Bring Ideas to Life
VIA University College

August 2023

Curriculum

Programme section

Bachelor of Engineering
Climate and Supply Engineering

Applicable to students enrolled in August 2023 and later.

Students enrolled before August 2023 will follow the structure and subjects of the curriculum 2021.

CONTENTS

Introduction

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

- 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 manage 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 manage 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 conducted 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.

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.

The reading of study material requires English B-level to complete the programme.

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.

The programme also includes practical workshops, see section 8.

The programme is structured as illustrated below:

Semester Theme	Course	Course	Course	Course/project	Course
7. Electives	Elective course	Elective course	Elective course	SE-BPR2 Bachelor project	
6. Electives	SE-UDE1 Tendering and contracting (compulsory)	Elective course	Elective course	SE-BPR1 Bachelor Project Preparation course	ENG-IDE1 Semester Project Innovation and Entrepreneurship
5. Internship	SE-INP1 Internship				
4. Urban Infrastructure and Climate Adaptation	SE-TMP2 Processes and Data	SE- MSC1 Materials Science and Corrosion	SE-VVM1 Environmental Assessment	SE-SUD1 Sustainable Drainage	SE-SEP4 Semester Project
3. Process Engineering	SE-TMP1 Thermodynamics, Process Engineering and District Heating	SE-BUD2 Water and Wastewater Processes and Mass Balances	SE-CMI1 Chemistry and Microbiology	SE-HYD2 Optimisation of Pipeline Networks	SE-SEP3 Semester Project
2. Climate Change Adaptation and Supply Infrastructure	SE-SCI2 Calculus, Linear Algebra and Dynamics	SE-INF1 Infrastructure	SE-CPL1 Climate planning and the Utility Sector	SE-HYD1 Basic Hydraulics	SE-SEP2 Semester Project
1. Sustainable Urban Development	SE-SCI1 Mathematical Analysis	SE-BUD1 Basic Utility Design	SE-CIA1 Climate Change, Impacts, and Adaptation	SE-GEO1 Basic Geology and Historical Climate Development	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.

The scope of the semester is 30 ECTS.

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.	Exam prerequisites: None Type of exam: Individual written exam, 4 hours. External assessment. Tools allowed: At 20-40% of the exam, the use of CAS programs is not allowed. The exam set will state in which assignments CAS programs may not be used and in which assignments CAS programs may be used. Re-exam: Equal to the ordinary exam.
Climate Change, Impacts, and Adaptation (SE-CIA1) – 5 ECTS	
The student must gain a basic understanding of the causes of climate change, its consequences and what methods can be used to mitigate it.	Exam prerequisites: None Type of exam: Ongoing assessment of three written assignments, handed in

The student will be introduced to the key professional GIS tools used for mapping and planning within climate adaptation.	according to deadline and a final exam consisting of a written course assignment, each weighing 25%. Internal assessment. Tools allowed: NA Re-exam: Individual oral exam, 20 minutes, with internal assessment.
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 and wastewater utility companies.	Exam prerequisites: None Type of exam: Ongoing assessment of three written assignments, handed in according to deadline and a final exam in the form of a written assignment, each weighing 25%. Internal assessment. Tools allowed: NA Re-exam: Individual oral exam, 20 minutes, with internal assessment.
Basic Geology and Historical Climate Development (SE-GEO1) – 5 ECTS	
The course aims to provide a basic knowledge of geology, soils and their properties related to the hydrological cycle. It also introduces historical climate change and its causes and effects.	Exam prerequisites: None Type of exam: Ongoing assessment of two written assignments, handed in according to deadline and a final exam in the form of a written test, each weighing 1/3. Internal assessment. Tools allowed: NA Re-exam: Individual oral exam, 20 minutes, on the basis of the afore-mentioned assignments. Internal assessment.
Semester Project (SE-SEP1) – 10 ECTS	
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 drinking water and wastewater must be forecasted in order to balance supply and demand. Additionally, rainwater must be handled locally. The focus of the PBL teaching in SEP1 is LEARNING TO LEARN, project methodology and PBL, including a basic introduction to study techniques and team-based project work.	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 exam 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 test. Internal assessment Tools allowed: The handed in project. 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.

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.

The scope of the semester is 30 ECTS.

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.	Exam prerequisites: None Type of exam: Individual oral exam, 20 minutes. 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. Internal assessment. Tools allowed: None Re-exams: Equal to the ordinary exam.
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 analyse and design sewer systems.	Exam prerequisites: None Type of exam: Ongoing assessment of 2 individual written assignments, each weighing 15% of the final grade. A final exam in the form of one hand-in mandatory group assignment (a Mike Urban project) in the end of the semester, which counts for 70% of final grade. Internal assessment. Tools allowed: N/A

	Re-exams: Individual written exam, 3 hours.
Infrastructure **(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.	Exam prerequisites: None Exam type: Ongoing assessment of two written individual/ group assignments, each weighing 50%. Internal assessment Tools allowed: N/A Re-exam: Individual oral exam, 20 minutes, based on course content.
Climate Planning and the Utility Sector **(SE-CLP1) – 5 ECTS**	
The student must gain a basic understanding of urban climate adaptation strategy, including fundamental concepts in municipal climate adaptation planning, climate adaptation mapping techniques, urban infrastructure planning including sewage systems. Moreover, students will develop practical skills in plan analysis, using GIS tools for analysis, devising local-level rainwater disposal plans, and articulating solutions aligned with sustainability goals.	Prerequisites: Mandatory assignments handed in before deadline and accepted. Type of exam: Ongoing assessment of two written assignments, handed in according to deadline and an exam in the form of a written assignment, equally weighted. Internal assessment. Tools allowed: N/A Re-exam: Individual oral exam, 20 minutes, based on course content.
Semester project **(SE-SEP2) – 10 ects**	
The urban development from first semester must now be equipped with an infrastructure to supply/handle the calculated amounts of drinking water, wastewater and rainwater. Furthermore, roads need to be designed for transport in and out of the area. The necessary infrastructure must be dimensioned and designed in a way that takes sustainability, legislation and environment into account. The purpose of the PBL part of the course is to promote the students' competencies in cross-professional collaboration.	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 exam 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 test. External assessment Tools allowed: The handed in project. 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.

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).

The scope of the semester is 30 ECTS.

Purpose, ECTS and assessment:

Thermodynamics, Process Engineering and District Heating (SE-TMP1) – 5 ECTS	**Assessment**
The course aims to provide students with competences in analysing and optimization of district heating processes and systems using process diagrams, energy balance and thermodynamics theory. In addition, the purpose is to enable the student to read and interpret academic literature as well as communicate about processes, thermodynamics and district heating.	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. Tools allowed: None Re-exams: Equal to the ordinary exam.
Optimisation of Pipeline Networks (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
Water and Waste Water Processes and Mass Balances (SE-BUD2) – 5 ECTS	
Quality of the drinking water distributed among consumers is highly dependent on the processes involved in raw water treatment. The quality of the raw water depends on the source of water. Wastewater that is going through wastewater treatment plant has special quality requirements before it is discharged to recipients. This course gives an insight in the processes involved in drinking water and waste water treatment and evaluates on the	Exam prerequisites: Four mandatory assignments, handed in before deadline and approved. Exam type: Individual oral exam, 20 minutes. Internal assessment Tools allowed: N/A

performance of already existing treatment plants and their design.	Re-exam: Same as the ordinary exam.
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 Exam type: 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 or district heating) 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 exam 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.

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 Danish Civil Engineering programme.

The scope of the semester is 30 ECTS.

Purpose, ECTS and assessment:

Processes and Data (SE-TMP2) – 5 ECTS	**Assessment**
The course aims to introduce students to the recording, collection, and processing of data within water, wastewater, and energy processes.	Exam prerequisites: None Exam type: Oral exam, 20 minutes based on a submitted mini project, prepared individually or in a group. Individual assessment based on an overall assessment of the mini project, which includes technical documentation and group presentation. Internal assessment. Tools allowed: 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: Not applicable Re-exam: Individual oral exam
Environmental Assessment (SE-VVM1) – 5 ECTS	
The purpose of this course is to provide the students with knowledge on environmental management according to EU legislation on Environmental Impact Assessment (EIA) as well as permitting process relevant to supply engineering projects.	Exam prerequisites: None Exam type: Oral exam, 20 minutes, based on a submitted assignment. Internal assessment. Tools allowed: All 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: NA Re-exam: Oral re-exam based upon a subject found by draw, 20 min. with no preparation. Internal assessment
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-exam.

The learning objectives of the courses (knowledge, skills and competencies) are further described in Appendix 1.

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.
Electives are listed in section 7.2.
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 exempted 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
Tendering and Contracting (SE-UDE1)	The course aims to introduce decision-making processes as well as legislation in the field of implementation of tenders for construction projects.	5 ECTS	Exam prerequisites: None Type of exam: Oral group exam with individual assessment. External assessment Tools allowed: None Re-exam: Individual oral exam, 20 minutes.
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 in English 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. The exam is in English. 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	5 ECTS	Exam prerequisites: Approved 30-minute individual multiple choice test on Philosophy of Science. No aids allowed during this test. 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 exam with joint discussion and individual

	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.		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 bachelor project, applying personal and project competencies from the previous semester projects in a practice-oriented and complex bachelor 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	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.

	more advanced than the traditional aeration and bio-sand filter. The methods may be filtration, sorption, precipitation, disinfection, etc.		Course assignments account for 50% of final grade. Exam accounts for 50% of final grade. Tools allowed: NA 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: None Type of exam: Individual oral exam, 20 min., based on one course assignment handed in before deadline. Internal assessment. Tools allowed: NA 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 Exam type: Individual oral exam, 20 minutes. Exam is based upon a subject found by draw and with 20 min. preparation after the draw. Internal assessment. Tools allowed: All tools allowed during preparation. Notes from preparation are allowed during exam. Re-exam: Conducted as the ordinary exam.
Renewable Energy (ME-ENE1)	The purpose of the course is to ensure that the student will understand the design and calculation of renew-able 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 exam. 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.

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.

SE-PWS1 Company visits
SE-PWS2 QGIS
SE-PWS3 Welding
SE-PWS4 Soil Contamination
SE-PWS5 Water Sampling

9 Bachelor project

SE-BPR1
SE-BPR2

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

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

BPR1 is expected to be approved before BPR2 begins.

The 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.

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.

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

updated before each new semester

Code	Title	ECTS-points	Knowledge	Skills	Competences
SE-BUD1	Basic Utility Design	5	Upon completion of the course, the students have gained knowledge of: - Components of drinking water and wastewater - Quality requirements for drinking water and wastewater discharge - Basic processes involved in drinking water and wastewater treatment	Upon completion of the course, the students will be able to: - Make basic analyses for drinking water and wastewater quality - Simple dimensioning of drinking water treatment - Calculation of drinking water consumption and wastewater produced - Present results for drinking water and wastewater quality	Upon completion of the course, the students will be able to apply knowledge and skills to: - At a basic level suggest a process design for drinking water and wastewater - Analyse demand and/or flows for a given area - Relate the demands for the quality to the existing legislations - Perform simple laboratory analyses - Describe the main components of each system
SE-CIA1	Climate Change, Impacts, and Adaptation	5	Upon completion of the course, the student has gained knowledge of: - Climate and weather systems - Climate change and impacts on society and the utilities sector - Climate change adaptation and mitigation - GIS platforms used for climate adaptation incl. their limitations - Screening and assessment of climate impacts - Climate adaptation strategy	Upon completion of the course, the student will be able to: - Identify and discuss the major causes of climate change - Propose suitable sustainable solutions for surface water management - Use various GIS tools for assessing flood or erosion risk - Gain an understanding of the intentions behind climate strategies	Upon completion of the course, the student will be able to apply knowledge and skills to: - Participate in discussions about climate adaptation projects at a qualified level - Assess and propose solutions for sustainable surface water management - Identify the different actors and responsibilities during the project process - Process/analyse climate challenges using GIS tools
SE-GEO1	Basic geology and Historical climate development	5	After the course, the student should have knowledge of: - The different types of the most common rocks and soils found in Denmark. - How the climate has changed over time and how it has shaped the Danish landscape. - That geology is variable (Geological profile) - Hydrogeology (water budget equation, infiltration, the different aquifers etc.) - That the Earth is one big system where everything is connected.	After the course, the student should be able to: - Recognize and describe the most common rock and soil types. - Relate the different rock and soil types to the Danish landscape and where they are typically found. - create a geological profile. - make an overall assessment of the hydrogeological properties of an area. - Overall assessment of an area's geological hazards.	After the course, the student should be able to: - Evaluate expected soil and groundwater conditions for a given site and assess their implications for a given area.
SE-SCI1	Mathematical Analysis	5	The student will get knowledge about: - Differentiation - Trigonometric functions - Exponential functions - Integration - Vectors in space - Vector functions in space	After the completion of the course, the student will be able to: - Identify and make simple calculation on selected transcendental functions - Identify and make simple calculation on the branch of infinitesimal calculation, which deals with finding the derivative of functions with one variable, including different applications thereof - Identify and make simple calculation on the	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.

Code	Title	ECTS-points	Knowledge	Skills	Competences
				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.	
SE-SEP1	Semester project 1	10	The students must obtain an understanding of planning and design of sustainable systems and climate change adaptation in urban area. The students must gain basic knowledge in the processes for producing drinking water, treating wastewater and collecting rainwater.	Through the design of a sustainable urban supply structure, the student must become familiar with organisation/stakeholders basic understanding of the two utilities (and synergies) in terms of resource, production, processes (plant) and consumption/demand. Through completion of the project, group cooperation, report writing and presentation technique will be put into practice. PBL skills learning objectives: - Establish and contribute to a collaboration with the group and the supervisor - Apply covered theories on group dynamics, teamwork, and conflict resolution - Formulate and enforce a group contract with the group. - Identify relevant problems, formulate a problem statement, and explain proposed solutions. - Apply knowledge about references and source management. - Apply academic and technical writing style, report structure and rules for plagiarism. - Communicate the results of the project work in writing, graphically and orally to different target groups.	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 supply. - Identify wastewater treatment solutions. - Identify climate challenges and design the rainwater management. - Include basic technical aspects. PBL competency learning objectives: - Apply and reflect on covered theories on learning and motivation. - Describe and reflect on the group's cooperation.
SE-CPL1	Climate planning and the utility sector	5	Upon completion of the course, the student has gained basic knowledge of: - Municipal climate adaptation planning and strategies. - Various techniques in climate adaptation mapping. - Integration of climate adaptation principles into urban planning. - Urban infrastructure planning, including sewage systems.	Upon completion of the course, the student will be able to: - Analyze plans and planning processes on a basic level. - Demonstrate the ability to use GIS for fundamental analysis. - Develop a comprehensible plan for rainwater disposal at the local level. - Articulate how the proposed solutions in the	Upon completion of the course, the student will be able to apply knowledge and skills to: - Demonstrate the ability to effectively apply foundational and basic understanding of plans and planning processes in the urban climate adaptation projects. - Effectively put into action fundamental and basic analysis skills when using GIS for spatial analysis. - Leverage foundational and basic skills to construct clear plans for local rainwater disposal.

Code	Title	ECTS-points	Knowledge	Skills	Competences
			- Applying fundamental engineering methods for climate adaptation.	project can contribute to the UN Sustainable Development Goals. - Identify and address, in a foundational way, constraints imposed by the project area and relevant legislation and plans. - Able to provide reasoned arguments for chosen potential solutions in the planning of urban climate adaptation projects.	- Basic knowledge to articulate how proposed solutions in projects can align with the UN Sustainable Development Goals. - Apply basic knowledge in the field of urban infrastructure planning, including sewage systems. - Presenting basic arguments for potential solutions in the planning of the urban climate adaptation projects.
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 - Analyse 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 analyse urban sewer systems in Mike Urban
SE-INF1	Infrastructure	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	After completion of this course, the student must have the competences to: - Determine a roads lay-out in regard 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

Code	Title	ECTS-points	Knowledge	Skills	Competences
				- Determine network structure - Setup drawings (plans and longitudinal profiles) including pipes	
SE-SCI2	Calculus, Linear Algebra and Dynamics	5	The student will get knowledge about: - Application of integration - Matrixes and matrix algebra - Linear equation systems - Polar coordinates - Complex numbers - Ordinary differential equations of the 1st and 2nd order - Physical quantities and units - Reference systems - Kinematics of particles - Kinetics of particles - Vehicle dynamics	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. - 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.	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 especially particle dynamics problems. - Use their acquired skills and knowledge to study more advanced Calculus, Algebra and Dynamics courses on the Engineering programme. - Use a commercial mathematical software to solve and perform serial technical calculations.
SE-SEP2	Semester project 2	10	The students must obtain an understanding of planning and design of sustainable infrastructural constructions and climate change adaptation in urban area. The students must gain basic knowledge in the processes for transporting drinking water, wastewater and rainwater. Furthermore, roads must be designed for the area.	The students must be able to design and dimension roads and pipe systems for drinking water and wastewater in the project area. The student must also be able to design and dimension installations for local rainwater handling. PBL skills Learning Objectives: - Be able to enforce and develop the group contract. - Can work based on the project group's own problem statement. - Apply covered theories on personal profiles and cross-cultural aspects in the group. - Apply knowledge about references and source management. - Apply academic and technical writing style, report structure and rules for plagiarism. - Communicate the results of the project work and learning process of the project group in a well-structured manner using technical terms in writing, graphically and orally.	The students will be able to: - Determine a road lay-out in regards to Danish Roads Standards and place utility pipes in a road and/or sidewalk - Dimension utility pipes based on demand - Select pump type if necessary - Dimension the selected pump if it is needed - Design optimal pipe network structure PBL Competency Learning Objectives - Describe potential conflicts in the group and suggest solutions. - Define and reflect on own learning aims from the current and previous semester.
SE-BUD2	Water and wastewater processes and mass balances	5	Upon completion of the course, the student will have gained knowledge of: - Sources of raw water and quality of these sources - Principles of risk management in relation to drinking water quality	Upon completion of the course, the student will be able to: - Perform a flow diagram with the water and mass balance - Construct process and instrumentation diagrams of existing and new treatment plants	Upon completion of the course, the student will be able to apply knowledge and skills to: - Propose a process design for drinking water and wastewater - Analyze treatment efficiency of existing treatment plant

Code	Title	ECTS-points	Knowledge	Skills	Competences
			- Treatment processes involved for drinking water and wastewater - The concept of water and mass balances in processes, which are key elements for understanding the behaviour of a treatment plant - Possible optimization methods for already existing treatment plants	- Complete simple dimensioning of treatment plant - Analyze the actual data from the existing treatment plant - Calculate the quantity of different factors needed to perform the efficient treatment	- Evaluate data from drinking water and wastewater treatment plant - Suggest the optimization possibilities for existing treatment plant
SE-CMI1	Water Quality - Chemistry and Microbiology	5	After completing the course, the student will be able to understand and 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 DNA - 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	After completing the course, the student will be able to: - 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	None.

Code	Title	ECTS-points	Knowledge	Skills	Competences
			- 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 analyse correlations between urban drainage, flow in watercourses, and water level variations in coastal recipients. Carry out long-term simulations with LTS-module. Analyse existing systems and make suggestions for the implementation of gates and pumps - and set up a management strategy. Use EPA net to analyse 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 analyses of existing systems.
SE-TMP1	Thermodynamics, Process Engineering and District Heating	5	The students gain knowledge about: - Principles of processes and specific unit operations, as well as instrumentation and components. - Basic thermodynamics, including the 0th and 1st law, energy balance of open and closed systems, equation of state and changes of state of ideal gases, thermodynamic cycle processes, the 2nd law and entropy of thermodynamics and real substances. - District heating system processes: Heat transmission/heat exchangers, pumps, steam power plants as well as refrigeration systems and heat pumps.	After completion of the course, the student will be able to: - Prepare block flow diagrams and pipe and instrumentation diagrams (P&ID) for an existing plant. - Outline and calculate energy balances for thermodynamic processes and systems. - Make basic calculations of thermodynamic systems, including heat exchangers, steam power plants and heat pumps. - Model a simple district heating system in Leanheat® Network software.	After completion of the course, the student will be able to: - Identify which parts of the acquired knowledge and skills are relevant to a given thermodynamic problem in a district heating system. - Relate the acquired knowledge and skills to creating simple mathematical models of real thermodynamic problems. - Analyse thermodynamic processes in a district heating system and suggest potential optimisation opportunities. - Communicate about processes, thermodynamics and district heating using professional terms
SE-SEP3	Semester Project 3	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 plant - Calculate retention time - Present names of microorganisms using correct	After completing the course, the student will be able to: - Analyse units or processes of a supply plant - Suggest potential process optimizations PBL competency Learning Objectives: - Can structure and adapt group collaboration to the preferences and competencies of the members. - Can receive and reflect on guidance and facilitation of group collaboration.

Code	Title	ECTS-points	Knowledge	Skills	Competences
				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.	- 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-VVM1	Environmental Assessment	5	Students completing this course will be familiar with: - How to find and read legislation on Environmental Impact Assessment (EIA) - How to identify projects which require Environmental Impact Assessment (EIA) - The overall processes of an Environmental Impact Assessment (EIA) - The process and questions relevant to an Environmental Impact Assessment (EIA) screening. - How to find typical areal conflicts of interest in the natural and environmental management - The most common used public webservices distributing geodata - The basics of permit applications for projects, including types of permits (e.g., excavation, construction, utility installation) and basic requirements. - The components of a permit application and the practical knowledge required for supply	Students completing this course will be able to: - Identify if a project belongs to appendix I or II of EIA directive - Identify typical conflicts of interest in the natural and environmental management - Identify and apply the methods and data used for EIA screening of different types of projects - Describe the use of significance arguments with respect to an EIA screening - Identify cross-links and remediation topics in the relation between project planning and EIA - Name the Competent Authority with respect to EIA relevant for a specific project - Extract relevant geodata from public webservices and import these into QGIS - Create a WebGIS to visualize the project results - Explain the basics of permit applications for projects, including various types of permits (e.g., excavation, construction, utility installation) and the basic requirements and components of a permit application.	After completion of the course the student must be able to: - Carry out an EIA screening for projects relevant to supply engineering - Be able to visualize geodata in maps intended for project communication - Identify and describe different types of permits (e.g., excavation, construction, utility installation) and outline the basic requirements and components of a permit application. - Create a thorough permit application for a hypothetical project

Code	Title	ECTS-points	Knowledge	Skills	Competences
			engineering projects.	- Prepare a comprehensive permit application for a hypothetical project.	
SE-MSC1	Material Science and Corrosion	5	After completion of the course the student must be able to: - Demonstrate basic knowledge about metals and polymers - Apply standard test methods - Explain deformation, stresses, and fracture in tension-loaded materials - Be familiar with the topics Corrosion Management and Failure Analysis	After completion of the course the student must be able to: - Select a suitable material for the manufacture of components in the supply industry - Carry out common test methods for materials - Explain the relation between deformation, stresses and fracture in tension-loaded materials - Explain relevant degradation mechanisms of materials specific to the supply industry - Carry out corrosion investigation of selected materials/components from the supply industry	After completion of the course the student must be able to: - Participate in development tasks covering the design and/or evaluation and improvement of components for the supply industry - Combine data from various sources for developing an improved corrosion management strategy - Analysed corrosion failures and link to corrosion industry standards
SE-TMP2	Processes and Data	5			
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 rainwater locally. - Reuse of rainwater. - 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.
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. - 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. PBL Skills Learning Objectives	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 different kinds, related to the project. PBL-Competency Learning Objectives - Plan, structure and execute effective interdisciplinary collaboration. - Reflect on knowledge sharing in the project group and with other groups. - Communicate and argue for the results of the project work and the project group's learning process in a structured way using academic

Code	Title	ECTS-points	Knowledge	Skills	Competences
				Apply academic and technical writing style, report structure and plagiarism rules.	concepts, both in writing, graphically, and orally. - Argue for the choice of sources, methods and solutions based on a critical assessment. - 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
SE-UDE1	Tendering and Contracting	5			
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.

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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 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	After having successfully completed the course, the students will be able to: - Engage in innovative and entrepreneurial processes in a cross-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.	After having successfully completed the course, the students will have gained competences in: - Introducing innovative ideas into 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 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	- Collect samples for analysis of drinking water quality (water, backwash water and/or filter medium) - Practice basic laboratory methods and equipment (pipettes, scales, dilution, calibration, safety) - Perform laboratory analyses for documentation of drinking water quality (physical, chemical and microbiological parameters) - Obtain and evaluate empirical data from laboratory experiments - Report results from laboratory analyses in text, figures and tables - Compare and evaluate the application of	- Analyse results of laboratory experiments, discuss the results and relate the results to the scientific papers and other literature - Analyse a situation with undesirable drinking water quality including: How to collect data and select the appropriate analyses. How to cope with the consumers and the legislation, etc.

Code	Title	ECTS-points	Knowledge	Skills	Competences
				physical, chemical and microbiological drinking water analyses	
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
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.	- 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	- 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.

Code	Title	ECTS-points	Knowledge	Skills	Competences
			- 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.	- Volume calculation of biological tank with nitrification, denitrification and phosphorus removal - Volume calculation of secondary settlement tank - Estimation of oxygen demands	- 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. - Usage and application of design models and constructions. - Ability to find needed constructions and process to create the wanted level of 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. - 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 analyse 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.	The student will be able to occupy a position in a utility, municipality or engineering company where the cur-rent course will give them capabilities on a general level to plan investigations of possible source locations and/or to make a quality assessment of a suggested survey.

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				- 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.	
SE-LCA1	Circular Economy and LCA	5	Students completing this course will be familiar with: - The international guidelines for LCA analyses (ISO standards 14040 and 14044). - The step-by-step working process that must be followed when carrying out an LCA analysis. - The principles behind defining functional units, system boundaries and time scopes for LCA analyses. - 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	- Define functional units, system boundaries and time scopes for LCA analyses according to the guidelines. - Carry out LCA analyses for simple production or service system scenarios according to the guidelines. - Compare competing production or service systems based on an LCA analysis. - Present and interpret results of LCA analyses and discuss these in relation to decision-making. - 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.	Students completing this course will be able to: - Define comparable scenarios for competing production/service systems in order to analyse the respective environmental impacts of these - Relate results from LCA analyses with the ideas of CE to suggest sustainable choices in given situations - Discuss how working towards fulfilling the SDGs requires individual as well as a political change of behaviour - 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	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

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			composition) and sludge management techniques. Quality criteria definitions for possible management technique		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, dimensions, functions and operation of these systems.	After the completion of the course, the student must be able to: - Describe the thermal properties of rock and soil. - Explain the working principle of a heat pump. - Calculate thermal conductivity from thermal response test data. - Dimension a geothermal system using the professional software EED. - Calculate COP for a heat pump by measuring produced and spent energy in a system. - Describe the construction of a borehole heat exchanger and identify critical areas. - Identify the various conflicts of interest in relation to ground source heating and cooling.	
SE-TBD1	Tool Box Drinking Water	5	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. - Analyse 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 network – Geothermal energy Renewable energy management (e.g. tax structures, costs for energy production, cost	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
			analyses, environmental issues)		