Unfold your talent
VIA University College

Dato: August 2020

Rev.: August 2021

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Curriculum

Programme section

Bachelor of Engineering, Climate & Supply Engineering

Valid from August 2020
Applicable for students enrolled in august 2020.

Students enrolled in August 2017-2019 will follow the structure and subjects of the curriculum 2017.
In case of a significant delay in a student's study programme, the design of a personally study plan may lead to a transition to this curriculum.
Previous study structures are listed in annex 1-3

Rev. August 2022:
- BPR1 updated

Rev. August 2023:
Clarification of exam prerequisites, 7th semester (autumn 2023)

INDHOLD

Introduction

In accordance with the Diploma Engineering Education programme, the purpose of the diploma-engineering programme is to qualify students to, nationally and internationally, carry out the following business functions;

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

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

VIA Engineering endeavours to work in accordance with a common DNA for all engineering courses. The DNA contains a description of what especially characterizes the engineering programmes at VIA, as well as what to expect from a graduate from our engineering programmes.

At VIA Engineering, we are practice- and project oriented and focused on the surrounding world. These goals are achieved in the form of qualified graduates obtained through targeted education, relevant research and development as well as cooperation and ongoing dialogue with the business community. The programmes at VIA Engineering will qualify the graduates to perform practice- and development-oriented business functions.
English-language programmes and international admission is a characteristic 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 a broad practical experience, and they understand how to anchor theory in practice through laboratory work, company visits and projects for and in collaboration with companies.

To ensure the usefulness of the content of the programme, the principles of the CDIO education concept are applied, ensuring that the individual courses are continuously reviewed, evaluated and developed.

1 Identity of the Programme

Bachelor of Engineering in Climate & Supply Engineering: water, wastewater and district heating at VIA Engineering, Horsens is a rounded program. According to the executive order, the degree program aims to qualify the students to perform professional functions within the utility sector, both in Denmark and abroad.

We educate and train the future engineers to have basic knowledge within the processes in water works, wastewater treatment plants and district heating plants. Furthermore, we teach how to dimension treatment plants and pipe networks, carry out risk assessments, environmental impact assessment and climate change adaptation.

The aim of the supply engineering study program is that graduates have acquired skills to describe, formulate and communicate issues and results in a scientific context, as well as the ability to apply scientific method. Furthermore, they must be able to use the results of national and international research, experimental as well as development work.

The purpose of the programme is primarily achieved by:
- Making project work an essential part of the course in which the technical elements of the programme are integrated through problem solving, focusing on use-oriented and practical engineering work. Through the project work it is also essential that the students develop technical, methodical, communicative and personal competences.
- Collaboration with research environments and utility companies in connection with the courses.
- Offering an international study environment, in which parts of the programme may be completed abroad.
- Using the student's internship actively to exchange knowledge and experience between VIA and the profession.
- Obtaining application and practice-oriented competences by using VIA's laboratory, workshops and library facilities.

2 Structure and Content

The programme is organized as a full-time higher education. The structure, progression and included tests of the programme will be as indicated in the table at the end of this section.

The official duration of the degree program is 3½ years, divided into 7 semesters corresponding to 210 ECTS credits.

ECTS (European Credit Transfer System) indicates the workload and the duration of a study element, but not the severity. One ECTS point corresponds to a workload of 27.5 hours. An academic year of 60 ECTS thus corresponds to 1,650 hours of work for the student.

New students are enrolled once a year in August.

English at B level is a prerequisite to complete the degree program.

The programme consists of:
- Compulsory courses and projects
- Elective courses
- Internship
- Workshops (further described in Joint Regulations for VIA Engineering)
- Bachelor project

One semester consists of 3-6 delimited courses. One course may have a volume of 5 to 10 ECTS credits, and a project may have a volume of 5 to 15 ECTS credits.

The course topics, scope, learning objectives and tests are described in this curriculum.
For a more detailed and comprehensive description of the individual courses, reference is made to the course descriptions applicable at any time, and available on Studynet.

The programme is structured as illustrated below. Previous study structures are listed in appendix 1-3.

Semester Topic	Course	Course	Course	Course / project	Course / project	
7. Electives	Elective course	Elective course	Elective course	SE-BPR2 Bachelor project		
6. Electives	CE-CMP2 Project and Construction Planning and Management	Elective course	Elective course	SE-BPR1 Bachelor-project Preparation course	SE-SEP6 Semester project	
5. Internship	SE-INP1 Internship					
4. Analysis of a supply district area	SE-MAL1 MATLAB	SE-MSC1 Material science and Corrosion	SE-PNM1 Pipe Network Modelling	SE-INO1 Engineering Innovation	SE-SEP4 Semester project 4	
3. Process Engineering	SE-TER1 Thermo-dynamics and fluid dynamics	SE-PRO1 Process Engineering	SE-HYD2 Hydraulic 2	SE-CMI1 Chemistry and Microbiology	SE-SEP3 Semester project 3	
2. Climate Change Adaptation and Supply Infrastructure	CE-SCI2 Calculus, Linear Algebra and Dynamics	SE-HYD1 Basic Hydraulics and Design of Sewer Systems	CE-GSW1 Engineering Geology and Soil Works	SE-INF1 Infrastructure – Highway Design in Rural Areas	SE-SEP2 Semester project 2	
1. Sustainable Urban Development	CE-SCI1 Mathematical analysis	SE-CCS1 Climate change and sustainability	SE-BUD1 Basic Utility design	SE-UTS1 Utility sector	CE-SSE1 Study Skills for Engineering Students	SE-SEP1 Semester project 1

Head of programme may decide that the academic content of a course is taught within the project of the semester in question, as the ECTS scope of the project is increased correspondingly.
This decision may be substantiated in terms of capacity or economics in the current semester.

3 Compulsory Courses of the Programme

All courses and projects on the first five semesters are compulsory.

The first four semesters contains a semester project representing 5-10 ects credits.
The main aim of the semester project is to demonstrate the ability to apply the skills acquired during the semester.

There will be a common theme for each semester.

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

3.1 1. Semester: Sustainable Urban Development

The overall theme of the 1st semester is Introduction to climate change and sustainable supply
The students will complete a project with focus on analysing and planning of sustainable water, wastewater and energy supply.

The project work is completed in project groups, who cooperate in solving the challenges within the current theme, supported by participation in lectures.

At the end of 1st semester, the students must have:
- Acquired understanding on water cycle, energy balance, mass balance, resources,
- Acquired understanding of legislation and framework for the utility sector
- Acquired understanding on climate change, sustainability and water, wastewater and district heating processes
- Acquired basic knowledge on utility organisation and stakeholders
- Acquired basic knowledge on quality related to water, wastewater, fuels and emission
- Acquired professional understanding of common terms climate change, sustainability and utility
- Acquired basic knowledge within the area of water-, wastewater and district heating utilities,
- Acquired basic mathematic tools for the calculation of simple problems related to civil works
- The ability to apply the most common principles within design, planning, specification of activities, project description and resource planning
- Trained and gained experience with group work, report writing and presentation techniques
- The ability to use digital tools such as GIS, Heat Roadmap Europe and Scalgo-live
- Knowledge and skills to perform a simple feasibility study
- The ability to apply the knowledge and skills gained during the semester in order to plan and design and projects in cooperation with other students.

Content, scope, tests and censorship

Title (code)	Content	Scope	Exam
Mathematical Analysis (CE-SCI1)	Transcendental functions Infinitesimal calculation Vectors Motion in space.	5 ECTS	Written test Grading based on the Danish 7-point scale External assessment
Climate Change and Sustainability (SE-CCS1)	Climate, weather patterns and systems, climate development, climate changes, impacts of climate changes, surface water, infiltration of surface water, sustainable drainage.	5 ECTS	Assessed on the basis of 4 tests during the semester, weighting 10%, 30%, 20% and 40% of the total grade respectively. Grading based on the Danish 7-scale. Internal assessment

Basic Utility Design (SE-BUD1)	Distribution system, drinking water treatment, sewer systems, wastewater treatment, district heating plants, energy sources, pipe network systems, water and heat consumption, wastewater production, quality limits, mass balance	5 ECTS	Assessed on the basis of 4 tests during the semester, each weighting 25% of the total grade respectively. Grading based on the Danish 7-scale. Internal assessment
Utility Sector (SE-UTS1)	The utility sectors requirements and obligations, legislation, economy, business conditions, organization, stakeholders, resources, community owned business model.	5 ECTS	Assessed on the basis of 4 tests during the semester, each weighting 25% of the total grade respectively. Grading based on the Danish 7-scale. Internal assessment
Study Skills for Engineering Students (CE-SSE1)	Study techniques Study tools	5 ECTS	Assessed on the basis of course work Approved / not approved Internal assessment
Semester project: Sustainable Urban Development (SE-SEP1)	Planning and design supply of an urban area with sustainable water, wastewater and district heating solutions.	5 ECTS	Oral test Grading based on the Danish 7-point scale Internal assessment

The learning objectives of the courses (knowledge, skills and competences) as well as assessment are further described in Appendix 4.

3.2 2. 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 work is completed in project groups, who cooperate in solving the challenges within the current theme, supported by participation in lectures.
The project groups will initiate their own project formulations and plan the project work however, the projects will be subject to certain minimums in relation to the extent and the analysis of the professional elements of the semester.

At the end of the 2nd semester, the students must have:
- obtained an understanding of planning and project design of infrastructural facilities
- obtained a routine in the completion of projects in this sector
- skills in applying learned knowledge to the solving of practical infrastructural project works
- the ability to convert the results of lab work into practical project oriented application
- the ability to plan and complete practical project works
- skills in communication of the project results to the client
- the ability to use the knowledge obtained and the skills achieved during the semester, in order to perform analyses of infrastructural projects, including applicable solutions
- the ability to design and calculate pipe installations in soil for water-, wastewater and district heating installations
- in cooperation with other students, the ability to complete design of infrastructural projects related to the semester theme

Content, scope, tests and censorship

Title (code)	Content	Scope	Exam
Calculus, Linear Algebra and Dynamics (CE-SCI2)	Calculus Linear algebra Particle dynamics	5 ECTS	Oral test Grading based on the Danish 7-point scale Internal assessment
Basic Hydraulics and Design of Sewer Systems (SE-HYD1)	Basic hydraulics Main sewerage	5 ECTS	Assessed on the basis of course work Grading based on the Danish 7-point scale Internal assessment
Engineering Geology and Soil Works (CE-GSW1)	Engineering Geology Construction Management and Planning	5 ECTS	Assessed on the basis of course work Grading based on the Danish 7-point scale Internal assessment
Infrastructure – Highway Design in Rural Areas (SE-INF1)	Road types and planning Intersections in rural areas Traditional asphalt types Cross-section with supply installation.	5 ECTS	Assessed on the basis of course work Grading based on the Danish 7-point scale Internal assessment
Semester project: Climate Change Adaptation and Supply Infrastructure (SE-SEP2)	Semester project Planning and design of supply distribution system in an urban area	10 ECTS	Oral test Grading based on the Danish 7-point scale External assessment

The learning objectives of the courses (knowledge, skills and competences) as well as assessment are further described in Appendix 4.

3.3 3. 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 water and wastewater quality, fluid flow and energy supply.

The project work is completed in project groups, who cooperate in solving the challenges within the current theme, supported by participation in lectures.

At the end of the 3rd semester, the students must have:
- Acquired basic knowledge of chemistry and microbiology as it applies to supply engineering.
- Acquired basic knowledge of thermodynamics and fluid flow as it applies to supply engineering.
- Acquired basic knowledge of process engineering.
- Acquired basic knowledge of hydraulics in gravity flow systems and pressurized pipelines and pumps.
- Calculate hydraulic and kinetic parameters
- Demonstrate understanding of a treatment process illustrated by a P&I-diagram
- Plan, write and review a project report:
- Analyse a supply plant
- Suggest potential optimizations

Content, scope, tests and censorship

Title (code)	Content	Scope	Exam
Thermodynamics and Particle Dynamics (SE-TER1)	Thermodynamics, ideal gases and reversible processes, the second law of thermodynamics and entropy, real substances, heat transfer/heat exchangers, fluid dynamics	5 ECTS	Oral test Grading based on the Danish 7-point scale Internal assessment
Chemistry and Microbiology (SE-CMI1)	Bonding, equilibrium, kinetics, aqueous solutions, acids and bases, oxidation/reduction, instrumental analysis, taxonomy, cell anatomy, growth, disinfection, effect of microorganisms, bacteria measurements.	5 ECTS	Written test Grading based on the Danish 7-point scale External assessment
Hydraulic 2 (SE-HYD2)	Types of sewer and rain water systems. Collection and conveyance of rain water and wastewater. Gravity flow. Water supply systems. Flow in the above systems. Pressure flow. Knowledge of design methods for the above. Modelling for supply pipelines. Analyse the area and able to design a new pipe system as per the Danish standards.	5 ECTS	Oral test Grading based on the Danish 7-point scale Internal assessment
Process Engineering (SE-PRO1)	Mass balance, process diagrams, unit operations, data requisition, instrumentation, residence time, optimization, process control	5 ECTS	Assessed on the basis of course work Grading based on the Danish 7-point scale Internal assessment
Semester project: Process Engineering (SE-SEP3)	Process description, Material balance, Flow diagram, Regulation and control, Unit operation, Hydraulic calculations, Kinetic calculations, Process optimization	10 ECTS	Oral test Grading based on the Danish 7-point scale External assessment

The learning objectives of the courses (knowledge, skills and competences) as well as assessment are further described in Appendix 4.

3.4 4. Semester: Analysis of a Supply District Area

The overall theme of the 4th semester is integrated analyses and design of a sustainable supply district area The students will complete a project with focus on Supply district areas, legislation and municipality planning, consumer patterns, supply potential and forecasting.

The project work is completed in project groups, who cooperate in solving the challenges within the current theme, supported by participation in lectures.

At the end of the 4th semester, the students must have:

- Acquired knowledge of modelling of pipe networks.
- Acquired knowledge of materials and products used within pipe networks.
- Acquired basic knowledge of registration of distribution networks as well as flows in open pipes under gravitational influence and closed pipes under pressurized influence respectively.
- Additionally, knowledge of district heating pipes and flows under thermal influence.
- Prepare analysis and forecast of data for a supply area including the distribution grid.
- Apply software for registration and modelling of pipes
- Analyse and apply data gathered from practical exercises and calculations
- apply the knowledge and skills gained during the semester in order to carry out an analysis of a supply area
- prepare justified forecasts for the area. All in cooperation with other students and by means of relevant software.

Content, scope, tests and censorship

Title (code)	Content	Scope	Exam
Matlab (SE-MAL1)	MATLAB® APP	5 ECTS	Written test Grading based on the Danish 7-point scale External assessment
Material Science and Corrosion (SE-MSC1)	Steel, Polymers, Corrosion, Degradation, Field Cases, Laboratory Work, Failure Analysis, Corrosion Management, Supply Industry, abiotic and biotic degradation mechanisms, products in supply industries	5 ECTS	Assessed on the basis of course work Grading based on the Danish 7-point scale Internal assessment
Pipe Network Modelling (SE-PNM1)	Pipe network modeling and analysis. The tools used are MIKE Urban, Energis and Aquis.	5 ECTS	Assessed on the basis of course work Grading based on the Danish 7-point scale Internal assessment
Interdisciplinary innovation project (SE-INO1)	Innovation, Creativity, Cross-/inter-/multidisciplinary and Professional identity	5 ECTS	Written test Grading based on the Danish 7-point scale Internal examiner
Semester project: Analysis of a supply district area (SE-SEP4)	Supply district areas, legislation and municipality planning, consumer patterns, supply potential, forecasting	10 ECTS	Oral test Grading based on the Danish 7-point scale External assessment

The learning objectives of the courses (knowledge, skills and competences) as well as assessment are further described in Appendix 4.

4 Workshop Courses

Workshop courses are practice-related courses of one week's duration (not ECTS-triggers). The courses will be conducted in parallel with the 1-4 semester. The following five courses are planned:

PWS1: Company visits
PWS2: Land Surveying
PWS3: Welding
PWS4: Soil Contamination
PWS5: Water Sampling

5 Internship

CE-INP1

The internship comprises a semester of 30 ECTS and it is placed on the 5th semester of the programme. The internship period is either paid or unpaid and takes place either in a private or in a public company in Denmark or abroad.

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

The following prerequisites must be met before an internship can commence:
− All courses on 1.-4. semester must be passed / approved
− Workshop courses must be passed / approved or exempted

The student is responsible for finding an internship host organization, which must be approved by VIA, who will also allocate a supervisor for the intern.

In cooperation with the company, the student prepares a plan for the internship programme including an assignment formulation.

The basis for the assessment of internship is a continuous reporting from the student to VIA, a feedback from the internship company, as well as a presentation where the supervisor can ask detailed questions about the internship content.

If the internship is terminated, the supervisor must, in consultation with the head of programme, assess whether the internship has had a duration and content sufficient for passing the internship.

The internship is assessed approved / not approved.

6 Courses at 6th and 7th Semester

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

Description of the individual courses is stated in the course descriptions.

In addition to the compulsory course CMP2, a speciality designation consists of courses totalling 15 ECTS as well as SEP6 and BPR1+2, all within the specific specialisation.

It is also possible to choose elective courses offered by VIA's other Programmes, except courses, which consists of elements from the student's previous academic record. Selecting courses from other Programmes must be approved by an Engineering study counsellor in order to secure the relevance and an increase of the technical level.

6.1 Compulsory Courses

Compulsory courses for all students on Supply Engineering programme.

Content, scope, tests and censorship

Title (code)	Content	Scope	Exam
Project and Construction Planning and Management (SE-CMP2)	The aim of this course is that students become familiar with requirements for project and construction management and planning obtain knowledge of building project phases, organizational and contractual relationship.	5 ECTS	Oral test Grading based on the Danish 7-point scale External assessment
Semester project (SE-SEP6)	The actual topics will vary depending on the specialization (drinking water, wastewater, district heating). Examples may be, but are not limited to, chemical, biological and/or physical processes in drinking- and wastewater treatment, advanced treatment, mechanical optimization of treatment plants, resource management, circular economy, residual management, risk assessment, sustainable fuels, pipe network optimisation, energy savings, economic and environmental evaluation, etc.	10 ECTS	Oral test Grading based on the Danish 7-point scale External assessment
Bachelor project preparation course (SE-BPR1)	The main purpose is to prepare the students for their bachelor project. Preparation includes selecting the subject, choosing a project group. Finding a supervisor and maybe an external partner, analyzing the subject, defending the project by oral presentation, and writing a Project Description according to VIA Engineering Guidelines.	5 ECTS	Assessed on the basis of course work, the final project description and its presentation and defence Grading based on the Danish 7-point scale No co-examiner
Bachelor project (SE-BPR2)	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.	15 ECTS	Oral test Grading based on the Danish 7-point scale External assessment

The learning objectives of the courses (knowledge, skills and competences) as well as assessment are further described in Appendix 4

6.2 Elective Courses and Specialisations

The following electives are available at the Supply Engineering programme:

Elective courses (**general**):

Title (code)	Content	Scope	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	Written test Grading based on the Danish 7-point scale Internal assessment

The learning objectives of the courses (knowledge, skills and competences) as well as assessment are further described in Appendix 4.

Elective courses within the **Water Supply** specialisation:

Title (code)	Content	Scope	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	Oral test Grading based on the Danish 7-point scale Internal assessment
Geophysics and Pump Test (SE-GPT1)	The student should 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.	5 ECTS	Oral test Grading based on the Danish 7-point scale Internal assessment
Tool Box Drinking Water (SE-TBD1)	Toolbox Drinking Water is a string of seminars on diversified drinking water related topics, that either digs a bit deeper in known areas, are new but important or are relevant for bachelor projects.	5 ECTS	Oral test Grading based on the Danish 7-point scale Internal assessment
Advanced Water Treatment (SE-AWT1)	The course concerns methods for treating surface water and ground water that requires more than a simple sand filtration. Methods may include micro ultra and nanofiltration, reversed osmosis, flocculation, chlorination, ozone, UV-light, pH adjustment, chemical dosing, softening and remineralisation. Some of the technologies will have uses within both drinking water, wastewater treatment and district heating.	5 ECTS	Oral exam Grading based on the Danish 7-point scale Internal assessment

The learning objectives of the courses (knowledge, skills and competences) as well as assessment are further described in Appendix 4.

Elective courses within the **Wastewater Supply** specialisation:

Title (code)	Content	Scope	Exam
Applied Wastewater Quality (SE-AWW1)	Wastewater sources and its quality (physical, chemical and microbiological) Different contamination scenarios Quality criteria (Danish/European wastewater discharge legislation, and supplemental parameters) Principles of wastewater sampling and analysis Principles of wastewater analyses (physical, chemical and microbiological) Laboratory analysis on different wastewater streams Analyse results of lab experiments, discuss the results and relate the results to the scientific papers and other literature used in the course Extended wastewater treatment methods	5 ECTS	Oral test Grading based on the Danish 7-point scale Internal assessment
Sludge Management (SE-SLM1)	To create an understanding of the sludge management techniques and their origin. Through information retrieval, discussions, presentations and laboratory exercises to provide the student with knowledge in and hands-on experience with current topics related to sludge management.	5 ECTS	Assessed on the basis of course work Grading based on the Danish 7-point scale Internal assessment
Design of Wastewater Treatment Plant (SE-DWT1)	Through information retrieval, discussions, presentations and laboratory exercises to provide the student with knowledge in planning establishment and design a proper wastewater treatment plant (WWTP) for achieving a current wastewater quality.	5 ECTS	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%. Grading based on the Danish 7-point scale Internal assessment
Design of Wastewater Treatment 2 (SE-DWT2)	To create an understanding of the activated sludge process and advanced wastewater treatment. Through information retrieval, discussions, presentations, and group works to provide the student with knowledge current topics related to biological treatment of wastewater.	5 ECTS	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%. Grading based on the Danish 7-point scale Internal assessment

The learning objectives of the courses (knowledge, skills and competences) as well as assessment are further described in Appendix 4.

Elective courses within the **District Heating** specialisation:

Title (code)	Content	Scope	Exam
Design & Simulation of District Heating System (SE-DSD1)	Thermal energy storage, electrical energy storage, heat transfer analysis, evaluation of temperature changes, computer simulations of various energy systems.	5 ECTS	Oral test on the basis of a mini project Grading based on the Danish 7-point scale Internal assessment

Geothermal Systems (SE-STS1)	Borehole Heat Exchanger, Heat Pump, COP, thermal properties of geological materials, drilling and grouting techniques, design of geothermal systems, calculations on efficiency.	5 ECTS	Oral test Grading based on the Danish 7-point scale Internal assessment
Design of Energy Systems (ME-DES1)	The student will obtain knowledge and calculation practice of refrigeration and heat pump systems in order to be able to design an efficient, environmentally friendly energy plant.	5 ECTS	Tests during the course 40% Oral test 60% Grading based on the Danish 7-point scale External assessment
Renewable Energy (ME-ENE1)	The purpose of the course is to ensure that the student will understand the design and calculation of renewable energy plants with focus on energy production, energy savings and storage and environmental conditions	5 ECTS	Tests during the course 40% Oral test 60% Grading based on the Danish 7-point scale External assessment

The learning objectives of the courses (knowledge, skills and competences) as well as assessment are further described in Appendix 4.

7 Bachelor Project

BPR1
BPR2

The programme is concluded with a bachelor project (BPR2) which constitutes 15 ECTS and is assessed with an oral test. The bachelor project commences on the 6th semester (BPR1, 5 ECTS), where the student must choose the subject for the project and prepare the project description.

The Bachelor project must demonstrate individual self-critical reflection within the chosen subject, and must document the student's ability to apply engineering theories and methods. In addition, the bachelor project must reflect the student's ability to express himself professionally and structured within his subject.

The condition for starting the bachelor project is that the bachelor preparatory course BPR1 has been approved. The condition for assessment of the bachelor project, BPR2, is that the student has passed all other courses.

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

The Bachelor project comprises an independent experimental, empirical and / or theoretical examination of a practical problem formulation related to the core subjects of the programme.

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

The students are examined in the project by an oral test / group test with individual assessment according to the learning objectives described under section 1 of this curriculum. The basis for the exam is the bachelor project. It is a prerequisite for participation in the exam that the bachelor project is handed in within the stipulated deadline, and that it meets the project requirements described.

The examination may take place at the earliest when all the other tests of the programme, including internship, have been passed. The examination is assessed on the 7-point scale and with the participation of external examiner.

8 Title and Issue of Diploma

Graduates who have completed the studies under this curriculum as well as the joint regulations for VIA Engineering is entitled to use the title Bachelor of Engineering in Climate & Supply Engineering.

For the completion of the programme, VIA University College issues a diploma, specifying the title as well as the result of the achieved assessments. The diploma furthermore details 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 graduates will receive the diploma in e-Boks no later than 5 weekdays after graduation.

9 Annex 1. Study structure, intake 2017

Semester Topic	Course	Course	Course	Course / project	Course / project	
7. Electives	Elective course	Elective course	Elective course	SE-BPR2 Bachelor project		
6. Electives	CE-CMP2 Project and Construction Planning and Management	Elective course	Elective course	SE-BPR1 Bachelor-project Preparation course	SE-SEP6 Semester project	
5. Internship	SE-INP1 Internship					
4. Analysis of a supply district area	SE-SCI4 Science 4	SE-MSC1 Material science and Corrosion	SE-PNM1 Pipe Network Modelling	SE-INO1 Engineering Innovation	SE-SEP4 Semester project 4	
3. Process Engineering	SE-SCI3 Calculus and Particle Dynamics	SE-PRO1 Process Engineering	SE-HYD2 Hydraulic 2	SE-CMI1 Chemistry and Microbiology	SE-SEP3 Semester project 3	
2. Climate Change Adaptation and Environmental Impact	SE-SCI2 Thermo-dynamics and Particle Dynamics	SE-HYD1 Hydraulic 1	SE-CCA1 Climate Change Adaptation	SE-SEN2 Supply Engineering 2	SE-SEP2 Semester project 2	
1. Land development and infrastructural constructions	SE-SCI1 Mathematical Analysis	SE-CMA1 Construction Management	SE-GEO1 Geology and Water	SE-SEN1 Supply Engineering 1	SE-SSE1 Study Skills for Engineering Students	SE-SEP1 Semester project 1

10 Annex 2. Study structure, intake 2018

Semester Topic	Course	Course	Course	Course / project	Course / project	
7. Electives	Elective course	Elective course	Elective course	SE-BPR2 Bachelor project		
6. Electives	CE-CMP2 Project and Construction Planning and Management	Elective course	Elective course	SE-BPR1 Bachelor-project Preparation course	SE-SEP6 Semester project	
5. Internship	SE-INP1 Internship					
4. Analysis of a supply district area	SE-SCI4 MATLAB	SE-MSC1 Material science and corrosion	SE-PNM1 Pipe Network Modelling	SE-INO1 Engineering Innovation	SE-SEP4 Semester project 4	
3. Process Engineering	SE-SCI3 Calculus and Particle Dynamics	SE-PRO1 Process Engineering	SE-HYD2 Hydraulic 2	SE-CMI1 Chemistry and Microbiology	SE-SEP3 Semester project 3	
2. Climate Change Adaptation and Environmental Impact	SE-SCI2 Thermo-dynamics and Particle Dynamics	SE-HYD1 Hydraulic 1	SE-CCA1 Climate Change Adaptation	SE-SEN2 Supply Engineering 2	SE-SEP2 Semester project 2	
1. Land development and infrastructural constructions	SE-SCI1 Mathematical Analysis	SE-CMA1 Construction management	SE-GEO1 Geology and Water	SE-SEN1 Supply Engineering 1	SE-SSE1 Study Skills for Engineering Students	SE-SEP1 Semester project 1

11 Annex 3. Study structure, intake 2019

Semester Topic	Course	Course	Course	Course / project	Course / project	
7. Electives	Elective course	Elective course	Elective course	SE-BPR2 Bachelor project		
6. Electives	CE-CMP2 Project and Construction Planning and Management	Elective course	Elective course	SE-BPR1 Bachelor-project Preparation course	SE-SEP6 Semester project	
5. Internship	SE-INP1 Internship					
4. Analysis of a supply district area	SE-SCI4 MATLAB	SE-MSC1 Material science and corrosion	SE-PNM1 Pipe Network Modelling	SE-INO1 Engineering Innovation	SE-SEP4 Semester project 4	
3. Process Engineering	SE-SCI3 Calculus and Particle Dynamics	SE-PRO1 Process Engineering	SE-HYD2 Hydraulic 2	SE-CMI1 Chemistry and Microbiology	SE-SEP3 Semester project 3	
2. Climate Change Adaptation and Environmental Impact	SE-SCI2 Thermo-dynamics and Particle Dynamics	SE-HYD1 Hydraulic 1	SE-CCA1 Climate Change Adaptation	SE-SEN2 Supply Engineering 2	SE-SEP2 Semester project 2	
1. Land development and infrastructural constructions	SE-SCI1 Mathematical Analysis	SE-CMA1 Construction management	SE-GEO1 Geology and Water	SE-SEN1 Supply Engineering 1	SE-SSE1 Study Skills for Engineering Students	SE-SEP1 Semester project 1

12 Annex 4. Course overview, learning goals and test form

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
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 physical, chemical and microbiological drinking water analyses	- 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.	Prerequisites: Mandatory assignments handed in before deadline and accepted. Type of examination: Individual oral examination with an internal examiner. Exam is without preparation and based upon course assignment(s) Allowed tools: Re-exam: Method will be similar to the ordinary exam.
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.	Exam prerequisites: None Type of exam: Individual oral exam with an internal examiner. Exam is without preparation and based upon course assignment(s) (Experimental reports) handed in before deadline and accepted. Course assignments account for 50% of final grade. Exam accounts for 50% of final grade. Tools allowed: NA

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
						Re-exam: Equal to the ordinary exam.
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	Prerequisites: Mandatory assignments handed in before deadline and accepted. Type of examination: Individual oral examination with an internal examiner. Exam is without preparation and based upon course assignment(s) Allowed tools: All tools allowed Re-exam: Method will be similar to the ordinary exam.
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	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	The course is evaluated based on: • 3 written individual course assignment • 1 written group assignment – The Project Description • Oral group presentation and defense of the Project Description Re-evaluations: Re-submission of a revised Project Description

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
				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).		
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.	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.
SE-BUD1	Basic Utility Design	5	Upon completion of the course, the student has gained knowledge of:	Upon completion of the course, the student will be able to:	Upon completion of the course, the student will be able to apply knowledge and skills to:	Prerequisites:

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
			Water cycle, that describes the continuous movement of water on, above and below the surface of the Earth, in order to understand the driving forces behind climate change effects such as flooding and water scarcity Components of water, wastewater and district heating systems Energy balance in order to understand energy systems and energy transfer in order optimize them and reduce the carbon footprint of heat production Mass balance as a tool for analyzing and describing physical systems such as wastewater treatment Quality requirements for water consumption and wastewater discharge	Use digital tools such as GIS, Heat Roadmap Europe and Scalgo-live Make basic analyzes for water and wastewater quality Calculation of system loading rates Calculation of water consumption, heat needed and wastewater produced	At a basic level suggest a process design for drinking water, wastewater and district heating Analyze demand and/or flows for a given area Relate the demands for the quality to the existing legislations Perform simple laboratory analyses Describe the components of each system	Mandatory assignments handed in before deadline and accepted. Type of examination: Assessed on the basis of four tests during the semester: Test 1 written, counts 25% Test 2 written, counts 25% Test 3 oral presentation, counts 25 % Test 4 written, counts 25 % Allowed tools: NA Re-exam: Individual oral examination without preparation based upon a subject found by draw (not course assignments).
SE-CCS1	Climate Change and Sustainability	5	Upon completion of the course, the student has gained knowledge of: Climate and weather systems Climate changes and impacts on society and the utility sector Climate change adaptions	Upon completion of the course, the student will be able to: Identify suitable processes for handling surface water	Upon completion of the course, the student will be able to apply knowledge and skills to: Evaluate and suggest solutions for sustainable urban drainage Identify areas of synergy between climate change adaption, heating supply, water supply and wastewater supply	Prerequisites: Mandatory assignments handed in before deadline and accepted. Type of examination: Assessed on the basis of 4 tests during the semester. Test 1 written, counts 25% Test 2 written, counts 25% Test 3 oral presentation, counts 25 % Test 4 written, counts 25 % Allowed tools: NA Re-exam: Individual oral examination without preparation based upon

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
						a subject found by draw (not course assignments).
SE-CMI1	Chemistry and Microbiology	5	- Describe and differentiate the different types of chemical bonds and intermolecular forces (ionic, covalent, metallic, hydrogen, van der Waals) and give specific examples of chemical compounds for each type. - Explain chemical equilibrium and carry out calculations with the Law of Mass Action. - Explain the terms kinetics, reaction order, reaction mechanism and activation energy. - Describe various aspects of aqueous solutions (solubility, speciation, Ionic Strength). - Carry out solubility calculations using the Debye-Hückel equation. - Define acids, bases and buffers and calculate pH in solutions of strong and weak acids and bases and buffers. - Calculate oxidation numbers and balance redox reactions. - Describe the use and making of Pourbaix diagrams. - 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.	- Apply basic chemical and microbiological methods to address issues relevant for cases related to process facilities of drinking water, wastewater and district heating. - Evaluate results of chemical kinetics by calculating and graphing various reaction orders. - Evaluate the principles and application of various methods of chemical instrumental analyses (e.g. UV/VIS spectroscopy, gas chromatography) for water samples. - Compare and evaluate the application of culture-based (e.g. HPC), enzymatic (e.g. ATP) and molecular biology (e.g. PCR) methods for water samples. - 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.	Prerequisites: Mandatory assignments handed in before deadline and accepted. Type of examination: Two written tests will be included in the course. 4 hour written exam with an external censor. Allowed tools: During the two written tests, *no* material aids are allowed. During the written exam, *all* material aids may be used. Re-exam: Method will be equal to the ordinary exam.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
			- Explain AOC, BDOC, biological stability and aftergrowth. - 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-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.	Exam prerequisites: Two course assignments approved. Type of exam: Individual oral exam based on mini project handed in before deadline. Internal assessment. Tools allowed: NA Re-exam: Equal to the ordinary exam.
SE-DWT1	Design of Wastewater Treatment Plant	5	Knowledge of designing basic treatment facilities in order to remove grease and oil, sand and gravel, suspended solids, organic matter and ammonia. Establishing of a simple flow diagram and understanding of the internal relations between functions. Knowledge of hydraulic demands within the individual cleaning functions as	Able to design a mechanical – chemical and biological WWTP. Able to describe necessary supervision and control of a WWTP. Calculation of volume of sand and grease trap. Calculation of primary settlement tank. Calculation of biological tank with nitrification Calculation of secondary settlement tank	Knowledge about treatment methods and their depending of previous treatments of the wastewater. Comparing different treatment systems and able to choose the right one for the actual case. Design treatment functions applying methods in order to reduce energy consumption. Use optimal hydraulic design in order to	Prerequisites: Course assignments handed in before deadline. Type of examination: 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%. Internal assessment.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
			well as the whole plant. Composition of wastewater and its significance in wastewater treatment. Recognition of wastewater cleaning methods related to the different wastewater treatment methods. Ability to find the right design of WWTP according to the actual outlet demands and geological conditions. Possible cleaning achievement from the different treatment methods and systems.		avoid unwanted settlement within the system. Analyse a specific wastewater flow and outlet demands in order to establish the necessary treatment plant. Explain the design criteria from an environmental point of view, create a flow diagram, and plan drawing of the WWTP according to this.	Allowed tools: NA Re-exam: Method will be similar to the ordinary assessment (new assignments).
SE-DWT2	Design of Wastewater Treatment 2	5	Concepts and assessment methods involved in providing basic understanding of activated sludge process and the possibility of achieving biological cleaning of wastewater. Usage and application of design models and constructions. Knowledge of the impact on the biological process from outside factors. Ability to find needed constructions and process to create the wanted level of treatment.	Able to calculate an activated sludge process tank with removal of organic matter, nitrogen and phosphor. Standards for sludge characterization. Analytical methods in identifying needed treatment of the wastewater. Principles and application of advanced as well as simple treatment methods. Functioning skills necessary to get a satisfying profit from working in groups	Characterize different treatment methods with respect to physical, chemical and microbiological parameters. Evaluate wastewater data and from this being able to describe a suitable cleaning method. Present results to the actual client in a clear and simplified way. Analyse a situation with inefficient treatment and find a way of improving this using learned treatment methods and skills.	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: NA Re-exam: Equal to the ordinary assessment (new assignments).
SE-GPT1	Geophysics and Pump Test	5	By the end of the course the student must be able to • design a well site and suggest relevant geophysical pre-investigations. • plan and interpret well tests. • estimate the long-term drawdown and evaluate the risk of contamination of the aquifer.	After completion of the course, the student must • Be able to analyze and calculate flow and pressure variations for simple groundwater models. • Be able from the target and expected geophysical properties of soils or rock in an area to suggest geo-physical method and strategy for mapping of relevance to ground water	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.	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.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
				mapping. • Have acquired knowledge on geoelectrical and electromagnetic geophysical methods, their principles and applications. Be able to discuss results and uncertainties. • Have acquired basic knowledge of other geophysical methods. Be able to list alternatives to geoelectrical and electromagnetic methods and their application. • Be capable of planning and interpreting well test analysis for a specific problem. • Be able to discuss what to focus on in risk assessments related to ground water extraction. • Be able to estimate the long-term influence of ground water extraction e.g. changing flow directions, effect on surface waters, salt water intrusion and mobility of contamination. • Be aware of water balances and parameters to evaluate for planning of sustainable water extraction.		Tools allowed: All tools are allowed. Re-exam: Equal to the ordinary exam.
SE-HYD1	Basic Hydraulics and design of sewer systems	5	After completion of the course, the student must have the knowledge of: •The physics of basic hydraulics •Pump selection and dimensioning of pumping plant •The design of dewatering systems •The design of sewer system	After completion of the course, the student must have the skills to: <u>Basic Hydraulics</u>: •Determine type of flow •Use energy equation •Calculate single and pipe losses •Calculate hydraulic and energy grade line •Use resistance, exponential and C&W's formula •Calculate combined networks	Competences After completion of this course, the student must have the competences to: •Understand hydraulic problems •Dimension a pump or a pumping plant by using performance curves •Plan and dimension: ◦Urban sewer systems ◦Dewatering systems along roads in rural areas	<u>Prerequisites</u>: NA <u>Type of examination</u>: 1 hand-in mandatory group assignment in the end of the semester, which counts for minimum 80% of final grade. Individual volunteering assignments solved during classes, which can count for up to 20% of final grade.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
				•Dimension a pump or pumping plant Sewer systems: •Design and dimension rain water and waste water pipelines •Perform back water calculations •Design CSOs/weirs and basins		If no volunteering during class, final hand-in counts for 100% of final grade. Allowed tools: NA Re-exams: 3 hours written exam
SE-HYD2	Hydraulic 2	5	Upon completion of the course, student should have acquired knowledge of: - Types of pipe systems and its appurtenances. - Losses in pipes and manholes. - Hydrologic calculations. - Design of storm drainage systems. - Design of Sewer networks. - Calculation of backwater calculations. - Design of water supply networks.	Upon completion of the course, student should have acquired skills to: - Assess the site area with problems in drainage and to propose possible solutions for those problems. - Analyse the terrain levels and able to decide the placement of pipes and manholes. - Estimate the storm water, wastewater and drinking water for the required pipe systems. - Analyse the existing systems and design of new pipe networks as required. - Analyse the pump capacity and design of pumping station.	Upon completion of the course, student should have acquired the competencies to: - Manage all the phases of sewer, rain water and water supply networks with the acquired knowledge and skills in order to evaluate the new construction related challenges. - Apply a varied set of technical and practical skills related to developing, designing and sizing of pipe networks for the above. - Estimate and design storm water and wastewater pipelines. - Estimate and design water supply pipelines. - Estimate the capacity of pumps and design of pump stations.	Prerequisites: Mandatory assignments handed in before deadline and accepted. Type of examination: Individual oral examination with internal examiner. Exam is based upon course assignment(s) and without preparation. Allowed tools: All tools are allowed. Re-exam: Method will be equal to the ordinary exam.
SE-INF1	Infrastructure - Highway Design in rural Areas	5	After completion of the course, the student must have the knowledge of: •Road types and planning •Traditional asphalt types and use of these in road constructions •Design of pipe, channels and basins with Mike Urban	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	After completion of this course, the student must have the competences to: •Determine a roads lay-out in regards to Danish Roads Standards and place pipes and cables in a road	Prerequisites: The students must solve course assignments based on the knowledge and skills achieved through the course. The assignments must be handed-in before deadline, and the students will be graded based on these assignments. Evaluation: The course assignments must be handed-in on time, and the assignments will be graded. Re-exams: Course assignment must be

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
				•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 •Generate local rains •Use Mike Urban to create complete dewatering systems •Setup drawings (plans and longitudinal profiles)		improved and handed-in, and the assignments will be graded. Any second resit is an individual oral exam without preparation based upon a subject found by draw (not course assignments).
SE-INO1	Engineering Innovation Weeks (SE)	5	After having successfully completed the course, the students will have gained: - An understanding of innovation and its uses within the field of engineering. - Knowledge about Design Thinking (double diamond) process. - Knowledge about how to create a systematic and measurable progress in innovation tasks	After having successfully completed the course, the students will be able to: - Engage in innovative processes in a cross-/inter-/multidisciplinary setting. - Conceive, plan, and execute innovative ideas. - Work methodically with innovation. - Collect and apply relevant information about technologies, markets and end users	After having successfully completed the course, the students will have gained competences in: - Introducing innovative ideas into project work. - Contributing own professional skills in teams with the objective of solving problems by using innovative processes and models. - Clarifying multidisciplinary group competencies	<u>Prerequisites</u>: Mandatory assignments handed in before deadline and accepted. Attendance 80% <u>Type of examination:</u> Individually writtten multiple choice test, with a duration of 30 minutes, performed without aids. Internal examiner. (20/25 correct answers is required to pass the test). <u>Allowed tools:</u> No tools allowed (besides laptop for test) <u>Re-exams:</u>
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-	Assessed on the basis of mandatory assignments: • Expected outcome/specific learnings targets for the internship position • Company presentation • Logbook • Main academic assignment(s) • Final reflections • Recommendation letter from the company • Participation in workshop for coming interns

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
					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-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.	Students completing this course will be able to: - Define comparable scenarios for competing production/service systems in order to analyze 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.	Exam prerequisites: None Type of exam: A case based written exam, 48 hours. Internal assessment. Tools allowed: All Re-exam: Same as the ordinary exam, with new assignment, or re-exam may be oral, 20 minutes.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
				- Evaluate business cases in relation to fulfilling the SDG. - Promote circular economy as an innovation tool for companies.		
SE-MAL1	MATLAB	5	After completion of the course the students have gained knowledge on the following: - Describe and differentiate the different types of graphical objects in MATLAB. - Explain how graphical object creation functions operate. - Explain the principle of the dot notation for graphical objects. - Explain how parameters can be set on objects - Describe various parameter values that affect the variables. - Carry out data transport between Excel and MATLAB. - Carry out characteristics of probability density functions and their cumulative distribution functions for random variables, such as mean, variance, standard deviation and coefficient of variation and modus, median and other percentiles. - Use MATLAB built-in statistics functions incl.: pdf, cdf and others - Carry out the programmatic layout of an APP by a MATLAB function. - Use the object types: figure, uipanel, uicontrol, axes, line, text and patch for the programmatic creation of the graphical user-interface. - Define sub-functions with varargin & varargout capabilities. - Define event handler functions	After completion of the course the student will be able to: - Layout the graphical user interface for an APP - Identify the graphical objects to undertake the tasks and operation - Combine the objects so that the graphics and the engineering numeric can interact via callback objects - Create an APP with a dedicated user interface; however with a limited scope.	After completion of the course the students will have introductory competences in programmatic APP creation that meets latest APP development features of the MATLAB environment.	<u>Prerequisites:</u> 100% of the criteria below must be met. <u>Type of examination:</u> The assessment is based on the following criteria. 1. All home assignments, must be handed in on time and be approved. (20%) 2. The mini-project must be presented and the technical documentation must be handed in no later than the day of presentation. The mini-project must be approved as a hole. (80%) <u>Allowed tools:</u> Not applicable <u>Re-exams:</u>

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
			(callbacks) for uicontrol objects. - Handle the updating of objects programmatically by event handlers. - Combine structural APP elements such as INIT, EVAL, EVENT, LOAD & SAVE. - Analyse error messages and adjust and optimize codes accordingly. - Create dedicated APPs that can undertake a small task within the field of supply engineering.			
SE-MSC1	Material Science and Corrosion	5	After completion of the course the student must be able to: - Demonstrate basic knowledge about metals and polymers - Apply standard test methods - Explain deformation, stresses and fracture in tension-loaded materials - Be familiar with the topics Corrosion Management and Failure Analysis	After completion of the course the student must be able to: - Select a suitable material for the manufacture of components in the supply industry - Carry out common test methods for materials - Explain the relation between deformation, stresses and fracture in tension-loaded materials - Explain relevant degradation mechanisms of materials specific to the supply industry - Carry out corrosion investigation of selected materials/components from the supply industry	After completion of the course the student must be able to: - Participate in development tasks covering the design and/or evaluation and improvement of components for the supply industry - Combine data from various sources for developing an improved corrosion management strategy - Analysed corrosion failures and link to corrosion industry standards Furthermore, the student should be capable of seeking, validating and implementing additional knowledge within the subject, on his or her own	Prerequisites: Course attendance min 75% Type of examination: 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 Allowed tools: NA Re-exam: Oral re-exam based upon a subject found by draw, 20 min. with no preparation. Internal assessment
SE-PNM1	Pipe Network Modelling	5	Identify the elements of a pipe network and describe their relations. Collect and critically assess the data for the model. Understand the function of a pipe network mode. Understand how to calibrate a pipe network model. Data input and operation of Aquis. Data input and operation of MIKE Urban. Data input and operation of Energis	Build and calibrate pipe network models in Aquis, Energis and MIKE Urban. Use the models for analyzing a pipe network. Suggest optimizations of a network based on the model results. Create and analyse scenarios. Use the model tools to propose solutions for a given network problem	Ability to create and analyse scenarios in the modelling tools Aquis, Energis and MIKE Urban Ability to critically assess an existing pipe network and suggest improvements. Ability to critically assess data validity. Ability to design and dimension pipe networks in new supply areas. Ability to analyse the	Prerequisites: Mandatory course assignments completed, handed in before deadline and accepted. Type of examination: Course assignments account for 100% of final grade. The exam is in the form of an internal assessment.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
					influence of thermal storages in a district heating network.	Allowed tools: All tools allowed. Re-exams:
SE-PRO1	Process Engineering 1	5	The student will become familiar with process principles, gain knowledge about specific unit operations, gain knowledge about instrumentation and components, understand industrial control systems and process optimization.	After completion of the course the student will be able to: Prepare Piping and Instrumentation Diagrams for an existing plant Demonstrate skills in calculating mass balances Identify relevant sensors and instruments in the process system. Calculate residence time distribution in reactors. Make design decisions and evaluate alternative designs. Analyse acquired data and suggest optimizations. Calculate key parameters of heat exchangers. Build simple model of automation in praxis or/and Simulink	After completion of the course the student will be able to: Analyse processes in a supply plant. Suggest potential optimization initiatives	Prerequisites: Course attendance incl. lab exercises min 75% Type of examination: 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 Allowed tools: NA Re-exam: Oral re-exam based upon a subject found by draw, 20 min. with no preparation. Internal assessment
SE-SEP1	Semester project 1 - Sustainable Urban Development	5	The students must obtain an understanding of planning and design of sustainable infrastructural constructions and climate change adaptation in urban area. The students must gain basic knowledge in the processes for producing drinking water, treating wastewater and producing heating.	Through the design of a sustainable urban supply structure, the student must become familiar with organisation/stakeholders basic understanding of all 3 utility types in terms of resource, production, processes (plant), consumption/demand, understand the interconnectedness of the 3 utilities (and synergies). Through completion of the project, group cooperation, report writing and presentation	At the end of the semester, the students must be able to: Analyse and design supply systems for a small urban area using competencies, skills and knowledge obtained in the individual courses including • Applying sustainability as a concept • Analyse and calculate demands for supply • Identify resources for water and energy supply.	Prerequisites: Project description must be duly handed in and approved in order to register for exam in the semester project. Type of examination: Group examination consisting of an oral presentation of the project followed by an examination with an internal examiner. Grades will be individual. Allowed tools: The handed in project.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
				technique will be put into practice.	• Identify wastewater treatment solutions • Stormwater handling • Include basic economic and technical aspects	Re-exam: Students who fail a semester project in January must attend an information meeting on the last Friday in June. At this meeting, the students will get information on specific deadlines as well as the process of re-exam. They will form new groups, if possible in relation to the number of failed students at the individual semesters. Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Deadline for hand in of the project is mid-August (exact date will be informed at the meeting). There will be no guidance in the period up to hand in. The project is assessed at an oral exam.
SE-SEP2	Semester project 2 - Climate and EIA Screening	10	The students must obtain an understanding of EIA Screenings, the use of geographical data and geographical information systems and furthermore, they must be skilled in the execution of projects within this area. The student must obtain knowledge on climate adaptation, possibilities and solutions. The student must obtain the necessary insight and understanding to be able to make a project what solves the climate change problems in a local area to prevent flooding of	To show understanding of the entire project complexity • To use the gained theoretical knowledge in practical activities • To analyse and use data • To set up, describe and interpret the collected data, including the development of individual competencies • To describe and complete a report, including presentation material • To present the project material	After the semester project, the student will be able to apply knowledge and skills to: • Interpret and use relevant data e.g. geological, climatic and hydrological and maps for Denmark using GIS tools for planning and conducting of an EIA screening. • Conduct an EIA screening • Be able to participate in the daily work of planning and operating within the contracting, consulting or public corporation in terms of knowledge of the juridical and legal framework for the company when conducting an EIA Screening.	Prerequisites: Project description must be duly handed in and approved in order to register for exam in the semester project. Type of examination: Group presentation followed by an individual examination with an external examiner. Allowed tools: NA Re-exam: Students who failed a semester project in June must attend an information meeting on the last

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
			buildings and other value constructions or infrastructure. The student will be able to use basic hydraulic principles to select and design hydraulic system to solve the existing problem.		• Assess data for the structural design in a climate adaptation project • combine/select different solutions for a project and assess the final result • know how to create ownership of a project to the citizens and stakeholders • construct a local solution to prevent flooding • evaluate the solution	Friday in June. At this meeting, the students will get information on specific deadlines as well as the process of re-exam. They will form new groups, if possible in relation to the number of failed students at the individual semesters. Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. Deadline for hand in of the project is mid-August (exact date will be informed at the meeting). There will be no guidance in the period up to hand in. The project is assessed at an oral exam.
SE-SEP3	Semester project 3	10	After completing this course the student has knowledge on how to: - Describe the major subjects in process engineering - Identify various units of a supply plant - Describe the function of each unit	After completing this course the student will be able to: - Illustrate a supply plant by construction of a simple Piping and Instrumentation Diagram (P&ID) - Demonstrate material balances for the overall process and for one or more specific compounds - Hydraulics: 1) Make a flow diagram for a supply plant, 2) Calculate head/pressure loss, 3) Calculate retention time - Setup a simple model for a supply plant in MATLAB - Present names of microorganisms using correct nomenclature - Describe beneficial or harmful effects of one or more groups of microorganisms - Present chemical reactions with correct notification	After completing this course the student will be able to apply knowledge and skills to: - Analyse a supply plant - Suggest potential process optimizations - Cooperate in a group effort	<u>Prerequisites</u>: Mandatory assignments handed in before deadline and accepted. <u>Type of examination</u>: Group presentation followed by an individual examination with the presence of the whole group and an external examiner. <u>Allowed tools</u>: All tools are allowed. <u>Re-exam</u>: Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. The students will be informed of specific deadlines as well as the process of re-exam.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
				- Setup chemical reactions for one or more relevant processes - Evaluate if the supply plant meets water quality requirements for one or more parameters - Describe instrumentation and components relevant for the supply plant - Plan, write and review a Project Report and a Process Report - Prepare and carry out an oral presentation		They will form new groups, if possible in relation to the number of failed students at the individual semesters. There will be no guidance in the period up to hand in. Grade is given on the basis of the updated or new project without oral defence.
SE-SEP4	Semester project 4 (update in progress)	10	The project is based on an analysis of a supply district area The area is analysed in terms of utility, consumer patterns, local plans and supply potential and forecasting of changing supply needs and suggestions for correcting and expansion of the pipeline network. Academically it is based on the overall well-known and well-defined methods and with a close relationship to the way land development is carried out today in practice. The training will be based on the latest knowledge and application of current theory and principles.	• To show understanding of the entire project complexity • Skills in applying learned knowledge to the solving of practical project work. • The ability to plan and complete practical project works. • Skills in communication of the project results to the client. • To use the gained theoretical knowledge in practical activities • To analyse and use data • To set up, describe and interpret the collected data, including the development of individual competencies • To describe and complete a report, including presentation material • To present the project material The course includes IT as a pedagogical method. The purpose is to support the students' learning processes and their understanding of the engineering opportunities, which is part of e.g. the use of modelling, simulation etc. Analyses of the team on basis of a Belbin test. Group formation		<u>Prerequisites:</u> Project description must be duly handed in and approved in order to register for exam in the semester project. <u>Type of examination:</u> Evaluation of the project will be based on presentation and conversation about the project work at an oral exam with an internal examiner. <u>Allowed tools:</u> NA <u>Re-exam:</u> Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. The students will be informed of specific deadlines as well as the process of re-exam. They will form new groups, if possible in relation to the number of failed students at the individual semesters. There will be no guidance in the period up to hand in.

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				and analyses of the strength and weaknesses of the group. You must put out a contract for the group. At the end of the project period, the group must reflect on the cooperation in the group, on basis of the teams Belbin profile.		Grade is given on the basis of the updated or new project without oral defence.
SE-SEP6	Semester project 6	10	After completing this course, the student has knowledge on how to: Plan the work process in problem solving Identify the data relevant for clarifying the problem in question Collect the data from the existing sources such as databases, literature, fieldwork, lab work, interviews, etc. Critically asses and analyse the collected data.	After completing this course, the student must be able to: Demonstrate overview and structure in problem solving Collect and analyse data in order to support a work hypothesis Show source criticism Draw conclusions based on the data analysis carried out, combined with the knowledge acquired in the previous semesters and practical placement. Put the results of the work in perspective and give recommendations for actions and/or further investigations • Illustrate the results with relevant diagrams • Plan, write and review a project report • Prepare and carry out an oral presentation	After completing this course, the student will be able to apply knowledge and skills to: • Analyse a complex problem • Draw scientifically based conclusions • Demonstrate an independent and self-governed work process	<u>Prerequisites:</u> Project handed in before deadline. <u>Type of examination:</u> Group presentation followed by an individual examination with the presence of the whole group. Assessed by an external examiner. <u>Allowed tools:</u> All tools allowed <u>Re-exam:</u> Students who failed a semester project have to improve the project. There will be no guidance in the period up to hand in. The project is assessed at an oral exam.
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	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	Characterize different sludge sources with respect to physical, chemical and microbiological parameters. Obtain and evaluate empirical data from laboratory experiments. Report results from laboratory analyses. Create, compare and evaluate the feasibility of different sludge management techniques based on sludge origin. Analyse a situation with inefficient sludge management technique and find	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

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			(sludge composition) and sludge management techniques. Quality criteria definitions for possible management technique	related to sludge management techniques	way of improving existing management method, including how to collect data and select the appropriate analyses, etc.	Tools allowed: All tools allowed Re-exam: Equal to the ordinary exam. (Based on new assignments)
SE-SSE1	Study Skills for Engineering Students	5	The student should be able to: • Explain the study activity model (SAM), and SOLO taxonomy and describe their uses • Explain the strengths and weaknesses of Problem-Based Learning (BPL) • Outline the stages of team development (such as the Tuckman stages) and how this model can be of use to a project team • Describe the purpose of a project report and a process report and explain the content of the typical main sections of each • Explain the phases of a project (project initiation, project definition, project execution and project evaluation) • List the features of academic writing and understand the concept of plagiarism • Define the characteristics of reliable sources (source criticism) • Outline cultural traits that can influence team work in a project	The student should be able to: • Apply good study techniques for time management, reading and note-taking in an intentional manner • Prepare and deliver oral presentations • Create and execute search strategies to find relevant literature • Give and receive peer-to-peer feedback and feed forward • Write a project description, project report and a process report for a semester project following the VIA Engineering guidelines.	The student should be able to: • Reflect on active learning and how take responsibility for own learning • Analyse and apply team dynamics such as communication, motivation, decision-making and conflict resolution.	Assessed on the basis of course assignments: 1.Class attendance of 80% or greater (mandatory) 2.A set of notes on 20-30 YouTube videos (mandatory) 3.A set of self-made definitions of selected terms (mandatory) 4.Written test on Project Guidelines 5.Written test on course Learning Objectives 6.Delivery of an oral presentation 7.Short-answer test on academic writing and preparation of an executive summary
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.		Exam prerequisites: None Type of exam: Individual oral exam, 20 min., based on one course assignment handed in before deadline. Internal assessment.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
				• 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.		Tools allowed: None. Re-exam: Equal to the ordinary exam.
SE-TBD1	Tool Box Drinking Water	5	Understand complex drinking water treatment technologies. Combine information from different sources. Reflect on researchers' findings, policies, legislation etc.	Critical review of scientific papers. Compile and give presentations based on a number of papers with opposing views on a given topic. Analyse information from different sources and present a structured summary Argue the pros and cons of the presented topic	Ability to apply critical thinking to scientific papers, reports, legislation. Ability to reflect on the implications of applying a given technology, law or approach in a given situation. Ability to compare different technologies, policies etc., in different settings.	Prerequisites: Mandatory course assignments completed, handed in before deadline, and accepted. Type of examination: Individual oral exam without preparation based upon course assignments. The exam is in the form of an internal assessment. Allowed tools: All tools allowed Re-exams:
SE-TER1	Thermodynamics and Particle Dynamics	5	The students will get knowledge about: Kinematics of a particle and kinetics of a particle or systems of particles using x-y and n-t coordinate systems, steady flow of a fluid stream. The basis of thermodynamics, ideal gases and reversible processes, the second law of thermodynamics and entropy, real substances, heat transfer/heat exchangers.	After completing the course the student will be able to: Analyse a particle dynamic system and/or a simple thermodynamic system and identify and select relevant theory so the student is able to perform serial mathematical calculations on variables and main capacities for the system. • Able to solve simple technical problems on the basis of fundamental calculus and dynamic or thermodynamic laws. • Follow simple procedures with	After completing the course the student can: Identify which parts of the acquired knowledge and skills that´s relevant to a given simple real-world particle dynamic or thermodynamic problem. Relate the acquired knowledge and skills to create simple mathematical models of real-world particle dynamic or thermodynamic problems. Use their acquired skills and knowledge to study more Dynamics and Thermodynamic courses on the Supply	Prerequisites: Upload in WISEflow of selected course assignments solved during course, approximately one week before the oral exam. Type of examination: Individual oral exam with an internal examiner, 20 min. Exam is without preparation and based upon course assignment(s) found by draw. Allowed tools: None

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
				different techniques of stating and solving dynamic or thermodynamic problems. • IT is used in a pedagogical method in the course. The aim is that IT will support the learning process of the students and their understanding of the engineering professional possibilities in, for example, the application of modelling, simulation, etc.	Engineering education. Use a commercial mathematical software to solve and perform serial technical calculations.	Re-exam: Method will be equal to the ordinary exam.
SE-UTS1	Utility Sector	5	Upon completion of the course, the student has gained knowledge of: Basic parameters defining utility services within drinking water, district heating, storm water and wastewater The utility framework and legislation in Denmark Community/publicly owned utilities	Upon completion of the course, the student will be able to: Identify stakeholders in the utility sector Suggest suitable resources for heating and drinking water Suggest suitable solutions for handling wastewater and storm water In general terms describe the legal framework concerning utility companies	Upon completion of the course, the student will be able to apply knowledge and skills to: Perform a simple feasibility study for a wastewater/storm water, drinking water and district heating project	Prerequisites: Mandatory assignments handed in before deadline and accepted. Type of examination: Assessed based on 4 tests during the semester. Test 1 written, counts 25% Test 2 written, counts 25% Test 3 oral presentation, counts 25 % Test 4 written, counts 25 % Allowed tools: NA Re-exam: Individual oral examination without preparation based upon a subject found by draw (not course assignments).
CE-CMP2	Project and Construction Planning and Management	5	The student will obtain knowledge of requirements for project management and project planning, get knowledge of building projects phases, organizational and contractual relationship. The student will obtain a basic knowledge of procurement and tender legislation in Denmark, the EU,	Upon completion of the course the student should: • Be able to perform planning analyses and communication strategies for stakeholder management. • Possess knowledge of project phases and their contents related to contractual issues in according to the Danish AB18 –		Prerequisites: None Type of examination: Oral team examination – presentation and defence - with internal or external examiner. Team members are all present during the whole examination. Is based on a summary and

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
			and internationally. Furthermore, the student will obtain a basic knowledge of process management, risk management, Last Planner System and Lean Construction.	system and FIDIC. • Possess knowledge of a building projects contracting and subcontracting relationships. • Be able to perform a tendering procedure using legislation and processes for national (Danish), and international (EU) tenders. The course will thus enhance the student's ability to participate in the daily work of planning and operating within the contracting, consulting and client corporation in terms of knowledge of the juridical and legal framework and procurement. • Posses knowledge of process management, risk management, Last Planner System and Lean Construction.		presentation of completed papers answered throughout the semester. Allowed tools: NA Re-exam:
CE-GSW1	Engineering Geology and Soil Works	5	After completion of the course, the student must have knowledge about: Engineering Geology: - The important geological processes and resulting materials in Denmark - The different types of geological maps and borehole information's and how this information is obtained digital and how they are used in consideration of expected soil layers in a given area. - The most common soil types and their Geotechnical characteristics as well as potential for re-use. - Ground water and ground water flow - Climate change - Contaminated soil: classification of sites and its and	After completion of the course, the student must be able to: Engineering Geology: - Recognize and describe the most common types of soil. - Carry out a hand drilling, collect samples, and perform common laboratory tests. - Gather geological information about a given area and draw a cross section from given boreholes and illustrate expected soil layers between boreholes. - Develop a cross section showing the potential for re-use of soil. - Use databases and maps for preliminary screening of a given area for contaminated soil - Assessment of soil handling on the basis of contamination risk and area classification	Engineering Geology: - Evaluate expected soil layers and ground water conditions for a given area/site and conclude related consequences for the given construction project on the site. Management: - Understand the complexity of planning in general. - Planning of soil works in connection with a road construction project	Prerequisites: Semester tests completed on time. Type of examination: The Students are graded based on the basis of course assignments and/or tests during the course. Allowed tools: None Re-exams: Individual oral exam with an internal examiner. Exam is without preparation based upon a subject found by draw. Any second re-exam will be held similar to the first re-exam.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
			influence on soil handling. Construction Management and Planning: - Basic planning methods - Most common planning tools including IT-tools - The relationship between manpower, machinery and materials - Planning and execution of soil works	Construction Management and Planning: - Divide a process into activities and estimate their time consumption. - Identify processes and links between activities. - Analyse, choose and apply appropriate planning tools. - Document and carry out resource planning through MS Project - Calculate quantities and define duration of soil works tasks		
CE-SCI1	Mathematical Analysis	5	The student will get knowledge about: • Differentiation • Trigonometric functions • Exponential functions • Integration • Vectors in space • Vector functions in space	After the completion of the course, the student will be able to: • Identify and make simple calculation on selected transcendental functions • Identify and make simple calculation on the branch of infinitesimal calculation, which deals with finding the derivative of functions with one variable, including different applications thereof • Identify and make simple calculation on the branch of infinitesimal calculation, which deals with integration of functions with one variable and different applications thereof • Analyse vectors and motion in space and perform calculations based on vector operations. IT is used in a pedagogical method in the course. The aim is that IT will support the learning process of the students and their understanding of the engineering professional possibilities in, for example, the	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.	Prerequisites: None Type of examination: 4 hours written exam with an external examiner. Allowed tools: All tools allowed, apart from the internet. Re-exam: Method will be equal to the ordinary exam.

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
				application of modelling, simulation, etc.		
CE-SCI2	Calculus, Linear Algebra and Dynamics	5	The student will get knowledge about: • Application of integration • Matrixes and matrix algebra • Linear equation systems • Polar coordinates • Complex numbers • Ordinary differential equations of the 1st 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 Law´s 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.	<u>Prerequisites:</u> Upload of course assignments in WISEflow approximately one week before the exam. <u>Type of examination:</u> Individual oral examination with an internal examiner. 20 min. Exam is based upon course assignment(s) found by draw and without preparation. <u>Allowed tools:</u> None <u>Re-exams:</u> Method will be equal to the ordinary exam.
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.	<u>Requirements for attending exam</u> No requirements <u>Type of exam:</u> Test + mini-project with individual oral exam 2 tests have a weight of 20% each The mini-project is weighted with 30% and the oral exam is weighted with 30%. Intern assessment Censor: Internal

Code	Title	ECTS-points	Knowledge	Skills	Competences	Test
						Allowed tools: All Re-exam: As ordinary
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 analyses, environmental issues)	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.	Prerequisites: Course assignments account for 40 % of final grade; it is divided into 20% for 2 assignments and 20% for 1 mini project. The final exam will count 60%. The final exam divided into: a. Oral evaluation on the mini project (30%) b. Additional question from draw on the spot (30%) Type of examination: Individual oral examination based upon a subject found by draw and mini project discussion. Censor: Internal Allowed tools: None Re-examination: Course assignments account for 40 % of final grade while the final re-exam count 60%. The students might asked to do new mini project if required, improve the already submitted one or keep it without improvement.