint examination with joint discussion and individual question rounds for approx. 20 minutes per student including voting. Individual assessment based on an overall assessment of the submitted work and the individual's performance during the oral exam. External assessment Tools allowed: All Re-exam: Same as the ordinary exam. Based on the submitted project, the examiner gives the student guidance on necessary improvements in relation to passing the exam (possibly, that a new project should be prepared). The students are informed about specific deadlines and details of the project work. Project groups are formed if possible. No guidance is provided in the period leading up to submission. The project is assessed at an oral exam.

The learning objectives of the courses (knowledge, skills and competencies) are further described 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 infrastructure and climate adaptation in urban areas with associated design, adaptation and modelling of the supply pipelines as well as planning of the execution of selected construction work.

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.	Exam prerequisites: None Type of exam: Ongoing assessment in the form of a coursework, submitted on time, weighing 20% as well as an oral exam based on a submitted mini project. Individual assessment based on an overall assessment of the mini project, which includes technical documentation and group submission, weighing 80%. Allowed tools: N/A Re-exam: Same as the ordinary exam.
Sustainable Drainage (SE-SUD1) – 5 ECTS	
The course aims to give the students a basic understanding on how the change in climate will have impact on dewatering of cities. Focus will be on sustainable methods.	Exam prerequisites: None Type of exam: Ongoing tests in the form of three written assignments, each weighing 10% and an exam in the form of a major written assignment weighing 70%. All assignments must be handed in before deadline. Tools allowed: N/A Re-exam: Individual oral exam
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.	Exam prerequisites: None Type of exam: Ongoing tests in the form of two written assignments, and an exam in the form of a written assignment, all weighing equally. Internal assessment Tools allowed: N/A Re-exam: Same as the ordinary exam

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.	Exam prerequisites: Course attendance min 75% If the exam prerequisites are not met, the student must hand in a written assignment on the subject from each of the missing lessons, to qualify for the re-exam. This assignment will be scheduled after the ordinary exam. Type of exam: 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 Tools allowed: N/A Re-exam: Oral re-exam based upon a subject found by draw, 20 min. with no preparation.
Semester project (SE-SEP4) – 10 ECTS	
Renovation of existing infrastructure and planning of necessary diversion of traffic, water, wastewater and district heating. An interdisciplinary coordination of the works has to be arranged between climate and supply engineers and civil engineers. The purpose of the PBL-part of the course is to promote the students' competencies in cross-professional collaboration.	Exam prerequisites: None Type of exam: Group exam with individual assessment based on project report and process report submitted before the deadline. Students' individual weighting of academic subjects must be specified in the process report. Group presentation approx. 20 minutes followed by joint evaluation with joint discussion and individual question rounds for approx. 20 minutes per student including grading. Individual grades are given on the basis of an overall assessment of the submitted work as well as the individual's presentation during the exam. External assessment. Tools allowed: All Re-exam: Based on the submitted project, the examiner gives the student guidance on necessary improvements in relation to passing the exam (possibly, that a new project should be prepared). The students are informed about specific deadlines and details of the project work. Project groups are formed if possible. No guidance is provided in the period leading up to submission. There will be no oral defence at the re-examination.

The learning objectives of the courses (knowledge, skills and competencies) are further described 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. Internship must have a duration of at least 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 is responsible for finding 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.
If too few students have chosen one of the specialisations, VIA reserves the right to cancel the specialisation in question.

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 this course is that students become familiar with requirements for project and construction management and planning obtain knowledge of building project phases, organizational and contractual relationship.	5 ECTS	Prerequisites: None Type of exam: Group presentation, 25 minutes, followed by an individual examination with the presence of the whole group. Oral team examination – presentation and defense – is based on a summary of presentations and completed papers answered throughout the semester. External examiner. Tools allowed: All Re-exams: Individual oral exam - based on a summary of presentations and completed papers answered throughout the semester.
Semester project (ENG-IDE1)	A cross-sectoral semester project that aims to develop and document an across disciplinary innovation and entrepreneurship project based on primary data collection.	10 ECTS	Exam prerequisites Hand in 6 written assignments to be approved in WISEflow before deadline. Type of exam: Exam is based upon the IDE1-report submitted in WISEflow before deadline. The group presents their prototype/pretotype. The exam room can be customized by the group to support the presentation. Group exam with individual assessment. Group presentation approx. 15 minutes followed by joint evaluation with joint discussion and individual question rounds for approx. 60 minutes per group including assessment. Individual grades are given based on an overall assessment of the submitted work as well as the individual's presentation during the exam. External assessment. Tools allowed: All. Re-exam: Based on the submitted project, the examiner gives the student guidance on necessary improvements in relation to passing the exam (possibly, that a new project should be prepared). The students are informed about specific deadlines and details of the project work. Project groups are formed if possible. No further guidance is provided in the period leading up to submission. The project is assessed at an oral project exam.

Bachelor project preparation course (SE-BPR1)	The main purpose of this 6th semester course is to prepare the student for their bachelor project – which will be carried out during the final semester. Preparation includes selecting the subject and choosing a project group for the bachelor project. During this course the project group develop their bachelor project description including finding external partners and collecting knowledge and data, to be prepared for starting up the bachelor project. The project group must consist of 2-6 students and should be carried out in association with an external partner. The purpose of the PBL part of the course is for the students to apply their personal and project skills gained from previous semester projects. Furthermore, they gain an understanding of the theory of science in relation to methods used in the bachelor project.	5 ECTS	Exam prerequisites: Approved 30-minute individual multiple choice test on Philosophy of Science Type of exam: Group exam with individual assessment based on the bachelor project description submitted before the deadline. Group presentation approx. 15 minutes, followed by joint examination with joint discussion and individual question rounds for approx. 15 minutes per group including voting. Individual assessment based on an overall assessment of the submitted work and the individual's performance during the oral exam. Internal assessment Tools allowed: All Re-exam: Same as the ordinary exam.
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	Exam prerequisites: Passed all other elements of the bachelor programme. Type of exam: Group presentation, 20 minutes, followed by an individual exam, 20 minutes per student, with the presence of the whole group. Exam is based on the bachelor project report handed in before deadline. External assessment. Tools allowed: All tools allowed. Re-exam: Same as the ordinary exam. Based on the submitted project, the examiner gives the student guidance on necessary improvements in relation to passing the exam (possibly, that a new project should be prepared). The students are informed about specific deadlines and details of the project work. Project groups are formed if possible. No guidance is provided in the period leading up to submission. The project is assessed at an oral exam.

The learning objectives of the courses (knowledge, skills and competencies) are further described 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	Exam prerequisites: None Type of exam: Individual oral exam with an internal examiner. Exam is without preparation and based upon course assignment(s) (Experimental reports) handed in before deadline and accepted. Course assignments account for 50% of final grade. Exam accounts for 50% of final grade. Tools allowed: N/A Re-exam: Equal to the ordinary exam.
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	Exam prerequisites: None Type of exam: Individual oral exam with an internal examiner. Exam is without preparation and based on Drinking Water Quality Report. Report must be handed in before deadline. Graded on the basis of an overall assessment of the submitted work as well as the individual's performance during the exam. Tools allowed: NA Re-exam: Equal to the ordinary exam.
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	Exam prerequisites: None Type of exam: Individual oral exam with an internal examiner. Exam is without preparation and based on Wastewater Quality Report. Report must be handed in before deadline. Graded on the basis of an overall assessment of the submitted work as well as the individual's performance during the exam. Tools allowed: NA Re-exam: Equal to the ordinary exam.

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	Exam prerequisites: Two course assignments approved. Type of exam: Individual oral exam, 20 min., based on one course assignment handed in before deadline. Internal assessment. Tools allowed: N/A Re-exam: Equal to the ordinary exam.
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	Exam prerequisites: Mandatory assignments. If the assignments are not handed in and approved by the deadline set by the lecturer, the prerequisites are not met, and new assignment and deadline will be set before the re-exam. Type of exam: The final exam will count 100%. The final exam divided into: a. Individual oral evaluation on a mini project handed in before deadline (50%) b. Additional question from draw on the spot (50%) Tools allowed: All Re-exam: Equal to the ordinary exam.
Design of Wastewater Treatment Plant (SE-DWT1)	Through information retrieval, discussions and presentations to provide student with knowledge in planning establishment and design a proper waste water treatment plant (WWTP) for achieving a current wastewater quality.	5 ECTS	Exam prerequisites: None Type of exam: Ongoing tests in the form of one presentation, weighing 30% and one written assignment, weighing 70%. All assignments must be handed in before deadline. Internal assessment. Tools allowed: N/A Re-exam: Equal to the ordinary assessment (new assignments).
Design of Wastewater Treatment 2 (SE-DWT2)	To create an understanding of the design of main wastewater treatment processes at the activated sludge plant and the importance of digital models used for this design. Through information retrieval and group work to provide student with knowledge about modelling program used for design and evaluation of wastewater treatment plant performance.	5 ECTS	Exam prerequisites: None Type of exam: Ongoing tests in the form of two written assignments, weighing 25% each and an oral exam on the basis of a third written assignment, weighing 50%. All assignments must be handed in before deadline. Internal assessment. Tools allowed: N/A Re-exam: Equal to the ordinary assessment (new assignments).

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	Exam prerequisites: Participation in field work. Type of exam: Individual oral exam with an internal examiner. 20 min. Exam is without preparation based upon course assignments, handed in before deadline. Tools allowed: All tools are allowed. Re-exam: Equal to the ordinary exam.
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	Exam prerequisites: None Type of exam: Individual oral exam, 20 min., based on one course assignment handed in before deadline. Internal assessment. Tools allowed: None. Re-exam: Equal to the ordinary exam.
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	Exam prerequisites: None Type of exam: A case based written exam, 48 hours. Internal assessment. Tools allowed: All Re-exam: Same as the ordinary exam, with new assignment, or re-exam may be oral, 20 minutes.
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	Exam prerequisites: Mandatory assignments. The assignments must be submitted by the deadline and be approved afterwards. Fail to meet the prerequisites will disqualify entering the examination. As of re-exam, a new set of assignment(s) and deadline will be set before the re-exam. Exam type: Oral Examination. The oral exam will count 100% and divided into: a. Oral evaluation based on a mini project handed in before deadline (50%) b. Additional question from draws on the spot (50%) Grade is on individual basis. Tools allowed: The submitted report of the mini project.

			Re-exam: Same as the ordinary exam. Case specific: A new set of assignment(s) and deadline might be set before the re-exam. The students might need to work on a new mini project, when necessary, improve the already submitted one or keep it without improvement.
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	Exam prerequisites: None Type of exam: Ongoing tests in the form of four experimental reports and a final exam in the form of a presentation. All five are weighing equally. All reports must be handed in before deadline. Internal assessment Tools allowed: All tools allowed Re-exam: Equal to the ordinary exam. (Based on new assignments)
Toolbox 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	Exam prerequisites: None Type of exam: Individual oral exam, 20 min. with 30 min. preparation and based upon three course assignments and three presentations, handed in before deadline. Internal assessment. Tools allowed: Computer and notes allowed during preparation. Only new notes written during preparation allowed during exam. Re-exam: Equal to the ordinary exam.

The learning objectives of the courses (knowledge, skills and competencies) are further described 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 (ENG-IDE1): 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 (ENG-IDE1): 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 (ENG-IDE1): 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 Company visits
PWS2 QGIS
PWS3 Welding
PWS4 Soil Contamination
PWS5 Water Sampling

Due to Covid-19, several of the workshop courses have not been completed.

9 Bachelor project

SE-BPR1 and 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

The assessment specified in this appendix is applicable for 1st -4th semesters A21-S23.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
SE-SCI1 CE-SCI1 in autumn 21	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.	Exam prerequisites: None Type of exam: 4 hours written exam with external assessment. 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. Re-exams: Method will be equal to the ordinary exam.
SE-BUD1	Basic Utility Design	5	Upon completion of the course, the students have gained knowledge of: • Components of water, wastewater and district heating systems • Energy balance in order to understand energy systems and energy transfer in order optimize them and reduce the carbon footprint of heat production • Quality requirements for water consumption and wastewater discharge	Upon completion of the course, the student will be able to: • Use digital tools such as Heat Roadmap Europe • Make basic analyzes for water and wastewater quality • Calculation of system loading rates • Calculation of water consumption, heat needed and wastewater produced	Upon completion of the course, the student will be able to apply knowledge and skills to: • At a basic level suggest a process design for drinking water, wastewater and district heating • Analyze demand and/or flows for a given area • Relate the demands for the quality to the existing legislations • Perform simple laboratory analyses	Exam prerequisites: Mandatory assignments handed in before deadline and accepted. Type of exam: Ongoing tests in the form of 3 assignments during the semester and a final exam in the form of a written test, each weighing 25%. Internal assessment.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
					• Describe the main components of each system	Allowed tools: N/A Re-exam: Individual oral exam with internal assessment.
SE-CCS1	Climate Change and Sustainability	5	Upon completion of the course, the student has gained knowledge of: • Climate and weather systems • Climate changes and impacts on society and the utility sector • Climate change adaptions and mitigations • Sustainable Urban Development • Sustainable energy systems	Upon completion of the course, the student will be able to: • Recognize and discuss the different contributions to climate changes • Identify suitable processes for handling surface water • Propose CO2 neutral energy sources	Upon completion of the course, the student will be able to apply knowledge and skills to: • Engage in discussions on climate and climate change at a qualified level • Evaluate and suggest solutions for sustainable urban drainage • Evaluate and suggest sustainable energy sources	Exam prerequisites: Mandatory assignments handed in before deadline and accepted. Type of exam: Ongoing tests in the form of 3 assignments during the semester and a final exam in the form of a written test, each weighing 25%. Internal assessment. Allowed tools: N/A Re-exam: Individual oral exam with internal assessment.
SE-SEP1	Semester project 1	10	Professional knowledge 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. Study knowledge Effective teams • Can explain involved theories about group dynamics, teamwork and conflict resolution Own learning process • Can refer to involved theories of learning, motivation, feedback and study techniques Project framework • Can identify relevant knowledge in relation to academic and technical written communication, including the	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. Study skills Effective teams • Can jointly formulate and apply a group contract in the group work • Can be part of and establish collaboration with project group and supervisor	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 Study competencies Effective teams • Can describe and reflect on the project group's collaboration - including own efforts - to define opportunities for improvement for future projects	Exam prerequisites: Project description must be duly handed in and approved in order to register for exam in the semester project. Project report and Process report submitted before deadline. Type of exam: Group exam consisting of an oral presentation of the project followed by an exam with an internal examiner. Grades will be individual. Allowed tools: The handed in project. Re-exam: Students who failed a semester project will be informed by the process supervisor, who in consultation with the internal censor decides, if the student(s) must prepare a new project,

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
			report's structure, references and source management • Can identify relevant presentation techniques for the target group, as well as use presentation techniques Problem Based Learning • Can explain basic elements within PBL • Can identify relevant issues and specific requirements for a problem formulation Project management • Can identify relevant project management methods, including planning, meeting management, risk assessment and quality assurance..	Own learning process • Can apply knowledge of learning theory and motivation theory in connection with own learning process as well as give and receive feedback Project framework • Can act source-critical as well as use references and source management, including rules for plagiarism. • Can convey the results of the project work and the project group's learning process in a structured way using professional concepts, both written, graphic and oral. • Can communicate in writing and orally to different target groups. Problem Based Learning • Can formulate a problem formulation, describe different solution options and explain solution proposals. Project management • Can explain the choice of and use of tools and methods for project management to achieve concrete goals in the project work.	Own learning process • Can reflect on own ability to learn through the various teaching activities including the work of the project group Problem Based Learning • Can take responsibility for the student-led part of the semester project	or if the failed project must be improved. In due time, the student(s) will be informed about the specific deadlines and the further course for the project work. There will be no guidance during the period up to hand in of the project. The project is assessed at an oral exam.
SE-UTS1	Utility Sector	5	Upon completion of the course, the student has gained knowledge of: • Basic parameters defining utility services within drinking water, district heating, storm water and wastewater • The utility framework and legislation in Denmark • Community/publicly owned utilities	Upon completion of the course, the student will be able to: • Identify stakeholders in the utility sector • Suggest suitable resources for heating and drinking water • Suggest suitable solutions for handling wastewater and storm water • In general terms describe the legal framework concerning utility companies	Upon completion of the course, the student will be able to apply knowledge and skills to: • Perform a simple feasibility study for a wastewater/storm water, drinking water and district heating project	Exam prerequisites: Mandatory assignments handed in before deadline and accepted. Type of exam: Ongoing tests in the form of 3 assignments during the semester and a final exam in the form of a written test, each weighing 25%. Internal assessment. Allowed tools: N/A Re-exam: Individual oral exam with internal assessment.
SE-GEO1 CE-GEA1 in spring 22	Basic Geology and GIS	5	After the course the student must have knowledge about: - The different types of geological maps and borehole information in digital form and how this information is used to	After the course the student must be able to: - Recognize and describe the most common Danish soil types - Use databases and collect geological	Assess expected soil layers and groundwater conditions for a specific location and determine their consequences for the project (whether	Exam prerequisites for exam: The 4 assignments mentioned below must be duly handed in. Type of exam:

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
			assess the expected soil layers in a certain area - The most common soil types and their geotechnical properties - How the soils strength and deformation parameters are determined - Theories and methods to determine settlements and the time progress of settlements - Initial- and creep settlements - Excavations, soil works, trenches for pipes and re-use of soil	information for a specific area and draw a geological profile - Calculate total, neutral and effective stresses - Define and determine soils strength and deformation properties - Describe connections between geological conditions and conditions for excavations - Calculate consolidation settlements	it is a building, road, district heating etc.)	Ongoing tests in the form of 3 written individual/ group assignments, weighing 25% and a final exam consisting of a written individual course assignment, weighing 25%. Internal assessment Tools allowed: N/A Re-exam: Individual oral exam, 20 minutes Internal assessment Topic found by draw
SE-INF1	Infrastructure – Highway Design in rural Areas	5	After completion of the course, the student must have the knowledge of: • Road types and planning • Traditional asphalt types and use of these in road constructions • Dimensioning of pipes for drinking water • Pump types • Pump dimensioning • Stormwater handling	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 a cross section • Describe elements within a cross section, including drainage principles for roads in rural areas • Describe where pipes and cables are placed in a cross section • Dimension road pavement structures based on the catalogue method • Use MicroStation for geometrical design of a roads cross section • Setup and prepare road drawings for print • Dimension drinking water pipes • Select and dimension pumps • Determine network structure • Setup drawings (plans and longitudinal profiles) including pipes	After completion of this course, the student must have the competences to: • Determine a roads lay-out in regards to Danish Roads Standards and place pipes and cables in a road • Dimension utility pipes based on demand • Select pump type • Dimension the selected pump • Design optimal pipe network structure	Exam prerequisites: The students must solve course assignments based on the knowledge and skills achieved through the course. The assignments must be handed-in before deadline, and the students will be graded based on these assignments. Type of exam: The course assignments must be handed-in on time, and the assignments will be graded. Two assignments weighing 25% each and an exam in the form of a written assignment weighing 50%. Re-exams: Course assignment must be improved and handed-in, and the assignments will be graded. Any second resit is an individual oral exam without preparation based upon a subject found by draw (not course assignments).
SE-SCI2 CE-SCI2 in spring 22	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	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	Exam prerequisites: Upload of course assignments in Wiseflow approximately one week before the exam. Type of exam: Individual oral exam with internal

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
			1st 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.	assessment. 20 min. Exam is based upon course assignment(s) found by draw and without preparation. Allowed tools: None Re-exams: Method will be equal to the ordinary exam.
SE-HYD1	Basic Hydraulics	5	After completion of the course, the student must have the knowledge of: • The physics of basic hydraulics • The design of rainwater and sewer systems • The Mike Urban program	After completion of the course, the student must have the skills to: Basic Hydraulics: • Determine type of flow • Use energy equation • Calculate single and pipe losses • Calculate hydraulic and energy grade line • Use exponential and C&W's formula Sewer systems: • Calculate inlet for rainwater and wastewater pipelines • Design and dimension rainwater and wastewater pipelines • Perform back water calculations • Design basins Mike Urban • Create pipe systems and catchment areas • Create local CDS-rains with or without climate factor • Analyze pipe systems and basins with CDS-rains • Present result as drawings and animations	After completion of this course, the student must have the competences to: • Understand hydraulic problems • Plan and dimension of Urban sewer systems • Calculate and analyze urban sewer systems in Mike Urban	Exam prerequisites: N/A Type of exam: 1 hand-in mandatory group assignment (a Mike Urban project) in the end of the semester, which counts for minimum 70% of final grade. Individual assignments (homework and during classes) count for 30% of final grade (15% each). If no individual assignments have been made the final hand-in counts for 100% of final grade. Allowed tools: N/A Re-exams: 3 hours written exam
SE-SEP2	Semester project 2	10	Professional knowledge 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	Professional skills The students must be able to design and dimension roads and pipe systems for water, wastewater and heating in the project area. The student must also be able to design and dimension	Professional competencies: - Determine a roads lay-out in regards to Danish Roads Standards and place utility pipes in a road - Dimension utility pipes based on demand - Select pump type if necessary	Exam prerequisites: Project description must be duly handed in and approved in order to register for exam in the semester project. Project report and Process report submitted before deadline.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
			processes for transporting drinking water, wastewater, heating and storm-water. Furthermore, roads must be designed for the area. Study knowledge Application of analytical skills. Effective teams Refer to knowledge about own strengths and weaknesses in connection with group work, refer to theories on personal profiles and personal and interpersonal competences as well as cultural differences. Project management Can identify reviewed analysis methods, methodologies and structures within project management.	installations for local rainwater handling. Study skills Effective teams Identify and describe the group's development. Apply theories on personal profiles and cross-cultural aspects in the group work in order to describe potential conflicts in the group and suggest solutions. Own learning process Describe own needs in connection with motivation for learning and act accordingly. Identify and apply preferred study techniques. List and reflect on own learning goals from the previous and current semester in the process report concerning future improvement. Project framework Communicate the project work's results and the project group's learning process in a structured manner using technical terms both in writing, graphically and orally. Apply knowledge on reference and source management. Describe the project execution in a process report. Problem Based Learning Describe which factors that may influence the individual and group-based learning in a PBL course. Can work based on the project group´s own problem formulation. Project management Can use profession-related methods and tools in project work. Can use digital tools such as office tools, digital project management as well as digital knowledge acquisition tools and portals.	- Dimension the selected pump if it is needed - Design optimal pipe network structure Study competencies: Academic/technical Competence learning aims Apply knowledge, skills and competences achieved during the semester to plan and design a road construction in rural areas. Plan a process by using the planning tool MS Project. Plan earth works by using mass curves and haul distances. Effective teams Take responsibility for the group cooperation and actively enforce and develop the group contract. List and select between steps for development and action of the group. Own learning process Give and receive constructive feedback in connection with own and other's learning process. Adjust own learning process based on experience and knowledge of own preferences. Project Framework Take responsibility for the work process of report writing and presenting in cooperation with the group. Apply oral, digital and graphic project presentation skills. Problem Based Learning Follow a methodology and work in a structured way on the semester project. Project management Take responsibility for the management of the project work with a continuous adjustment between tasks and resources.	Type of exam: Group exam consisting of an oral presentation of the project followed by an exam with an internal examiner. Grades will be individual. Allowed tools: The handed in project. Re-exam: Students who failed a semester project will be informed by the process supervisor, who in consultation with the internal censor decides, if the student(s) must prepare a new project, or if the failed project must be improved. In due time, the student(s) will be informed about the specific deadlines and the further course for the project work. There will be no guidance during the period up to hand in of the project. The project is assessed at an oral exam.
SE-CMI1	Water Quality - Chemistry and Microbiology	5	After completing the course, the student will be able to understand and	After completing the course, the student will be able to:	None.	Exam prerequisites: Mandatory assignments handed in

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
			use the following basic chemistry and microbiological terms and methods: - Describe and differentiate the different types of chemical bonds and intermolecular forces, give specific examples of chemical compounds for each type, and give specific examples on how these can influence the water quality and can be applied in the water treatment, including ion exchange, freezing point depressions. - Describe and differentiate various aspects of aqueous solutions relevant for water quality with respect to drinking water, wastewater, district heating and climate adaptation, including coagulation, flocculation, and chemical precipitation. - Explain chemical equilibrium and carry out calculations with the Law of Mass Action - Explain and describe acids, bases, and buffers and use the calculation of pH in aqueous solutions with relevance for water treatment and water quality - Describe basic chemistry of gas in water with relevance for the water treatment and water quality, including dissolved oxygen and oxygen demand - Calculate oxidation numbers and balance redox reactions with relevance for corrosion, water treatment and water quality. - Describe the structure of basic organic molecules including ATP and DN/A - Describe the taxonomic classification system of microorganisms and name common bacteria - List different types of microorganisms and describe the general cell structure of bacteria and eukaryotes - Explain the bacterial growth phases and calculate bacterial growth rates - Explain AOC, BDOC, biological stability and after growth in relation to water quality	- Apply basic chemical and microbiological methods to address water quality issues related to processes of drinking water, wastewater, district heating and climate adaptations - Compare and evaluate water quality parameters for water samples - Evaluate the principles and application of various methods for chemical analyses of water samples (e.g., spectrophotometry, nepholometry, electrochemical methods) - Compare and evaluate the application of culture-based (e.g., HPC), enzymatic (e.g., ATP) and molecular biology (e.g. PCR) methods for water quality analysis - Describe growth optimum of microorganisms and understand the influence of environmental factors (e.g., temperature, pH and nutrients) on microbial growth - Contrast beneficial, pathogenic and indicator organisms and give examples of microorganisms in each group in water systems - Compare planktonic and sessile mode of growth and discuss the advantages for microorganisms of living in a biofilm		before deadline and accepted Type of exam: Written exam in total 4 hours composed of two parts: 1-hour multiple choice and 3 hours written exam Tools allowed: 1-hour multiple choice exam with no material aids allowed 3 hours written exam with all material aids allowed Re-exam: Same as ordinary exam – written exam in total 4 hours composed of two parts: 1-hour multiple choice and 3 hours written exam

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
			- Describe the application of disinfection strategies for microorganisms (e.g., heat, chlorination, UV) - 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 - Describe the structure, development, and function of biofilms in water systems			
SE-HYD2	Hydraulics 2	5	Construction of model of pipe network, which integrates fjord, stream and city. Address and control climate-based water level rises by introducing pumps and flood gates. Construction of a model of pipelines in a pressurized system. Energy savings through pressure zones, use of elevated storage tanks and pumping strategy	To be able to build Mike Urban models with boundary conditions and control of flood gates and pumping stations. Understanding of the connection between water level in recipients and control and regulation strategy. To be able to build and calibrate EPA network models. Understanding the connection between operating strategy and energy consumption.	Use Mike Urban to analyze correlations between urban drainage, flow in watercourses, and water level variations in coastal recipients. Carry out long-term simulations with LTS-module. Analyze existing systems and make suggestions for the implementation of gates and pumps - and set up a management strategy. Use EPA net to analyze pipe networks and on that basis make proposals for division into pressure zones, as well as restructuring in order to facilitate monitoring and leak detection. Make suggestions for operational optimization based on analyzes of existing systems.	Exam prerequisites: The compulsory assignments must be handed in. Type of exam: Individually oral exam, 20 min. Internal assessment Tools allowed: None Re-exams: Same as the ordinary exam
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	Exam prerequisites: Course attendance incl. lab exercises min 75% Type of exam: Ongoing tests in the form of two oral assignments and one written assignment and an exam in the form of a written course assignment. All four weighing equally. Internal assessment Allowed tools: N/A

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
						Re-exam: Oral re-exam based upon a subject found by draw, 20 min. with no preparation. Internal assessment
SE-PRO1	Process Engineering (from A23)	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 Block flow diagrams and Piping and Instrumentation Diagrams for an existing plant - Demonstrate skills in calculating mass balances - Identify relevant sensors and instruments in the process system - Make design decisions and evaluate alternative designs - Analyze acquired data and suggest optimizations	After completion of the course the student will be able to: - Analyze processes in a supply plant - Suggest potential optimization initiatives	
SE-SEP3	Semester project 3	10	Academic/technical knowledge learning aims The student will get knowledge on how to: - Describe the major subjects in process engineering - Identify various units of a supply plant - Describe the function of each unit Effective teams Can refer to involved theories in order to increase efficiency for the group as a whole but also for the individual student	Academic/technical skills learning aims After completing the course, the student will be able to: - Illustrate a supply plant by construction of a simple Process and Instrumentation Diagram (P&ID) - Demonstrate material/energy balances for the overall process and for one or more specific compounds - Make a flow diagram for a supply plant - Calculate retention time - 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 a given process meets 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	Professional Competence Learning Objectives After completing the course, the student will be able to: - Analyze a supply plant - Suggest potential process optimizations - Cooperate in a group effort Effective teams Able to use experience and knowledge of own preferences to strengthen group collaboration Can receive and reflect on guidance and facilitation of group collaboration Can take responsibility for structuring and adapting the form of collaboration to the members' personal and interpersonal competencies Own learning process Able to independently plan, structure and optimize own learning process based on previous courses Project framework Able, in collaboration with the group, to take responsibility for the work process in connection with report writing and presentation. Can use oral, digital and graphic project presentation techniques	Exam prerequisites: Project report and Process report submitted before deadline. Type of exam: Group examination with individual assessment. Group presentation approx. 20 minutes followed by joint examination with joint discussion and individual question and answer sessions for approx. 20 minutes per student including evaluation. Individual grades are given on the basis of an overall assessment of the submitted work as well as the individual's performance during the exam. External assessment Tools alloowed: All Re-exam: Students who failed a semester project will be informed by the process supervisor, who in consultation with the internal censor decides, if the student(s) must prepare a new project, or if the failed project must be

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				- Prepare and carry out an oral presentation - Enter into a respectful dialogue and collaborate with companies for the benefit of both parties. Effective teams Can plan the project group's workprocess and work with a focus on the group's learning and goals Can identify and apply methods for solving basic cross-cultural communication and collaboration problems. Own learning process Can describe and analyze own learning process in the process report Can search, find and include relevant knowledge Can set and reflect on own learning objectives from current and previous semesters in the process report with a view to future improvement Project framework Can communicate the results of the project work and the project group's learning process in a structured way using professional concepts, both written, graphic and oral. Can argue for the choice of sources and references in connection with the project work. PBL Can analyze and explain overall contexts. Can work with a holistic view of the project, the subjects and the outside world. Can work interdisciplinary.	PBL Can work analytically, methodically and structured with the semester project in the project group. Project management Can plan, adapt and optimize a project process with reasoned selection of the specific project management tools. Can account for the use of digital tools such as digital project management as well as digital knowledge collection tools and portals.	improved. In due time, the student(s) will be informed about the specific deadlines and the further course for the project work. There will be no guidance during the period up to hand in of the project. The project is assessed at an oral exam.
SE-SEP3	Semester project 3 (From A23)	10	The student will get knowledge on how to: - Describe the major subjects in process engineering - Identify various units or processes of a supply plant - Describe the function of each unit	After completing the course, the student will be able to: - Illustrate a supply plant by construction of a simple Process and Instrumentation Diagram (P&ID) - Demonstrate material/energy balances for the overall process and for one or more specific compounds - Make a flow diagram for a supply	After completing the course, the student will be able to: - Analyze units or processes of a supply plant - Suggest potential process optimizations PBL competency Learning Objectives: - Can structure and adapt group	

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
				plant - Calculate retention time - 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 a given process meets 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 - Enter into a respectful dialogue and collaborate with companies for the benefit of both parties. PBL Skills Learning Objectives: - Can search, find, and include relevant knowledge. - Can apply academic and technical writing, report structure and rules of plagiarism. - Can communicate the results of the project work and the project group's learning process in a structured way using professional concepts, both written, graphical, and oral.	collaboration to the preferences and competencies of the members. - Can receive and reflect on guidance and facilitation of group collaboration. - Is capable of independently planning, structuring, and optimizing own learning process based on previous experiences. - Can argue for the choice of sources, methods, and solutions based on a critical assessment. - Can incorporate a holistic and sustainable approach to the project with an eye for connections to the surrounding world.	
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.	Exam prerequisites: Upload in WiseFlow of selected course assignments solved during course, approximately one week before the oral exam. Type of exam: Individual oral exam without preparation based upon course assignment(s) found by draw. Duration: 20 min.

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				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 their acquired skills and knowledge to study more Dynamics and Thermodynamic courses on the Supply Engineering education. Use a commercial mathematical and other software to solve and perform serial technical calculations.	Internal examiner. Allowed tools: None Re-exam: Method will be equal to the ordinary exam.
SE-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. The Student will be able to use Scalgo and Mike Urban to design overland structures for handling of rainwater.	Exam prerequisites: N/A Type of exam: Ongoing tests in the form of three written assignments, each weighing 10% and an exam in the form of a major written assignment weighing 70%. All assignments must be handed in before deadline. Allowed tools: N/A Re-exam: Individual oral exam
SE-MAL1	MATLAB	5	After completion of the course the students have gained knowledge on the keywords from the MATLAB environment, that is listed below. MATLAB Programming Environment M-Files (Scripts, functions), Set Path, Command Window, Editor, Publish, Data types and arrays. Functional Programming function, input argument, output argument, varargin, varargout, nargin, nargout, control flows, relational operators, logical operators, random number generation IO-operations save, load, mfilename, which incl. data transport between Excel and MATLAB. Graphics objects groot, uifigure, uigridlayout, uiimage,	After completion of the course, the student will be able to build dedicated apps for the climate and supply sector.	After completion of the course, the students will have introductory competences in programmatic app building that meets latest app features of the MATLAB app building environment.	Prerequisites: 100% of the criteria below must be met. Type of exam: The assessment is based on the following criteria. 1. Assignments must be handed in on time and be approved. (20%) 2. The mini-project comprises 1) technical documentation 2) presentation in teams at the day of the oral examination. The mini-project is approved as a hole. (80%). Allowed tools: N/A

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			uiaxes, line, patch, text, light, uipanel, uitable, uihtml + standard plots.			Re-exam: Oral exam
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 - Analyzed corrosion failures and link to corrosion industry standards	Exam prerequisites: Course attendance min 75% Type of exam: Ongoing tests in the form of two oral assignments and one written assignment and an exam in the form of a written course assignment. All four weighing equally. Internal assessment Allowed tools: N/A Re-exam: Oral re-exam based upon a subject found by draw, 20 min. with no preparation. Internal assessment
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 model. Understand how to calibrate a pipe network model. Data input and operation of Aquis Data input and operation of Energis.	Build and calibrate pipe network models in Aquis and Energis. Use the models for analyzing a pipe network. Suggest optimizations of a network based on the model results. Create and analyze scenarios. Use the model tools to propose solutions for a given network problem.	Ability to create and analyse scenarios in the modelling tools Aquis and Energis. 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 thermal storages in a district heating network.	Exam prerequisites: Mandatory course assignments completed, handed in before deadline and accepted. Type of exam: Three course assignments account for 100% of final grade, weighing equally. The exam is in the form of an internal assessment. Allowed tools: All tools allowed. Re-exams:
SE-SEP4	Semester project 4	10	The student is expected to achieve an understanding of other engineering capabilities during the completion of the project. The student must achieve knowledge and skills to plan and design renovation of infrastructure in urban areas.	The student must achieve skills to: • Use a digital platform for collaboration in work groups • Demonstrate an understanding for the complexity of an infrastructure renovation project.	Upon finalising the project the student must have achieved the following competencies: • Use a digital platform for collaboration • Demonstrate an understanding of the complexity of an urban infrastructure renovation project	Exam prerequisites: Project report and Process report submitted before deadline. Type of exam: Group exam with individual assessment.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
				• Demonstrate the ability to communicate project results to the project owner. • Analyse and use data of many different kinds, related to the project. • Understand different forms of communication and act accordingly. • Give an account of the ethical considerations in the project work. • Reflect on the efficiency of knowledge sharing in the project group and the quality of the project work. Furthermore, group collaboration, report writing, and presentation skills must be practiced during the project work.	• Demonstrate the ability to communicate project results to the project owner. • Analyse and use data of many different kinds, related to the project. • Understand different forms of communication and act accordingly. • Give an account of the ethical considerations in the project work. • Reflect on the efficiency of knowledge sharing in the project group and the quality of the project work.	Group presentation approx. 20 minutes followed by joint evaluation with joint discussion and individual question rounds for approx. 20 minutes per student including grading. Individual grades are given on the basis of an overall assessment of the submitted work as well as the individual's presentation during the exam. External assessment. Tools allowed: All Re-exam: Students who failed a semester project will be informed by the process supervisor, who in consultation with the internal censor decides, if the student(s) must prepare a new project, or if the failed project must be improved. The students(s) will be informed about the specific deadlines and the further course for the project work. New project groups will be formed, where possible in relation to the number of failed students at the individual semester. There will be no guidance during the period up to hand in of the project. A grade will be given directly on the basis of the quality of the improved or new submitted project. There will be no oral defence.
SE-SEP4	Semester project 4 (From S24)	10	The student is expected to achieve an understanding of other engineering capabilities during the completion of the project. The student must achieve knowledge and skills to plan and design renovation of infrastructure in urban areas.	The student must achieve skills to: • Use a digital platform for collaboration in work groups • Demonstrate an understanding for the complexity of an infrastructure renovation project. • Demonstrate the ability to communicate project results to the project owner. • Analyse and use data of many different kinds, related to the project.	Upon finalising the project the student must have achieved the following competencies: • Use a digital platform for collaboration • Demonstrate an understanding of the complexity of an urban infrastructure renovation project • Demonstrate the ability to communicate project results to the project owner. • Analyse and use data of many	

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
				• Understand different forms of communication and act accordingly. • Give an account of the ethical considerations in the project work. • Reflect on the efficiency of knowledge sharing in the project group and the quality of the project work. PBL-Skills Learning Objectives Can apply academic and technical writing style, report structure and plagiarism rules.	different kinds, related to the project. PBL-Competency Learning Objectives - Be able to plan, structure and execute effective interdisciplinary collaboration. - Be able to reflect on knowledge sharing in the project group and with other groups. - Be able to communicate and argue for the results of the project work and the project group's learning process in a structured way using academic concepts, both written, graphic, and oral. - Be able to argue for the choice of sources, methods and solutions based on a critical assessment. - Be able to explain ethical considerations in the project work.	
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 • 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 and construction management and planning, obtain 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	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.	Upon completion of the course, participants should be able to identify themselves with the directly involved stakeholders and be able to participate in construction management at large. After the course, the student will be able to: •Analyze, argue and explain the scope of a generic building project.	

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
			basic knowledge of process - and risk management.	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. Possess knowledge of process and risk management.	•Compare, select and argue for an appropriate organization and procurement form and perspectives the different forms.	
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). - Prioritize, choose, and justify the selection of solution models for complex issues, including reflecting on the choice of scientific method. - Argue for the selection of sources, references, and data in connection with project work.	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. - Independently and critically analyze new knowledge and argue for its application related to the project work. - Work analytically, methodically, and systematically on the semester project within the project group and incorporate ethical considerations within the profession.	
ENG-IDE1	Innovation and Entrepreneurship project	10	After having successfully completed the course, the students will have gained: - An understanding of innovation and entrepreneurship and its uses within	After having successfully completed the course, the students will be able to: - Engage in innovative and entrepreneurial processes in a cross-	After having successfully completed the course, the students will have gained competences in: - Introducing innovative ideas into	

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			the field of engineering and business. - Knowledge about three different innovation processes Design Thinking, Effectuation and Lean Startup - Knowledge about how to create a systematic and measurable progress in innovation and entrepreneurship tasks	discipline setting - Conceive, plan, and execute innovative ideas - Work methodically with innovation and entrepreneurship - Collect and apply relevant data/information about technologies, markets, and end users - Apply method to gain insights about the solutions impact on the current market. - Convey and argue for the results of a cross-disciplinary project group and the project group's learning process using correct professional terminology and optimal tools both in writing, graphically and orally.	project work - Contributing own professional skills in multidisciplinary teams with the objective of solving problems by using innovative and entrepreneurial processes and models - Clarifying multidisciplinary group competencies - Analyzing group dynamics and adapting working methods and collaboration methods to new group constellations to achieve effective collaboration in cross-disciplinary project teams - Independently structuring and planning own learning process in an interdisciplinary learning environment Able to independently argue for the application and implementation of valid knowledge	
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-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	- 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	- 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	

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			supplemental parameters) - Describe aspects of deterioration of drinking water quality (physical, chemical and microbiological) - Explain causes of different contamination scenarios - Understand the use of extended water treatment methods	(physical, chemical and microbiological parameters) - 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	analyses. How to cope with the consumers and the legislation, etc.	
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-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	

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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. - Possible cleaning achievement from the different treatment methods and systems. - The impact on the biological process from outside factors.	- Able to design a mechanical – chemical and biological WWTP - Dimensioning of the screens - Volume calculation of sand and grease trap - Volume calculation of primary settlement tank - Volume calculation of biological tank with nitrification, denitrification and phosphorus removal - Volume calculation of secondary settlement tank - Estimation of oxygen demands	- Comparing different treatment systems and able to choose the right one for the actual case. - Characterize different treatment methods with respect to physical, chemical and microbiological parameters. - Use optimal hydraulic design in order to avoid unwanted settlement within the system. - Analyze 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. - Analyze a situation with inefficient treatment and find a way of improving this using learned treatment methods and skills.	
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. - Digital models used for wastewater treatment plant design. - Usage of WEST – modelling program used for design and evaluation of wastewater treatment.	- Able to create a digital wastewater treatment plant model. - Analytical methods in identifying needed treatment of the wastewater. - Principles and application of advanced as well as simple treatment methods. - Analyze the performance of created model and evaluate on the results.	- Characterize different treatment methods with respect to physical, chemical and microbiological parameters. - Evaluate wastewater data and from this being able to design digital model for treatment. - Present digital results in a clear and simplified way.	

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
			- Usage and application of design models and constructions. - Ability to find needed constructions and process to create the wanted level of treatment.		- Analyze a situation with inefficient treatment and find a way of 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 • design a well site and suggest relevant geophysical pre-investigations. • plan and interpret well tests. • estimate the long-term drawdown and evaluate the risk of contamination of the aquifer.	After completion of the course, the student must • Be able to analyze and calculate flow and pressure variations for simple groundwater models. • Be able from the target and expected geophysical properties of soils or rock in an area to suggest geo-physical method and strategy for mapping of relevance to ground water mapping. • Have acquired knowledge on geoelectrical and electromagnetic geophysical methods, their principles and applications. Be able to discuss results and uncertainties. • Have acquired basic knowledge of other geophysical methods. Be able to list alternatives to geoelectrical and electromagnetic methods and their application. • Be capable of planning and interpreting well test analysis for a specific problem. • Be able to discuss what to focus on in risk assessments related to ground water extraction. • Be able to estimate the long-term influence of ground water extraction e.g. changing flow directions, effect on surface waters, salt water intrusion and mobility of contamination. • Be aware of water balances and 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 current 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-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.	- 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.	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	

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
			- The principles behind defining functional units, system boundaries and time scopes for LCA analyses. - 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	- 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. - 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.	- 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 - Reflection about business models and product development in CE.	
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.	
SE-STS1	Geothermal Systems	5	The student will gain knowledge about geothermal systems as a sustainable energy source and to obtain an understanding of the physical design,	After the completion of the course, the student must be able to: • Describe the thermal properties of rock and soil.		

Code	Title	ECTS-points	Knowledge	Skills	Competences	Assessment
			dimensions, functions and operation of these systems.	• 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	At the successful completion of the course, the student will be able to… • Describe the typical structure of a peer-reviewed paper. • Describe complex drinking water treatment technologies. • Describe a variety of data metrics used in drinking water treatment.	At the successful completion of the course, the student will be able to… • Review scientific papers in a critical manner. • Perform literature searches to identify supplemental references. • Analyze and compile information from different sources and potentially opposing views on a topic. • Present a structured summary of a given topic in class using oral and visual techniques. • Argue the pros and cons of the presented topic.	At the successful completion of the course, the student will be able to… • Apply critical thinking to scientific papers, reports, legislation. • Evaluate implications of applying a given technology, law or approach in a given situation. • 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	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	Assessment
			network – Geothermal energy Renewable energy management (e.g. tax structures, costs for energy production, cost analyses, environmental issues)			