Bring Ideas to Life
VIA University College

Curriculum

Programme section

Bachelor of Engineering in Civil Engineering

Applicable to students enrolled in August 2021.

Students enrolled before August 2021 will follow the structure and subjects of the curriculum 2017.
In case of a delay in a student's study programme, the design of a personal study plan may lead to a transition to this curriculum.

Updates august 2022:
- course in the 4th semester replaced (SUD/HYD)
- CE-BPR1, content and assessment
- electives
- conditions for obtaining speciality designation (Structural Design)

Updates February 2023:
- technical updates of 4th semester (running spring 2023 for the first time)

Updates August 2023:
- clarification of exam prerequisites, 5th to 7th semester (autumn 2023 - autumn 2024)
- list of elective courses updated

Updates February 2024:
- technical updates of 6th and 7th semester (running spring and autumn 2024)

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Introduction

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

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

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

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

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

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

1 Identity of the programme

We educate and train the future engineers to have basic knowledge of building and civil works.

The aim of the programme is to train engineers for design and project management within
- Building constructions and energy design
- Geotechnical structures
- Infrastructural structures

and to participate in the construction management and planning.

The degree programme focuses on digitalisation, sustainability and climate adaptation.

The aim of the programme is also to educate independent and problem-oriented graduates with competences in applying the profession's methodologies and communicating issues and results, and that they are able to participate in national and international teams.

2 Graduate profile for VIA Engineers

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

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

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

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

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

3 Teaching and working methods

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

Active and practice-oriented learning is supported by:

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

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

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

Online/virtual elements can be included in the teaching.

4 Structure and content

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

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

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

New students are admitted every year in August.

The study includes:

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

One semester consists of 3-4 delimited courses. One course may have a volume of 5 ECTS points, and a project may have a volume of 10 to 15 ECTS points.

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

There are 5 workshops at the civil engineering programme.

The programme is structured as illustrated below:

Semester Theme	Course	Course	Course	Course/project	Course
7. Electives	Elective course	Elective course	Elective course	CE-BPR2 Bachelor project	
6. Electives	CE-CMP2 Construction Management and Planning (compulsory)	Elective course	Elective course	CE-BPR1 Bachelor Project Preparation course	ENG-IDE1 Semester Project Innovation and Entrepreneurship
5. Internship	CE-INP1 Internship				
4. Urban Infrastructure and Climate Adaptation	CE-HYD1 Basic Hydraulics	CE-KON4 Design of Simple Steel Structures and Stability of Shear Wall Buildings	CE-GEA2 Geotechnical Engineering and Civil Works	CE-INF2 Road Design in Urban Areas	CE-SEP4 Semester Project
3. Office Buildings	CE-BET1 Basic Material and Concrete Structures	CE-KON3 Theory of Elasticity with a focus on Basic Steel Structures	CE-CMP1 Planning of Construction Site Design and Execution of Construction in In Situ Cast Concrete and Prefabricated Concrete Elements	CE-BEN2 Building Services, Indoor Environment and Energy Demand Analysis	CE-SEP3 Semester Project
2. Road Construction in Rural Areas	CE-SCI2 Calculus, Linear Algebra and Dynamics	CE-KON2 Statics and basic elastic calculation of stresses.	CE-GEA1 Engineering Geology and Geotechnical Engineering	CE-INF1 Infrastructure in Rural Areas	CE-SEP2 Semester Project
1. Small Sports or Industrial Buildings	CE-SCI1 Mathematical Analysis	CE-KON1 Basic Static Analysis and Load Determination	CE-BDE1 Building Design	CE-BEN1 Building Physics and Building Energy Demand	CE-SEP1 Semester Project

Workshops are structured as illustrated below:

Semester	Course
1. semester During the semester	Workshop 1: • Company visits • Construction site visits • Modelling workshop
2. semester During the semester	Workshop 2: • Workshop within digitalisation and sustainability
3. semester Before the semester	Workshop 3 • Welding and Plumbing • Introduction to MagiCad
3. semester Before the semester	Workshop 4 • Activities in Concrete Laboratory • Construction site visits • Manufacturer visits • Give Steel Academy
4. semester During the semester	Workshop 5 • Introduction to the Civil Engineers role and tasks as a consultant engineer, client and as a contractor.

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

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

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

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

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

1. semester: Small sports or industrial buildings
2. semester: Road Construction in Rural Areas
3. semester: Office buildings
4. semester: Urban Infrastructure and climate adaptation

5.1 1st semester: Small Sports or Industrial Buildings

The overall theme for the first semester is 'Design of Small Sports or Industrial Buildings'. Project work is being carried out to focus on design of selected constructions as well as the energy consumption of the building.

Through the design of a small sport or industrial building, the student must become familiar with the most common construction principles, choice of materials, building stability, and the building's energy consumption and interior design, cf. the building regulations.
The project focuses on sustainable materials and digital tools as well as forms of collaboration.

Purpose, ECTS and assessment:

Mathematical Analysis (CE-SCI1) – 5 ECTS	**Assessment**
The course aims to prepare the student for further studies in Civil engineering. Furthermore, the purpose is to enable the student to read and interpret technical literature, which use mathematics.	Individual written exam, 4 hours External assessment Grading based on the Danish 7-step-scale
Building Design (CE-BDE1) – 5 ECTS	
The course aims to give the student insight into the general rules of building design, acquire the basis for choosing materials considering among other things, load-bearing structures, energy and maintenance. Furthermore, the course aims to introduce students to 3D modelling and use of BIM.	Ongoing tests in the form of 3 individual written assignments during the course, each weighing 25%, as well as an oral group exam, weighing 25% Internal assessment. Grading based on the Danish 7-Point scale
Basic Static Analysis and Load Determination (CE-KON1) – 5 ECTS	
The course aims to provide participants with a basic knowledge within static analysis and load determination.	Individual oral exam, 25 minutes Internal assessment Grading based on the Danish 7-point scale

Building physics and building energy demand (CE-BEN1) – 5 ECTS	
The course aims to give the students' knowledge of the building envelopes basic characteristics with focus on heat transport and moisture conditions, as well understanding of the calculation of the energy demands of buildings in accordance with the building regulation.	Individual oral exam, 20 minutes Internal assessment Grading based on the Danish 7-point scale
Semester project (CE-SEP1) – 10 ECTS	
The aim of the project is to: - Make academic competencies useful in a problem-based context. - Solve engineer academic issues on the basis of courses of the current semester. - Demonstrate the ability to prioritise issues and work in the detail with selected issues. The focus of the teaching in SEP1 is: Study techniques and team-based project work. In addition, experimental exercises in the field of statics. Theme: Learning to learn	Oral group exam with individual assessment Group presentation, 20 min., assessment approx. 20 min./stud. Internal assessment Grading based on the Danish 7-point scale

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

ECTS credits: 30

5.2 2nd semester: Road Construction in Rural Areas

The overall theme for 2nd semester is "Road Construction in Rural Areas".

Through project work, the student must be able to convert knowledge and skills to competencies within engineering geology, basic geotechnics, consolidation settlements of soil, road design and planning of soil work.
Furthermore, the focus is on the students' collaboration, communication and presentation techniques.

Purpose, ECTS and assessment:

Infrastructure in Rural Areas (CE-INF1) – 5 ECTS	**Assessment**
The course aims to provide the student with an understanding of the basic concepts of road construction, including design of roads in rural areas	Individual oral exam, 20 minutes Internal assessment Grading based on the Danish 7-point scale
Statics and Basic Elastic Calculation of Stresses (CE-KON2) – 5 ECTS	
The course aims to provide the student with knowledge and understanding of elastic determination of internal forces and deformation in plane structures and in this context use computer software as a quality control.	Individual written exam, 4 hours Internal assessment Grading based on the Danish 7-point scale
Calculus, Linear Algebra and Dynamics (CE-SCI2) – 5 ECTS	
The course aims to prepare the student for further studies in Civil engineering. Furthermore, the purpose is to enable the student to read and interpret technical literature, which use mathematics.	Individual oral exam, 20 minutes, no aids allowed. Internal assessment Grading based on the Danish 7-point scale

Engineering Geology and Geotechnical Engineering (CE-GEA1) – 5 ECTS	
The course aims to introduce engineering geology and geotechnical engineering, including strength of soil, stresses in soil and deformation of soil.	Ongoing tests in the form of 3 written individual/group assignments, each weighing 25% and an exam consisting of a written individual course assignment, weighing 25%. Internal assessment Grading based on the Danish 7-point scale
Semester project (CE-SEP2) – 10 ects	
The aim of the project is to: - Make academic competencies useful in a problem-based context. - Solve engineer academic issues on the basis of courses of the current and previous semesters. - Demonstrate the ability to prioritise issues and work in the detail with selected issues. The focus of the teaching in SEP2 is: Study techniques and team-based project work. In addition, professional inputs on the planning of soil work in a major road project, including planning methods and tools Theme: Cooperation	Oral group exam with individual assessment Group presentation, 20 min., assessment approx. 20 min./stud. External assessment Grading based on the Danish 7-point scale

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

ECTS credits: 30

5.3 3rd semester: Office Buildings

The overall theme for the 3rd semester is "Design, planning and execution of office buildings".

Project work is being carried out to focus on the design, planning and execution of selected constructions.
The students work with In situ-cast concrete, prefabricated concrete elements and steel.
Furthermore, an analysis must be performed of the building's energy consumption and indoor climate considerations, as well as the dimensioning and 3D modelling of installations.
The students must relate to sustainability certifications in the building.

Purpose, ECTS and assessment:

Basic Material and Concrete Structures (CE-BET1) – 5 ECTS	**Assessment**
The course aims to provide basic knowledge of concrete as a material and calculation of concrete beams in both the ultimate and the serviceability limit state.	Individual oral exam, 25 minutes Internal assessment Grading based on the Danish 7-point scale
Theory of Elasticity with a focus on Basic Steel Structures (CE-KON3) – 5 ECTS	
The course aims to provide the student with a basic knowledge and understanding of elastic strength of materials focusing on simple steel structures.	Individual written exam, 4 hours Internal assessment Grading based on the Danish 7-point scale

Planning of Construction Site design and execution of Construction in In Situ Cast Concrete and Prefabricated Concrete Elements (CE-CMP1) – 5 ECTS	
The course aims to provide knowledge of the processes involved in the construction phase of a building project, including undertaking resource management for construction site layout, in situ cast concrete construction and precast concrete element construction.	Ongoing tests in the form of 6 written assignments and 1 written exam, all weighing equally. Internal assessment Grading based on the Danish 7-point scale
Building services, indoor environment and energy demand analysis. (CE-BEN2) – 5 ECTS	
The course aims to provide students with an understanding of building services. Knowledge of indoor climate parameters and impact on the design of ventilation. Work with Integrated Energy Design (IED) and introduction to sustainable certifications for buildings. Apply BIM strategy and illustrate 3D design	Individual oral exam, 20 min External assessment Grading based on the Danish 7-point scale
Semester project (CE-SEP3) – 10 ECTS	
The aim of the project is to: - Make academic competencies useful in a problem-based context. - Solve engineer academic issues on the basis of courses of the current and previous semesters. - Demonstrate the ability to prioritise issues and work in the detail with selected issues. Professional inputs on calculating the bearing resistance for spread foundations Theme: self-dependent application of knowledge	Oral group exam with individual assessment Group presentation, 20 min., assessment approx. 20 min./stud. External assessment Grading based on the Danish 7-point scale

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

ECTS credits: 30

5.4 4th semester: Urban Infrastructure and Climate Adaptation

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

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

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

Purpose, ECTS and assessment:

Sustainable Drainage (CE-HYD1) – 5 ECTS	**Assessment**
To provide students the understanding of basic hydraulics and design urban sewer systems. Furthermore, the students learn to use Mike Urban to analyse and design sewer systems.	Ongoing tests in the form of two written assignments, in total weighing 30% and an exam in the form of a major written assignment weighing 70%. Internal assessment Grading based on the Danish 7-point scale

Design of Simple Steel Structures and Stability of Shear Wall Buildings (CE-KON4) – 5 ECTS	
The main purpose is to gain a basic knowledge about global stability of multiple story shear wall building and plastic design of steel structures.	Individual oral exam, 25 minutes External assessment Grading based on the Danish 7-point scale
Geotechnical Engineering and Civil Works (CE-GEA2) – 5 ECTS	
The course aims to introduce bearing capacity of single piles, design of retaining walls and planning and construction of infrastructural projects in urban areas.	Individual oral exam, 20 min. External assessment Grading based on the Danish 7-point scale
Road Design in Urban Areas (CE-INF2) – 5 ECTS	
The course aims to prepare students to work with the design of roads and intersections in urban areas.	Ongoing tests in the form of 2 written individual/group assignments, weighing 15% and 35% and an individual written exam, weighing 50%. Internal assessment Grading based on the Danish 7-point scale
Semester project (CE-SEP4) – 10 ECTS	
The aim of the project is to: - Make academic competencies useful in a problem-based context. - Solve engineer academic issues on the basis of courses of the current and previous semesters. - Demonstrate the ability to prioritise issues and work in the detail with selected issues. In addition, professional inputs on risk management of construction projects and installation methods for sheet pile walls Theme: Interprofessional cooperation	Oral group exam with individual assessment Group presentation, 20 min., assessment approx. 20 min./stud. External assessment Grading based on the Danish 7-point scale

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

ECTS credits: 30

6 Internship, 5th semester

CE-INP1

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

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

The student is responsible for finding an internship, which must be approved by VIA, who appoints a supervisor for the intern.

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

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

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

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

7 6th-7th semesters

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

Compulsory courses/projects are listed in section 7.1.

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

If too few students have chosen one of the specialisations, VIA reserves the right to cancel the specialisation in question.

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

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

7.1 Compulsory courses and projects

Compulsory courses at 6. and 7. Semester, for all students on Civil Engineering programme.

Purpose, ECTS and assessment:

Title (code)	Purpose / Content	Scope	Assessment
Construction Management and Planning (CE-CMP2)	The aim of this course is that students become familiar with requirements for project and construction management and planning obtain knowledge of building project phases, organizational and contractual relationship.	5 ECTS	Prerequisites: None Type of exam: Group presentation, 25 minutes, followed by an individual examination with the presence of the whole group. Oral team examination – presentation and defense – is based on a summary of presentations and completed papers answered throughout the semester. Individual, external assessment. Tools allowed: All Re-exams: Individual oral exam - based on a summary of presentations and completed papers answered throughout the semester.

Semester project (ENG-IDE1)	A cross-sectoral semester project that aims to develop and document an across disciplinary innovation and entrepreneurship project based on primary data collection.	10 ECTS	Exam prerequisites Hand in 6 written assignments to be approved in WISEflow before deadline. Type of exam: Exam is based upon the IDE1-report submitted in WISEflow before deadline. The group presents their prototype/pretotype. The exam room can be customized by the group to support the presentation. Group exam with individual assessment. Group presentation approx. 15 minutes followed by joint evaluation with joint discussion and individual question rounds for approx. 60 minutes per group including assessment. Individual grades are given based on an overall assessment of the submitted work as well as the individual's presentation during the exam. External assessment. Tools allowed: All. Re-exam: Based on the submitted project, the examiner gives the student guidance on necessary improvements in relation to passing the exam (possibly, that a new project should be prepared). The students are informed about specific deadlines and details of the project work. Project groups are formed if possible. No further guidance is provided in the period leading up to submission. The project is assessed at an oral project exam.
Bachelor project preparation course (CE-BPR1)	The main purpose of this 6th semester course is to prepare the students for their bachelor project – which will be carried out during the final semester. Preparation includes selecting the subject and choosing a project group for the bachelor project. During this course the project group develop their bachelor project description including finding external partners and collecting knowledge and data, to be prepared for starting up the bachelor project. The project group must consist of 2-6 students and should be carried out in association with an external partner. The purpose of the PBL part of the course is for the students to apply their personal and project skills gained from previous semester projects. Furthermore, they gain an understanding of the theory of science in relation to methods used in the bachelor project.	5 ECTS	Exam prerequisites: Approved 30-minute individual multiple choice test on Philosophy of Science Type of exam: Group exam with individual assessment based on the bachelor project description submitted before the deadline. Group presentation approx. 15 minutes, followed by joint examination with joint discussion and individual question rounds for approx. 15 minutes per group including voting. Individual assessment based on an overall assessment of the submitted work and the individual's performance during the oral exam. Internal assessment Tools allowed: All Re-exam: Same as the ordinary exam.

Bachelor project (CE-BPR2)	The project must be based on a building or construction engineering problem, with a project description created in the BPR1 course. The purpose of the technical professional part of the bachelor's project is to give the students practical experience in solving complex, real-world problems related to construction and civil works, which reflect the types of challenges they may face in their professional careers. The BPR2 project gives the students the opportunity to explore a wide range of academic subjects with the possibility of collaboration with external partners. The project gives the student the opportunity to work with design, planning, development and documentation based on the problem identified through the BPR1 project. The purpose of the PBL part of the course is for the students to apply their personal and project competencies from the previous semester projects in a practice-oriented and complex bachelor project.	15 ECTS	Exam prerequisites: Passed all other courses of the bachelor programme. Type of exam: Oral group exam with individual assessment. The exam is based on a project report submitted before the deadline. Group presentation, 20 minutes, followed by individual examination, 20 minutes per student, in the presence of the whole group. External assessment. Tools allowed: All tools allowed. Re-exam: Based on the submitted project, the examiner gives the student guidance on necessary improvements in relation to passing the exam (possibly, that a new project should be prepared). The students are informed about specific deadlines and details of the project work. Project groups are formed if possible. No guidance is provided in the period leading up to submission. The project is assessed at an oral exam.

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

7.2 Electives

The Civil Engineering programme provides a selection of the following electives.

Electives run if there are sufficient number of registered students.

The scope of all electives is 5 ECTS. Purpose and assessment:

Title (code)	**Purpose / Content**	**Assessment**
Contractors Financial Management (CE-CMP3)	Estimate Charts of accounts Economics, budgets and calculation principles Cash budget Managing of own production Managing of subcontractors Additional works Site meetings and safety meetings Calculation and reporting Lean Construction management JIT and 5S Last Planner SystemTM, PPC and 5xWHY Kaizen Waste	Prerequisites: None Type of exam: Ongoing assessment in the form of four written assignments and an exam in the form of a written assignment, each weighing 20%. Internal assessment. Tools allowed: All tools allowed. Re-exams: Individual oral exam with internal assessment. Exam is without preparation based upon a subject found by draw (not course assignments).

Deep Excavations and Slopes in Urban Areas (CE-GEO1)	Execution of construction pits Installation methods for retaining walls. Influence of groundwater on excavations. Design of ground water lowering installations.	Prerequisites: None Type of exam: Oral exam, 20 min. Internal assessment. Tools allowed: Personal notes Re-exams: Same as the ordinary exam.
Concrete 2 (CE-BET2)	The purpose of this course is to build on the fundamental knowledge gained in previous courses such that a complete analysis and design can be undertaken on concrete beams, columns, walls and slabs in both ultimate and serviceability limit states. Furthermore, to have knowledge about statics used for prefabricated concrete element buildings.	Exam prerequisites: Four out of five course assignments must be handed in and approved. If the exam prerequisite is not met, the student must submit new course papers within the same subject to qualify for the re-exam. Exam type: Oral exam, 25 minutes incl. grading. Internal assessment. Tools allowed: All Re-exam: Same as the ordinary exam.
Finite Element Method for Frame and Plate Structures (CE-FEM1)	The emphasis of the course is on the terminology and techniques in modern structural modelling. The target is on the adoption of the FE approach and commercial FE software packages. Specific subjects introduced include parametric geometry generation (MATLAB), direct stiffness method, (MATLAB) specifications of properties, releases, materials and loads (STAAD Pro).	Prerequisites: None Type of exam: Ongoing tests in the form of one written assignment, weighing 20% An oral exam, weighing 80%. The oral exam is based on a written mini project, handed in before deadline. Internal assessment. Tools allowed: Not applicable Re-exams: Oral exam similar to the ordinary exam.
Geotechnical Design (CE-GEO2)	Risk of punch through for foundations on thin soil layers Plane pile works Strengthening of soil and deep compaction Design of ground anchors and anchor plates incl. anchor length Stability calculations Design of steel in Ground Engineering	Prerequisites: None Type of examination: Ongoing tests in the form of four written assignments, each weighing 20%, and an exam in the form of a test, weighing 20%. Internal assessment. Allowed tools: N/A Re-exams: Same as the ordinary (new assignments). Third attempt is an oral exam without

		preparation based on subject found by draw.
Indoor Environment (CE-INE1)	Evaluating the indoor environment, by studying the influence of the physical environment, i.e., Thermal, air quality, noise and light on human health, comfort and performance. Measurements of indoor climate parameters. Introduction to Daylight calculations. Simulation of indoor environmental parameters with the software BSIM. Indoor Environmental assessment tool.	Prerequisites: None Type of exam: Ongoing assessment of 3 written individual/group assignments, weighing 10% each, and a final exam consisting of a written group course assignment, weighing 70% Internal assessment Tools allowed: NA Re-exam: Oral re-exam, 15 mins, with an internal examiner. Individual presentation of final course assignment and draw of a question in the full course content.
Infrastructure – Planning and Design of Roundabouts (CE-INF4)	Analyse capacity in roundabouts. Plan and design roundabouts. Choice of materials and pavements. Design of roundabouts. Traffic flow during construction works. Traffic safety measures.	Exam prerequisites: None Type of exam: Ongoing tests in the form of one written individual assignment, weighing 50% and a written individual exam, weighing 50%. Internal assessment. Tools allowed: Not applicable Re-exams: Individual oral exam without preparation based upon a subject found by draw. Any second resit is an individual oral exam without preparation based upon a subject found by draw, similar to the first re-exam.
Infrastructure – Planning, Design and Maintenance of Road Projects in Urban Areas (CE-INF5)	Plan and design urban infrastructure project, such as parking spaces and traffic terminals. Identify and describe the workflow and roles of stakeholders involved in the project, from initial ideas to operation and maintenance. Carry out project documentation from outline design phase to operation and maintenance phase	Prerequisites: None Type of exam: Ongoing tests in the form of four written individual/group assignments, each weighing 15% and an exam in the form of a written test, weighing 40%. Internal assessment Tools allowed: Not applicable Re-exams: Individual oral exam without preparation based upon a subject found by draw. Any second resit is an individual oral exam without preparation based upon a subject found by draw, similar to the first re-exam.

Masonry Structures (CE-MAS1)	Masonry structures Masonry beams Wall ties Movement joints Shear walls Arches Reinforced masonry	Prerequisites: None Type of exam: Individual oral exam, 25 min. The exam is based upon a subject found by draw, and with no preparation. Internal assessment. Tools allowed: No tools allowed. Re-exams: Conducted as the ordinary exam.
Steel Structures (CE-STU1)	Structural systems. Welded plate girders. Buckling of plates Stiffeners Lateral torsional buckling, Bracing systems for compression members Steel connections.	Exam prerequisites: Eight out of ten course assignments must be handed in and approved. If the exam prerequisite is not met, the student must submit new course papers within the same subject to qualify for the re-exam. Type of exam: Oral exam, 25 minutes incl. grading. Internal assessment. Tools allowed: None Re-exams: Same as the ordinary exam.
Sustainable Buildings (CE-SUB1)	Sustainability - The Sustainable Development Goals –17 SDG´s Sustainable Assessment of Buildings. Working with the assessment tool DGNB Integrated Energy Design IED/Integrated design process IDP Sustainable building materials. Working with Life Cycle Assessment (LCA) and Cradle-to-Cradle principals. Energy performance framework Indoor climate i. E. daylight calculation	Prerequisites: NA Type of exam: Ongoing assessment of three written individual/group assignments, weighing 10% each, and a final exam consisting of a written group course assignment, weighing 70% Internal assessment Tools allowed: NA Re-exam: Oral re-exam, 15 mins, with an internal examiner. Individual presentation of final course assignment and draw of a question in the full course content.
Timber Structures (CE-TIM1)	Wood materials. Moisture content and load duration. Structural timber. Glued laminated timber. Wood-based panels. Tension/compression bars, beams, moment loaded compression bars. Lateral torsional buckling Roof and wall diaphragms. Connections with nails and bolts. Tapered Beams Curved Beams Pitched cambered beam Trusses	Exam prerequisites: Four out of five course assignments must be handed in and approved. If the exam prerequisite is not met, the student must submit new course papers within the same subject to qualify for the re-exam. Type of exam: Oral exam, 25 minutes incl. grading. Internal assessment.

	Glued thin-flanged beams Frames and bracing of timber buildings Connections with screws, dowels, glued in bolts, toothed shear plates. Fire resistance	Tools allowed: None Re-exams: Same as the ordinary exam.
Ventilation Systems (CE-VEN1)	Criteria and methods used for design of mechanical ventilation- and climatic systems. Components that ensure low energy consumption and determine strategies for control and operation of such systems. Ventilation system that satisfies human requirements. Principles of natural ventilation.	Prerequisites: None Type of exam: Ongoing assessment in the form of two written individual course assignments, each weighing 15% and a group assignment followed by an oral group exam, 10 minutes per student, weighing 70%. Internal assessment. Tools allowed: All Re-exam: Written individual assignment. Internal assessment

In addition, the following courses provided by other engineering programmes, are part of the specialisations listed in section 7.3 to 8.6:

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	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.
Geothermal Systems (SE-STS1)	Facts about the thermal properties of different rock and soil types. The influence of groundwater on borehole heat exchangers. Construction of boreholes, design, and dimensioning of borehole heat exchangers. Thermal response test. Energy storage and balanced heat abstraction. Modelling software Earth Energy Designer (EED).	Exam prerequisites: None Type of exam: Individual oral exam, 20 min., based on one course assignment handed in before deadline. Internal assessment. Tools allowed: None. Re-exam: Equal to the ordinary exam.

Sustainable Drainage (SE-SUD1)	Climate change Rain water Green roofs Infiltration basins Open channels.	Exam prerequisites: None Type of exam: Ongoing tests in the form of three written assignments, each weighing 10% and an exam in the form of a major written assignment weighing 70%. All assignments must be handed in before deadline. Tools allowed: N/A Re-exam: Individual oral exam
Thermodynamics and Particle Dynamics (SE-TER1)	Basic Thermodynamics Particle Dynamics.	Exam prerequisites: None Type of exam: Individual oral exam, 20 min. with internal assessment. The exam is on the basis of course assignments found by lot and without preparation. The course assignments are selected by the examiner and communicated to the students no later than the last day of teaching on VIA's intranet. Course assignments must be uploaded in WISEflow approx. 1 week before the exam. If the student does not upload the course assignments in WISEflow, the student is offered to solve the course assignments during the exam. External assessment Tools allowed: None Re-exams: Equal to the ordinary exam.
Renewable Energy (ME-ENE1)	The purpose of the course is to ensure that the student will understand the design and calculation of renewable energy plants with focus on energy production, energy savings and storage and environmental conditions	Prerequisites for exam: Mandatory assignments. The assignments must be submitted by the deadline and be approved afterwards. Fail to meet the prerequisites will disqualify entering the examination. As of re-exam, a new set of assignment(s) and deadline will be set before the re-exam. Exam type: Oral Examination. The oral exam will count 100% and

		divided into: a. Oral evaluation based on a mini project handed in be-fore deadline (50%) b. Additional question from draw on the spot (50%) Grade is on individual basis. Tools allowed: The submitted report of the mini project. Re-exam: Similar to the ordinary exam. Case specific: A new set of assignment(s) and deadline might be set before the re-exam. The students might need to work on a new mini project, when necessary, improve the already submitted one or keep it without improvement.

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

7.3 Sustainable Energy Design

Contents
The following 45 ECTS are compulsory for the specialisation:
- Indoor Environment (CE-INE1)
- Ventilation Systems (CE-VEN1)
- Project and Construction Planning and Management (CE-CMP2)
- 6. semester project (ENG-IDE1): Innovation and Entrepreneurship
- Bachelor project (BPR1+2): Project within Sustainable Energy Design

In addition, the following electives are recommended:
- Sustainable Buildings (CE-SUB1)
- Geothermal Systems (SE-STS1)
- Life Cycle Assessment (SE-LCA1)
- Thermo Dynamics (SE-TER1)
- Renewable Energy (ME-ENE1)

7.4 Construction Management and Geotechnical Engineering

Contents
The following 45 ECTS are compulsory for the specialisation:
- Contractors Financial Management (CE-CMP3)
- Deep Excavations and Slopes in Urban Areas (CE-GEO1)
- Project and Construction Planning and Management (CE-CMP2)
- 6. semester project (ENG-IDE1): Innovation and Entrepreneurship
- Bachelor project (BPR1+2): Project within Construction Management and Geotechnical Engineering

In addition, the following electives are recommended:
− Life Cycle Assessment (SE-LCA1)
− Infrastructure – Planning, Design and Maintenance of Road Projects in Urban Areas (CE-INF5)
− Sustainable Drainage (SE-SUD1)

7.5 Infrastructure

Contents
The following 45 ECTS are compulsory for the specialisation:
− Infrastructure – Planning and Design of Roundabouts (CE-INF4)
− Infrastructure – Planning, Design and Maintenance of Road Projects in Urban Areas (CE-INF5)
− Project and Construction Planning and Management (CE-CMP2)
− 6. semester project (ENG-IDE1): Innovation and Entrepreneurship
− Bachelor project (BPR1+2): Project within Infrastructure

In addition, the following electives are recommended:
− Sustainable Drainage (SE-SUD1)
− Contractors Financial Management (CE-CMP3)
− Deep Excavations and Slopes in Urban Areas (CE-GEO1)
− Basic Railway and Light rail - Planning and Design (CE-INF3)
− Life Cycle Assessment (SE-LCA1)

7.6 Structural Design

Contents
The following 55 ECTS are compulsory for the specialisation:
− Concrete 2 (CE-BET2)
− Finite Element Method for Frame and Plate Structures (CE-FEM1)
− Timber Structures (CE-TIM1)
− Steel Structures (CE-STU1)
− Project and Construction Planning and Management (CE-CMP2)
− 6. semester project (ENG-IDE1): Innovation and Entrepreneurship
− Bachelor project (BPR1+2): Project within Structural Design

In addition, the following electives are recommended:
− Masonry Structures (CE-MAS1)
− Deep Excavations and Slopes in Urban Areas (CE-GEO1)

8 Workshops

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

CE-PWS1 (1. semester):	The Civil Engineers role and tasks as a consultant engineer, client and as a contractor. Excursions and company visits
CE-PWS2 (1. semester):	Basic carpentry and masonry work
CE-PWS3: (3. semester):	Welding and Plumbing, MagiCad
CE-PWS4: (2./3. Semester):	Soil work and building site, road building, casting of concrete beams
CE-PWS5: (4. Semester):	Asphalt Factory, 3D surveying, drone flight, surveying

9 Bachelor project

CE-BPR1
CE-BPR2

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

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

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

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

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

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

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

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

10 Title and issue of degree

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

It is also possible to obtain the following special designations:
- Sustainable Energy Design
- Construction Management and Geotechnical Engineering
- Infrastructure
- Structural Design

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

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

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

11 Appendix 1: Courses Civil Engineering Programme

- assessment described in this appendix is applicable for 1.-4. Semester A2021-S2023 only

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
CE-BDE1	Building Design	5	After completion of the course, the student must have knowledge about: BDE: - Describe common building terminology - Identify and outline typical of building materials and structures - Explain and design common building constructions - Explain and understand project phases - Design Methodology BIM: - Describe the concept of BIM processes and advantages/challenges - Identify basic principles for modelling with 3D software and methods for composition of 3D building models in compliance with existing common principals from e.g. Det digitale Byggeri (Digital Building) and BIPS	After completion of the course, the student must be able to: Building design: - Apply the regulations of the Planning Law for national, regional and municipal planning. - Work in accordance with current regulations for projecting and building legislation - Design and demonstrate relevant choice of materials and construction for the building envelope and static structure. - Perform field work with measurement and registration of building components Building Information Modelling (BIM): - Apply 3D tools in the planning of a project. - Implement BIM methods, allowing extract of data for further processing and analysis in associated programmes - Plan and execute drawings, belonging to the relevant phases in the execution of a project.	BDE + BIM: The course substance is used in the term project, which will give the student an exercise in applying the theory in a context that ensures understanding of how a project material is constructed and designed: - Understand the complexity of design solutions. - Be able to choose, plan and control a project's technical solutions appropriately.	Exam prerequisites: Course assignments handed in before deadline. Type of exam: Ongoing tests in the form of three individual written assignments. An exam in the form of a written group assignment. All weighing 25% each. Internal assessment. Tools allowed: - Re-exams: The 4 assignments must be submitted for re-evaluation within an agreed timeframe
CE-BEN1	Building Physics and Building Energy Demand	5	Following completion of the course, the student can: Understand and explain the calculation methods for heat transmission coefficients and the heat loss from a building. Understand and explain building components moisture conditions (Hygrothermal conditions). Outline the Building Regulation requirements for buildings energy demands, given for new buildings. Understand the calculation methodology for buildings energy consumption. Describe the design process of the ventilation system (Outline proposal level).	Following completion of the course, the student can: Calculate heat transfer coefficients for the building envelope components (U-values) Calculate moisture conditions in the building envelope components. Apply heat loss calculations to determine the building's heat emitters. Evaluate the amount of ventilation in a building and illustrate physical planning with 3D tools Calculate the energy demands of the building according to the Building Regulations.	Following completion of the course, the student can: Design and evaluate the building envelope with focus on U values, linear losses, and moisture conditions. Evaluate the influence of a thermal cold bridge on the u value. Evaluate a building's heat loss and design of heaters in the building (radiators, etc.) (Outline proposal) Design a ventilation system (Outline proposal) Analyze the building's energy demand according to the building regulations Explain the impact of the building envelope, the ventilation and the heating system on the total energy demand of the building.	Exam prerequisites: None Type of exam: Individual oral exam with internal assessment, 20 min. The exam is based upon a subject found by draw, and with no preparation. Tools allowed: No tools allowed. Re-exams: Conducted as the ordinary exam.

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
CE-KON1	Basic static analysis and load determination	5	After the course, the students must have gained knowledge of and understanding within: Global stability and static analysis of smaller frames and shear-wall buildings. Including design of simple joints. Loads on smaller buildings and structures according to Eurocode. Distribution of loads in statically determinate shear-wall and diaphragm structures. Plastic distribution of loads in statically indeterminate shear-wall and diaphragm structures. Basic knowledge of calculation of reactions in externally statically determinate structures. (Beams, frame and trusses.)	After the course, the student must: • Be able to perform static analysis by explaining load transfer in simple frame and shear-wall buildings. • Be able to determine loads on simple structures in accordance with Eurocode (EC) 0, EC 1-1, EC 1-3, EC 1-4: Determination of snow load, wind load, imposed load and self-weight, including determination of load combinations. • Be able to draw free-body diagrams, set up equilibrium equations and calculate reactions for externally statically determinate structures.	At the end of the 1st semester, the student must be able to use the achieved knowledge and skills to be able to work with the relevant topics in the semester project together with other students.	Exam prerequisites: Home assignments handed in before deadline. Type of exam: Individual oral exam, 25 minutes, internal assessment. The exam is based upon a subject found by draw, and with no preparation. Tools allowed: All materials from the course allowed. Re-exams: Conducted as the ordinary exam.
CE-SCI1	Mathematical analysis (CE-)	5	The student will get knowledge about: • Differentiation • Trigonometric functions • Exponential functions • Integration • Vectors in space • Vector functions in space	After the completion of the course, the student will be able to: • Identify and make simple calculation on selected transcendental functions • Identify and make simple calculation on the branch of infinitesimal calculation, which deals with finding the derivative of functions with one variable, including different applications thereof • Identify and make simple calculation on the branch of infinitesimal calculation, which deals with integration of functions with one variable and different applications thereof • Analyse vectors and motion in space and perform calculations based on vector operations IT is used in a pedagogical method in the course. The aim is that IT will support the learning process of the students and their understanding of the engineering professional possibilities in, for example, the application of modelling, simulation, etc.	After completing the course, the student can: • Perform a basic understanding for Calculus. • Use their acquired skills and knowledge to study more advanced Calculus and Algebra courses on their Engineering programme. • Use a commercial mathematical software to solve and perform serial technical calculations.	Exam prerequisites: None Type of exam: 4 hours written exam with external assessment. Tools allowed: At 20-40% of the exam, the use of CAS programs is not allowed. For the rest of the exam, the use of CAS programs is permitted. Re-exams: Method will be equal to the ordinary exam.
CE-SEP1	Semester project 1	10	<u>Effective teams</u> Can explain involved theories about group dynamics, teamwork and conflict resolution. <u>Own learning process</u> Can refer to involved theories of learning,	<u>Effective teams</u> Can jointly formulate and apply a group contract in the group work Can be part of and establish collaboration with project group and supervisor <u>Own learning process</u> Can apply knowledge of learning theory	<u>Effective teams</u> Can describe and reflect on the project group´s collaboration - including own efforts - to define opportunities for improvement for future projects <u>Own learning process</u> Can reflect on own ability to learn through	Exam prerequisites: Project report and Process report must be submitted before deadline. The student's individual effort of technical topics in the project report must be specified in the process report. Type of exam:

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
			motivation, feedback and study techniques Project framework Can identify relevant knowledge in relation to academic and technical written communication, including the report´s structure, references and source management Can identify relevant presentation techniques for the target group, as well as use presentation techniques Problem Based Learning (PBL) Can explain basic elements within PBL Can identify relevant issues and specific requirements for a problem formulation Project management Can identify relevant project management methods, including planning, meeting management, risk assessment and quality assurance Professional knowledge The students must obtain an understanding of planning and design of a typical sport or industrial building. Knowledge about principles of sustainable solutions for the construction. Knowledge from the semester's courses must be used in the design of the project (BDE1 + KON1 + BEN1)	and motivation theory in connection with own learning process as well as give and receive feedback Project framework Can act source-critical as well as use references and source management, including rules for plagiarism. Can convey the results of the project work and the project group´s learning process in a structured way using professional concepts, both written, graphic and oral. Can communicate in writing and orally to different target groups. Problem Based Learning Can formulate a problem formulation, describe different solution options and argue for solution proposals. Project management Can explain the choice of and use of tools and methods for project management to achieve specific goals in the project work. Professional skills	the various teaching activities including the work of the project group Problem Based Learning Can take responsibility for the student-led part of the semester project Professional competencies Through design of a small sport or industrial building, the student must become familiar with the most common construction principles, choice of materials, calculate and analyze the stability of the building, its energy consumption as well as the building's design according to the building code. The project focuses on sustainable materials and digital tools, as well as forms of collaboration Digitization - Digital collaboration in common 3D model (worksharing).	Group exam with individual assessment Group presentation, approximately 20 minutes, followed by a group exam with group discussions and individual questions, approximately 20 minutes per student including voting. Individual grades will be given on the basis of an overall assessment of the submitted work as well as the individual performance during the test. Internal assessment Tools allowed: All Re-exam: Students who failed a semester project will be informed by the process supervisor, who in consultation with the internal censor decides, if the student(s) must prepare a new project, or if the failed project must be improved. The students(s) will be informed about the specific deadlines and the further course for the project work. New project groups will be formed, where possible in relation to the number of failed students at the individual semester. There will be no guidance during the period up to hand in of the project. A grade will be given directly on the basis of the quality of the improved or new submitted project. There will be no oral defense.
CE-GEA1	Geotechnical Engineering and Civil Works	5	After the course the student must have knowledge about: - The different types of geological maps and borehole information in digital form and how this information is used to assess the expected soil layers in a certain area - The most common soil types and their geotechnical properties - How the soils strength and deformation parameters are determined - Theories and methods to determine settlements and the time progress of settlements - Initial- and creep settlements - Excavations, soil works, trenches for pipes and re-use of soil	After the course the student must be able to: - Recognize and describe the most common Danish soil types - Use databases and collect geological information for a specific area and draw a geological profile - Calculate total, neutral and effective stresses - Define and determine soils strength and deformation properties - Describe connections between geological conditions and conditions for excavations - Calculate consolidation settlements	Assess expected soil layers and groundwater conditions for a specific location and determine their consequences for the project (whether it is a building, road, district heating etc.)	Prerequisites for exam: The 4 assignments mentioned below must be duly handed in. Exam type: Ongoing tests in the form of 3 written individual/ group assignments, weighing 25% and a final exam consisting of a written individual course assignment, weighing 25%. Internal assessment Tools allowed: - Re-exam: Individual oral exam, 20 minutes Internal assessment Topic found by draw

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
CE-INF1	Infrastructure in Rural Areas	5	After completion of the course, the student must have the knowledge of: • Road types and planning • Intersections in rural areas • Traditional asphalt types and use of these in road constructions	After completion of the course, the student must have the skills to: • Perform analyses and road planning in rural areas • Carry out an environmental screening • Determine design parameters for a road project • Propose relevant design of horizontal and vertical alignments, as well as, cross sections • Describe elements in horizontal and vertical alignments • Describe elements within a cross section, including drainage principles for roads in rural areas • Describe why and where superelevation is used and how a cross section changes from roof crown profile to being super elevated • Perform capacity calculations for a free road section • Dimension road pavement structures based on the catalogue method • Use MicroStation and InRoads for geometrical design of roads and to draw out quantities from the 3D model • Setup and prepare road drawings for print	After completion of this course, the student must have the competences to: • Determine a road lay-out in regards to Danish Roads Standards and surrounding environment • Design a bypass road in 3D using MicroStation and OpenRoads Designer	Exam prerequisites: The students must solve course assignments based on the knowledge and skills achieved through the course. The assignments must be handed-in prior to the exam day through Wiseflow. Furthermore, drawings shall be delivered as two printed copies – details are provided in class. Type of exam: The exam is a 20 min. individual oral exam without preparation based upon a course assignment found by draw. The exam is with internal assessment. Tools allowed: None Re-exams: Individual oral exam without preparation based upon a course assignment found by draw, similar to the first exam. Any second resit is an individual oral exam without preparation based upon a subject found by draw (not course assignments).
CE-KON2	Statics and basic elastic calculation of stresses.	5	After the course, the students must have gained knowledge of and understanding within: Bar loads in plane trusses. Diagrams for internal forces for externally statically determinate structures: Normal force, shear force, bending moment and torsional moment. Linear elastic relationship between stresses and strains (Hook's law) Center of gravity, moment of inertia, moment of resistance. Elastic calculation of normal stress from normal force and bending moment. The Robot program for control calculation of reactions and sectional force curves.	After the course the student must be able to: Determine bar forces using the node method and Ritter's shear force method for lattice structures. Determine and record shear force curves for structures. Determine center of gravity and moment of inertia for arbitrary cross-sections. Determine normal stresses from bending and normal force as well as elastic length deformations in steel. Use Robot to calculate reactions and shear forces in smaller structures.	At the end of the second semester, the student must be able to use the acquired knowledge and skills acquired during the semester to perform elastic shear force and stress calculations in arbitrary cross-sections in the subsequent semester projects, as well as length deformation in steel.	Exam prerequisites: - Type of exam: 4 hour written exam with internal assessment. Tools allowed: Books, notes, examples, calculators and computers are allowed. Communication via email, internet or mobile phone etc. is not allowed. The use of specialist structural design software is not allowed. Re-exams: Conducted as the original exam (new assignment) or as an oral exam, 25 min.
CE-SCI2	Calculus, Linear Algebra and Dynamics (CE-)	5	The student will get knowledge about: • Application of integration • Matrixes and matrix algebra • Linear equation systems	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	After completing the course, the student will be able to: • Identify which parts of the acquired knowledge and skills that’s relevant to a	Exam prerequisites: Upload of course assignments in Wiseflow approximately one week before the exam.

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
			• 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	coordinate system. • Identify and solve Linear equations systems. • Identify Area, Centroid, Moments of Inertia for a plane region and length of a curve in a polar-coordinate system. • Make simple calculations on complex numbers. • Describe simple problems and solve Ordinary differential equations of the 1st and 2nd order • Identify kinematic relations in the description of motion particles in different reference systems. • Set up and perform serial calculations by using the Laws of Newton. • Analyse the motion of a vehicle treated a particle.	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.	Type of exam: Individual oral exam with internal assessment. 20 min. Exam is based upon course assignment(s) found by draw and without preparation. Tools allowed: None Re-exams: Method will be equal to the ordinary exam.
CE-SEP2	Semester project 2	5	Academic/technical knowledge learning aims Obtain knowledge to plan and design a road construction in rural areas. Effective teams Refer to knowledge about own strengths and weaknesses in connection with group work, refer to theories on personal profiles and personal and interpersonal competences as well as cultural differences. Project management Can identify reviewed analysis methods, methodologies and structures within project management.	Academic/technical skills learning aims Demonstrate an understanding of the complexity in a civil works project. Effective teams Identify and describe the group's development. Apply theories on personal profiles and cross-cultural aspects in the group work in order to describe potential conflicts in the group and suggest solutions. Own learning process Describe own needs in connection with motivation for learning and act accordingly. Identify and apply preferred study techniques. List and reflect on own learning goals from the previous and current semester in the process report concerning future improvement. Project framework Communicate the project work's results and the project group's learning process in a structured manner using technical terms both in writing, graphically and orally. Apply knowledge on reference and source management. Describe the project execution in a process report. Problem Based Learning	Academic/technical Competence learning aims Apply knowledge, skills and competences achieved during the semester to plan and design a road construction in rural areas. Plan a process by using the planning tool MS Project. Plan earth works by using mass curves and haul distances. Effective teams Take responsibility for the group cooperation and actively enforce and develop the group contract. List and select between steps for development and action of the group. Own learning process Give and receive constructive feedback in connection with own and other's learning process. Adjust own learning process based on experience and knowledge of own preferences. Project Framework Take responsibility for the work process of report writing and presenting in cooperation with the group. Apply oral, digital and graphic project presentation skills. Problem Based Learning Follow a methodology and work in a structured way on the semester project.	Exam prerequisites: Project report and process report must be submitted before the deadline and in accordance with formality requirements. Students must have minimum 75% attendance to be registered for the exam. Type of exam Group exam with individual assessment. Group presentation approx. 20 minutes followed by a joint exam with a joint discussion and individual question rounds for approx. 20 minutes per student including voting. Individual grades are given on the basis of an overall assessment of the submitted work as well as the individual´s performance during the exam. External examiner. Allowed tools All Re-exams Students who failed a semester project will be informed by the process supervisor, who in consultation with the internal censor decides, if the student(s) must prepare a new project, or if the failed project must be improved. The students(s) will be informed about the specific deadlines and the further course for the project work. New project groups will be formed, where possible in relation to the number of failed students

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
				Describe which factors that may influence the individual and group-based learning in a PBL course. Can work based on the project group's own problem formulation. <u>Project management</u> Can use profession-related methods and tools in project work. Can use digital tools such as office tools, digital project management as well as digital knowledge acquisition tools and portals.	<u>Project management</u> Take responsibility for the management of the project work with a continuous adjustment between tasks and resources.	at the individual semester. There will be no guidance during the period up to hand in of the project. A grade will be given directly on the basis of the quality of the improved or new submitted project. There will be no oral defence.
CE-BEN2	Building services, indoor environment and energy demand analysis.	5	Following completion of the course, the student can: Describe all building services and their purpose. Identify and explain the indoor climate parameters and their impact on the ventilation and management and thereby the building´s energy demand. critical points in the building envelope. Account for the Building Regulations requirements for building energy demand, indoor climate and building services. Outline the traditional and renewable forms of energy sources. Describe the sustainability principle and explain the Danish sustainability certification method	Following completion of the course, the student can: Design and evaluate building services, water, heating and drainage (project proposal level) Design the ventilation system and understand indoor climate parameters and the management of the ventilation (project proposal level). Calculate and evaluate daylight conditions. Apply and illustrate the concept of integrated energy design when calculating the energy demands of buildings.	Following completion of the course, the student can: Design the building services and ventilation and execute in 3D (project proposal level) Design, analyse and reflect on the importance of the various parameters for the building´s energy demand, calculated in accordance with the building regulations and sustainability certification methods.	<u>Exam prerequisites:</u> None <u>Exam type:</u> Individual oral exam with an external examiner - 20 min. per student Exam is based upon a subject found by draw and with 20 min. preparation after the draw. <u>Tools allowed:</u> All tools allowed during preparation. Notes from preparation are allowed during exam. <u>Re-exam:</u> Conducted as the ordinary exam.
CE-BET1	Basic Materials and Concrete Structures	5	After the course, the student must: - Have gained knowledge of the basic composition and structure of concrete. - Have gained knowledge about aggregates for concrete. - Have gained basic knowledge about decomposition of concrete and the causes hereof. -Have gained knowledge of curtailment of reinforcement in beams.	After the course, the student must: Choose relevant concrete based on durability requirements (environmental impacts). In the ultimate limit state: • Be able to calculate the ultimate resistance of arbitrary reinforced concrete cross-sections subjected to bending moment and axial force using the geometrical, physical and statically conditions. Be able to perform the relevant sketches for this. • To be able to perform cross-sectional bearing capacity calculations by iterative method using MathCad. • Be able to understand, explain and use the diagonal strut method for shear-reinforced concrete beams. • Be able to calculate some few examples of abutments.	At the end of 4 semesters, the student must be able to use the acquired knowledge and skills to, in collaboration with other students, be able to plan, make the relevant concrete material choices and design simple concrete beams in the ultimate limit state and service ability limit state.	<u>Exam prerequisites:</u> The assignments must be submitted to be able to join the exam. At least 80% must be submitted. <u>Exam type:</u> Individual oral exam, 25 min., internal assessment. <u>Tools allowed:</u> All <u>Re-exam:</u> Conducted as the ordinary exam with new assignments.

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
				• Be able to calculate continuous beams one-way spanning slabs. In the serviceability limit state: • Have knowledge of requirements for concrete structures, including requirements for maximum crack widths. • Be able to calculate stresses in concrete cross-sections using the method with transformed cross-sections. • Be able to calculate deflections and crack widths in reinforced concrete beams and slabs.		
CE-CMP1	Planning of Construction Site design and execution of Construction in In Situ Cast Concrete and Prefabricated Concrete Elements	5	After completion of the course, the student must have knowledge about: – Theory and methods for casting of in situ cast concrete constructions, such as formwork systems, reinforcement as well as choice of concrete according to environmental classes. – Theory and methods for planning a safe construction site. – Theory and methods to choose the crane type, size and location. – Various concepts and methodologies adhering to the planning, design and assembly processes of the use of precast concrete elements in building projects. – Various precast concrete element types, together with a review of typical key connection details and other drawings in connection with precast concrete building projects.	After completion of the course, the student must be able to: – Possess knowledge of different formwork systems (traditional form/system form) as well as be able to dimension/pick out these. – Calculate formwork pressure from the concrete on vertical formwork. – Calculate the required maturity of the concrete before the formwork can be dismantled. – Possess knowledge of concrete production. – Possess knowledge of to prevent damage to newly cast concrete. – Perform planning for reinforcement work, such as choice of reinforcement type, environmental class, and apply rules for reinforcement placement in the formwork. – Prepare cut and bending lists of reinforcement bars for carrying out reinforcement units. – Perform planning of a safe construction site. – To choose crane type, size and decide on a location for erection on the building site. – Possess knowledge of the use of prefabricated concrete elements in building projects. – Possess knowledge of the planning, design and assembly process. Associated with relevant concepts. – Apply knowledge of precast concrete design processes to prepare drawing information for a precast concrete production and assembly.	After the course, the student will be able to apply knowledge and skills to: - The students must present abilities of analyzing, argue, explain and exemplify within the scope of the 3th semester project. – The course provides the students with a general ability to work with in situ cast concrete constructions and precast concrete projects as a project assistant on site for the construction site management. – The course gives the students a basic knowledge about the contractors' resource management in relation to construction projects. – The student will acquire such a knowledge about in situ cast concrete construction and precast concrete element projects, which they can plan and carry out measures of various concepts and methodologies adhering to the planning of the execution of a construction project.	Exam prerequisites: The assignments mentioned below handed in before deadline. Exam type: Ongoing tests in the form of 6 written assignments and 1 written exam, all weighing equally. Internal assessment Tools allowed: All Re-exam: The 6 written assignments and 1 written exam are improved, all weighing equally.

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
				– Demonstrate an understanding of the basics of building phases.		
CE-KON3	Theory of elasticity with a focus on basic steel structures	5	The course aims to provide the student with a basic knowledge and understanding of elastic strength of materials focusing on simple steel structures.	After the course, students must have gained knowledge of and understanding within: • The elastic strength of materials - basic principles and methods. • determination of stresses for simple load bearing structures •Calculation of deformation in beams •Structural classes and structural documentation Introduction to load transfer from foundation to soil (structures with footing foundations) including introduction to Terzagih´s load capacity equation	After the course the student must be able to: • Determine cross-sectional parameters • Calculate elastic stresses for beams subjected to axial forces, pure bending, biaxial bending, bending and axial forces, shear forces and torsion • Perform a verification of a steel section in the elastic state • Design a centrally loaded steel column • Choose a structural class according to BR18 • Calculate deformation of a beam using the principle of virtual work and differential equations • Calculate reactions of statically indeterminate beams using the flexibility method.	Exam prerequisites: None Exam type: Individual written exam, 4 hours, internal assessment. Tools allowed: All aids are allowed except communication with the outside world. Re-exam: Conducted as the ordinary exam.
CE-SEP3	Semester project 3	10	Academic/technical knowledge learning aims A study of typical office buildings including structural- and building services design. Knowledge of principles for sustainable solutions in construction must be studied. Explain BIM and the use of 3D design. Knowledge from the semester's courses are used in the design of the project. Effective teams Can refer to involved theories in order to increase efficiency for the group as a whole but also for the individual student	Academic/technical skills learning aims Apply BIM and 3D design, including demonstrating quantity extraction for further processing, collision checks and quality assurance. Effective teams Can plan the project group's work process and work with a focus on the group's learning and goals Can identify and apply methods for solving basic cross-cultural communication and collaboration problems. Own learning process Can describe and analyse own learning process in the process report Can search, find and include relevant knowledge Can set and reflect on own learning objectives from current and previous semesters in the process report with a view to future improvement Project framework Can communicate the results of the project work and the project group's learning process in a structured way using professional concepts, both written, graphic and oral. Can argue for the choice of sources and references in connection with the project	Professional Competence Learning Objectives Design and analyse according to relevant design methods. Assess interdisciplinary elements, including e.g. plan the physical execution/coordination of installations/ventilation and the building's constructions using 3D tools Implement/evaluate selected parts of the construction in relation to sustainable certifications in the build environment, e.g. can assess parts of the building's climate footprint. Effective teams Able to use experience and knowledge of own preferences to strengthen group collaboration Can receive and reflect on guidance and facilitation of group collaboration Can take responsibility for structuring and adapting the form of collaboration to the members' personal and interpersonal competencies Own learning process Able to independently plan, structure and optimize own learning process based on previous courses Project framework Able, in collaboration with the group, to	Exam prerequisites: Project report and Process report submitted before deadline. Type of exam: Group examination with individual assessment. Group presentation approx. 20 minutes followed by joint examination with joint discussion and individual question and answer sessions for approx. 20 minutes per student including evaluation. Individual grades are given on the basis of an overall assessment of the submitted work as well as the individual's performance during the exam. External assessment Tools allowed: All Re-exam: Students who failed a semester project will be informed by the process supervisor, who in consultation with the internal censor decides, if the student(s) must prepare a new project, or if the failed project must be improved.

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
				work. PBL Can analyse and explain overall contexts. Can work with a holistic view of the project, the subjects and the outside world. Can work interdisciplinary.	take responsibility for the work process in connection with report writing and presentation. Can use oral, digital and graphic project presentation techniques PBL Can work analytically, methodically and structured with the semester project in the project group. Project management Can plan, adapt and optimize a project process with reasoned selection of the specific project management tools. Can account for the use of digital tools such as digital project management as well as digital knowledge collection tools and portals.	The students(s) will be informed about the specific deadlines and the further course for the project work. New project groups will be formed, where possible in relation to the number of failed students at the individual semester. There will be no guidance during the period up to hand in of the project. A grade will be given directly on the basis of the quality of the improved or new submitted project. There will be no oral defense.
CE-GEA2	Geotechnical Engineering and Civil Works	5	After completion of the course the student will have knowledge about: - The resistance of single piles loaded in compression and in tension - Soil pressure theory - Theory and methods to design free sheet pile walls and anchored sheet pile walls with 0 plastic hinges according to Brinch Hansen - Design of king post walls - Pricing of civil works projects - Jobsite planning for civil works projects in an urban environment - The influence of contaminated soils in the project site	After completion of the course, the student will be able to: - Determine the compression and tensile resistance of single piles according to Annex L in Danish National Annex to Eurocode 7 part 1 in both ultimate limit state and serviceability limit state - Undertake analysis and calculations on free sheet pile walls and sheet pile walls with one anchor level according to Brinch Hansen's soil pressure theory in ultimate limit state - Apply SPOOKS software for design of free and anchored sheet pile walls for basic failure mechanisms - Design steel sheet piles according to Eurocode 3 part 5, under consideration of bending moment, corrosion loss and cross sectional class. - Draw phase plans and manage traffic handling for civil works projects - Pricing of civil works projects by use of MOLIO price database	After the course, the student will be able to: - Design pile foundations for building and constructions according to Eurocode 7, part 1 and the Danish national annex - Carry out ultimate limit state design of sheet pile walls without ground water flow according to Eurocodes - Specify design basis with relevant soil- and groundwater conditions as well as load situations and load combinations for retaining structures - Suggest an appropriate steel sheet pile profile from a catalogue of an actual sheet pile manufacturer and an appropriate steel profile for king posts under consideration of bending moment - Plan and price a civil works project in an urban environment	Exam prerequisites: None Exam type: 20 min. individual oral exam without preparation with an external examiner. Exam is based upon a subject found by draw. Tools allowed: None Re-exam: Conducted as the ordinary exam.
CE-HYD1	Basic Hydraulics	5	After completion of the course, the student must have the knowledge of: • The physics of basic hydraulics • The design of rainwater and sewer systems • The Mike Urban program	After completion of the course, the student must have the skills to: Basic Hydraulics: • Determine type of flow • Use energy equation • Calculate single and pipe losses • Calculate hydraulic and energy grade line • Use exponential and C&W's formula Sewer systems:	After completion of this course, the student must have the competences to: • Understand hydraulic problems • Plan and dimension of Urban sewer systems • Calculate and analyze urban sewer systems in Mike Urban	Exam prerequisites: NA Type of exam: Exam in the form of 1 hand-in mandatory group assignment (a Mike Urban project) in the end of the semester, which counts for minimum 70% of final grade. Individual assignments (homework and during classes) count for 30% of final

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
				• Calculate inlet for rainwater and wastewater pipelines • Design and dimension rainwater and wastewater pipelines • Perform back water calculations • Design basins Mike Urban • Create pipe systems and catchment areas • Create local CDS-rains with or without climate factor • Analyze pipe systems and basins with CDS-rains • Present result as drawings and animations		grade (15% each). If no individual assignments have been made the final hand-in counts for 100% of final grade. Tools allowed: NA Re-exams: 3 hours written exam
CE-INF2	Road Design in Urban Areas	5	After completion of the course, the student must have knowledge of: - Intersection types and use of these in urban areas - Capacity calculations of intersections in urban areas	After completion of the course, the student must have the skills to: - Design cross sections for roads in urban areas - Execute traffic counts and handle traffic data - Perform and evaluate capacity calculations for simple prioritized- and signal controlled intersections - Design an intersection in 2D using Open roads designer - Dimension pavement structure, and chose relevant marking and signs - Perform road laboratory tests on road materials - Perform field tests to determine the compaction of soil	After completion of the course, the student must have the competences to: - Decide the geometry for an intersection according to the Danish Road codes and surrounding environment - Analyse and compare the capacity of simple prioritized- and signal controlled intersections - Analyse the quality of sub-base materials - Analyse and compare results from road laboratory- and field tests	Exam prerequisites: Course assignments handed in before deadline Exam type: Ongoing tests in the form of 2 written individual/group assignments, weighing 15% and 35% and an individual written exam, weighing 50%. Internal assessment Tools allowed: None Re-exam: Individually oral exam with internal examiner. Exam is without preparation based upon a subject found by draw.
CE-KON4	Design of simple steel structures and stability of shear wall buildings.	5	After the course, students must have gained knowledge of and understanding within: - Plastic and elastic load distribution in statically indeterminate shear wall multiple story structures - Virtual work and flexibility method for calculating deflexion, rotation and reactions. - Plastic moment distribution using partly the principle of virtual work as well as superposition - Steel columns subjected to moment - Simple welded and bolted steel connections.	After the course, the student must be able to: - demonstrate the global stability of statically determinate shear wall and diaphragm buildings, including determination of whether seismic load or wind load is dominant. - determinate deflection and rotation in structures by using virtual work principle. - determinate the reactions in statically indeterminate beams by using flexibility method. - determinate plastic moment distribution using the principle of virtual work - design columns subjected to moment and axial force.	At the end of 4 semesters, the students in collaboration with other students must be able to, use the achieved knowledge and skills to be able to design steel structures as well as an estimate of the stability of shear wall buildings.	Prerequisites: 80% of all assignments must be handed in on time AND 80% of all assignments must be approved at the beginning of the project period. Type of exam: Individual oral exam with external assessment, 25 min. Tools allowed: No tools allowed. Re-exams: Conducted as the ordinary exam.

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
				- design simple welded and bolted steel connections.		
CE-SEP4	Semester project 4	10	The student is expected to achieve an understanding of other engineering capabilities during the completion of the project. The student must achieve knowledge and skills to plan and design renovation of infrastructure in urban areas.	The student must achieve skills to: • Use a digital platform for collaboration in work groups • Demonstrate an understanding for the complexity of an infrastructure renovation project. • Demonstrate the ability to communicate project results to the project owner. • Analyse and use data of many different kinds, related to the project. • Understand different forms of communication and act accordingly. • Give an account of the ethical considerations in the project work. • Reflect on the efficiency of knowledge sharing in the project group and the quality of the project work. Furthermore, group collaboration, report writing and presentation skills must be practiced during the project work.	Upon finalising the project, the student must have achieved the following competencies: • Use a digital platform for collaboration • Demonstrate an understanding of the complexity of an urban infrastructure renovation project • Demonstrate the ability to communicate project results to the project owner. • Analyse and use data of many different kinds, related to the project. • Understand different forms of communication and act accordingly. • Give an account of the ethical considerations in the project work. • Reflect on the efficiency of knowledge sharing in the project group and the quality of the project work.	Exam prerequisites: Project report and Process report submitted before deadline. Type of exam: Group exam with individual assessment. Group presentation approx. 20 minutes followed by joint evaluation with joint discussion and individual question rounds for approx. 20 minutes per student including grading. Individual grades are given on the basis of an overall assessment of the submitted work as well as the individual's presentation during the exam. External assessment. Tools allowed: All Re-exam: On the basis of the feedback, the students have received after the ordinary test, either a new project must be prepared, or the failed project must be improved. The students will be informed at a separate meeting at the end of June about specific deadlines and more detailed progress for the project work. New project groups are formed where possible in relation to the number of students who failed. No guidance is provided in the period leading up to delivery. Grades are given based on the quality of the updated or new project. There will be no oral defence at the re-examination.
CE-INP1	Engineering Internship (CE-)	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	

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
					learning environments • promote an engineering-oriented approach during the remaining semesters on the Bachelor programme • develop personal skills required for the professional career as engineer • form the basis for developing personal/professional network	
CE-CMP2	Project and Construction - Planning and Management	5	The student will obtain knowledge of requirements for project and construction management and planning, obtain knowledge of building projects phases, organizational and contractual relationship. The student will obtain a basic knowledge of procurement and tender legislation in Denmark, the EU, and internationally. Furthermore, the student will obtain a basic knowledge of process - and risk management.	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. Possess knowledge of a building projects contracting and subcontracting relationships. Be able to perform a tendering procedure using legislation and processes for national (Danish), and international (EU) tenders The course will thus enhance the student's ability to participate in the daily work of planning and operating within the contracting, consulting and client corporation in terms of knowledge of the juridical and legal framework and procurement. Possess knowledge of process and risk management.	Upon completion of the course, participants should be able to identify themselves with the directly involved stakeholders and be able to participate in construction management at large. After the course, the student will be able to: Analyse, argue and explain the scope of a generic building project. Compare, select and argue for an appropriate organization and procurement form and perspectives the different forms.	
ENG-IDE1	Innovation and Entrepreneurship project	10	After having successfully completed the course, the students will have gained: - An understanding of innovation and entrepreneurship and its uses within the field of engineering and business. - Knowledge about three different innovation processes Design Thinking, Effectuation and Lean Startup - Knowledge about how to create a systematic and measurable progress in innovation and entrepreneurship tasks	After having successfully completed the course, the students will be able to: - Engage in innovative and entrepreneurial processes in a cross-discipline setting - Conceive, plan, and execute innovative ideas - Work methodically with innovation and entrepreneurship - Collect and apply relevant data/information about technologies, markets, and end users - Apply method to gain insights about the solutions impact on the current market. - Convey and argue for the results of a cross-disciplinary project group and the project group's learning process using correct professional terminology and optimal tools both in writing, graphically and orally.	After having successfully completed the course, the students will have gained competences in: - Introducing innovative ideas into project work - Contributing own professional skills in multidisciplinary teams with the objective of solving problems by using innovative and entrepreneurial processes and models - Clarifying multidisciplinary group competencies - Analyzing group dynamics and adapting working methods and collaboration methods to new group constellations to achieve effective collaboration in cross-disciplinary project teams - Independently structuring and planning own learning process in an interdisciplinary learning environment Able to independently argue for the	

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
					application and implementation of valid knowledge	
CE-BPR1	Bachelor Project Preparation Course	5	At the successful completion of the course, students will be able to: - Recognize forms of bias. - Distinguish between primary and secondary research.	At the successful completion of the course, students will be able to: - Identify a good project topic in a systematic way. - Create and execute search strategies to find relevant literature. - Construct an experimental design for the coming project. - Preparation and delivery of oral presentations. - Write a Project Description following the VIA Engineering guidelines including the following parts: 1. Background description, 2. Definition of purpose, 3. Problem statement, 4. Delimitation, 5. Choice of models and methods (experimental design), 6. Time schedule, 7. Risk assessment and 8. Sources of information (reference list). - Prioritize, choose, and justify the selection of solution models for complex issues, including reflecting on the choice of scientific method. - Argue for the selection of sources, references, and data in connection with project work.	At the successful completion of the course, students will be able to: - Communicate with an external partner. - Extract the essence of a project and defend this clearly through oral presentation. - Make effective use of feedback/feedforward from a supervisor. - Work together in the project group as a team. - Independently and critically analyze new knowledge and argue for its application related to the project work. - Work analytically, methodically, and systematically on the semester project within the project group and incorporate ethical considerations within the profession.	
CE-BPR2	Bachelor Project	15	After completing the project work, the student must be able to: - Conclude and reflect on relevant tools, methods and results in connection with the solution of the problem. - Develop an understanding of personal learning needs and choose appropriate strategies to structure self-directed learning in an interdisciplinary context. - Explain theories and methods used in the project. - Critically acquire new knowledge.	After completing the project work, the student must be able to: - Independently assess theoretical and practical issues within the construction sector and justify the choice of chosen solution models based on their relevance, responsibility, durability and applicability with a focus on modern technologies and best practice. - Assess new knowledge independently and argue for its strategic use in project work, demonstrate the ability to effectively incorporate innovative ideas into practical solutions. - Search for and select the best suited theories and methods for the project. - Apply selected theories and methods to the project. - Participate in and take responsibility for professional collaboration. - Communicate both orally and in writing the results of the project as well as the	After completing the project work, the student must be able to: - Analyze a building or construction engineering problem, collects data, selects and applies relevant methods, concludes and puts results into perspective. - Plan and structure a complex project. - Perform a practice-oriented project in accordance with a plan. - Reflect on the results of the project in a professional, holistic and ethical perspective.	

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
				process.		
CE-BET2	Concrete 2	5	After completion of the course, the student must: - Have knowledge about calculating beams, wall and slabs. - Have knowledge about statics for precast concrete elements.	After completed the course, the student must be able to: - Calculate the loadbearing capacity of simple centrally loaded concrete columns - Calculate the loadbearing capacity of eccentrically and transversely loaded columns. - Calculate walls by using “EC2 – simplified method for walls as well as the “Danish Element formula”. - Calculate continuous concrete one-way spanning slabs according to the lower bound solution. - Calculate two-way spanning slabs according to the strip method.(a lower bound solution). - Be able to determine the horizontal transfer of forces to walls in a statically determinate and statically indeterminate wall structure, using elastic or plastic distribution of forces. - Calculate a wall using the “Strut and tie” model. - Gain an understanding of casting joints and be able calculate these in according to DS/EN 1992-1-1.	After completion of the course, the student must be able to communicate clearly both orally as well as in writing, especially by being able to visualize the calculation with relevant sketches that show the applied calculation model, preconditions etc.	
CE-CMP3	Contractors Financial Management	5	After completion of the course, the student must have knowledge about: – Company economy – Project economy – Cash flow – Accounts	After the course, participants should: – Understand how the economic systems work in a construction company. – Have knowledge of a construction company’s economic conditions - including liability and risk - and have a thorough understanding of payment systems. – Be able to conduct a project cash flow. – Understand the application of LEAN Construction.	Upon completion of the course, participants should: – Be able to assist in economic and managerial aspects in a construction company – Be able to conduct a company´s project work. – Be able to analyse, argue, and explain the scope of a construction company’s economy. – Be able to compare, select and argue for an appropriate way of calculating direct and indirect costs, risk and margin. - Be able to assist in an organization managed by LEAN Construction principles.	
CE-FEM1	Finite Element Method for Frame and Plate Structures	5	After completion of the course, the students must: – Have knowledge about theory that covers basic aspects of matrix mechanics including stiffness relations for 2D-beam elements. The theory will be	After the completion of the course, the student must: – Transform a conventional structural model into a model appropriate for FE-treatment. – Adopt the procedures of commercial	After completion of the course, the student must be able to use knowledge and skill within all subject areas to plan and make relevant choices of techniques and theories in order to solve structural design project.	

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
			accompanied by MATLAB exercises and followed up by applications on steel, concrete and timber structures using the commercial STAAD PRO software package.	finite element programs in general and the STAAD PRO software in particular.		
CE-GEO1	Deep Excavations in Urban Areas	5	After completion of the course, the student will have knowledge of: Execution of deep excavations and construction pits. The main characteristics and risks connected to different types of retaining walls. One- and two-dimensional ground water flow. Calculation of gradient, critical gradient and the risk of base failure. Different methods for ground water lowering	After completion of the course, the student will have the skills to: Compare the suitability of different types of retaining walls. Calculate the critical gradient and check for risk of base failure. Calculate the influence of flowing ground water on earth- and water pressure on retaining structures. Perform calculations on the drawdown for ground water lowering in confined and unconfined ground water aquifers	After the course, the student will be able to apply knowledge and skills to: Discuss the suitability of different types of retaining walls in urban applications for most soil and ground water conditions. Evaluate risks of constructing deep excavations. Design and plan simple ground water lowering systems. Evaluate the influence of ground water on excavations and retaining walls	
CE-GEO2	Geotechnical design	5	Following completion of the course, the student has knowledge of: – Risk of punch through for foundations on thin soil layers – Plane pile works / piles in groups – Methods for strengthening of soil	After completion of the course, the student must have the skills to: – Calculate the bearing capacity of a soil layer placed at a limited depth below the foundation – Calculate the bearing capacity of piles in groups – Examine the stability of slopes – Determine the best suitable method for strengthening soil	After the course, the student will be able to apply knowledge and skills to: – Design ground anchors – Design of anchor plates and anchor length to ensure total stability – Design of steel in excavation pits – Evaluate the need for strengthening the soil	
CE-INE1	Indoor Environment	5	Following completion of the course, the student can: Explain the indoor environmental parameters and impact on human health and comfort, that includes; thermal, atmospheric, acoustic, visual and mechanical indoor climate. Describe the impact of the physical indoor environment on human work performance. Identify relevant legislation and standards for Indoor Environment. Observe and describe building installations that influence the indoor climate	Following completion of the course, the student can: Calculate and illustrate the thermal, atmospheric and visual indoor climate. Use software tools to simulate and document the indoor environment with focus on thermal and atmospheric indoor climate. Apply existing codes, standards, and guidelines for the indoor environment. Plan measurements and surveys of indoor climate and use instruments to measure relevant parameters in one selected work environment.	Following completion of the course, the student can: Select and analyse relevant indoor environment design criteria's for a specific work environment for planning of ventilation system. Interpret relevant legislation, standards and executive orders. Plan and execute simple indoor climate field surveys and analyse and evaluate the results Carry out a project in groups and present the work in a report and in an oral presentation	
CE-INF4	Traffic Safety & Planning and Design of Roundabouts	5	After completion of the course, the student must have the overall knowledge on key elements of roundabouts and use of these in an urban environment.	After completion of the course, the student must have the skills to plan and design the geometry of roundabouts in urban areas. Furthermore, the student must have the skills to evaluate and apply traffic safety measures in the project. After the completion of the course, the student must: Understand the characteristics and needs	After completion of this course, the student must have the competences to: Analyse the capacity in a roundabout. Propose relevant designs of roundabouts – horizontal and vertical geometry, as well as, cross sections. Use CAD software for design of roundabouts. Design traffic solutions where the characteristics of the different road users are incorporated. Evaluate drainage	

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
				of the different road users in city and urban areas. Analyse and understand different situations and designs with the purpose of identifying potential traffic safety problems. Handle and document traffic safety issues in own designs and to come up with solutions and ideas on how to improve on existing designs	principles and carry out drainage controls in own design. Propose materials and pavements for a roundabout. Evaluate and plan traffic flow during construction works. Analyse traffic safety measures in new and existing designs	
CE-INF5	Infrastructure – Planning, Design and Maintenance of Road Projects in Urban Areas	5	After completion of the course, the student must have the knowledge of: • Workflows and roles of stakeholders involved in urban infrastructure projects, from initial ideas to operation and maintenance • Project documentation for urban infrastructure projects in preliminary design phase • Project documentation for urban infrastructure projects in detail design phase • Project documentation for urban infrastructure projects in tender phase • Project documentation for urban infrastructure projects in operation and maintenance phase	After completion of the course, the student must have the skills to: • Identify which stakeholders are involved in an urban infrastructure project at each project phases • Describe the roles of stakeholders involved in an urban infrastructure project at each project phases • Plan and design urban infrastructure projects, such as parking spaces and traffic terminals and speed reducers	After completion of this course, the student must have the competences to: • Manage a simple road infrastructure project in urban areas from initial ideas to operation and maintenance phase	
CE-MAS1	Masonry Structures	5	After the course, the student should have knowledge about using of masonry structures in common buildings. After completion of the course, the students must: - have knowledge about fundamental material properties of masonry - have basic knowledge about stress analysis and calculation of deformation of simple load-bearing masonry structures.	After the course, the student must be able to: - determine material properties of masonry structures - design of masonry walls subjected to vertical and horizontal loads - design of lintels - design of wall ties - describe movement joints, shear walls, reinforced masonry and steel columns in masonry structures. - Evaluate the execution of masonry structures	After completion of the course, the student must be able to use knowledge and skill within all subject areas to plan and make relevant choices of techniques and theories in order to solve masonry structural design project and choose suitable fire protection for common structural elements.	
CE-STU1	Steel Structures	5	After completion of the course, the students must: – Have knowledge about different types of steel structures (e.g. industrial buildings, hangars). – Have knowledge about the principles for calculation of plate elements with stiffeners and be able to calculate a chosen few. – Have knowledge about the resistance of transverse forces (design resistance of webs in plate girders).	After completion of the course, the students must: – Be able to model globally stable structural steel systems. – Be able to calculate buckling of plates, eg. in welded plate girders. – Be able to calculate cross sections in class 4 using the effective cross section in the ultimate limit state. – Be able to calculate a plate girder with respect to lateral torsional buckling. – Analysis of bracing systems which are	After completion of the course, the student must be able to use knowledge and skill within all subject areas to plan and make relevant choices of techniques and theories in order to solve structural design project.	

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
			– Have knowledge about flange induced web buckling. – Have basic knowledge of fire design for structural steel. – Have knowledge of various steel connection types. – Have a basic understanding of load transfer in steel connections.	required to provide lateral stability of beams and compression members (eg. columns). – Be able to calculate restraint in structural parts subject to compression. – Be able to analyse/calculate some chosen structural steel connections (eg. welded connections in portal frames, design tension resistance of a T-stub flanges in plate girders).		
CE-SUB1	Sustainable Buildings	5	The students will gain knowledge about the concept of sustainable buildings.	After completion of the course, the student must be able to: Define sustainability i. E. relate to and apply sustainable concepts and understand The UN Sustainable Development Goals - 17 SDG´s. Understand and apply the concept of sustainable assessment tools, with focus on DGNB and introduction to LEED. Understand and work with the importance of early teamwork in the planning process between developer, architect and engineer – Integrated design process IDP. Design and analyse a building with respect of the concept of Integrated Energy Design.Calculate, analyse and evaluate the Energy performance Framework with passive and active techniques. Acquire knowledge and understanding of indoor environmental climate in buildings, i. E. simple analyse of daylight. Implement methods of LCA and Cradle to Cradle concept.	Following completion of the course, the student can:Relate Engineering competences to the UN Sustainable Development Goals - 17 SDG´s – role and responsibilitiesAssess the sustainable assessment method DGNB by screening the overall performance of the build environment. Evaluate in depth selected DGNB credits with respect of:Integrated Energy Design IED/Integrated design process IDP. Sustainable building materials. Energy performance framework. Indoor climate, daylight calculation. Life Cycle Assessment (LCA)	
CE-SUD1	Sustainable Drainage	5	The purpose of the course is to provide the students with knowledge on how to implement sustainable solutions to handle an increase of rain/raise of sea water in urban areas.	After the completion of the course the student must have knowledge about: • Climate change, precipitation, sea water level. • Methods to handle rain water locally. • Reuse of rain water. • Green roofs. • Infiltration basins. • Open channels • Use of Scalgo	The student will be able to communicate with students, engineers and companies about sustainable drainage and outline proposals for projects involving new and sustainable methods of handling rainwater.	
CE-TIM1	Timber Structures	5	After completion of the course, the students must: – have knowledge about fundamental properties of materials in Timber. – have basic knowledge about Stress analysis and calculation of deformation of simple load-bearing structures.	After completion of the course, the students must: • have gained an understanding of Timber structure and physical properties. • be able to apply their knowledge in order to carry out stress analysis and calculation of deformation of simple load-	After completion of the course, the student must be able to use knowledge and skills within all subject areas to plan and make relevant choices of techniques and theories in order to solve structural design project. The students must also be able to	

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
			– have knowledge and understanding of the most complex load bearing structures and connections in timber. - have knowledge about CO2 Emission from wood.	bearing structures in timber beams and centrally loaded timber columns. • be able to describe materials of Timber based panels Also they must be able to describe, calculate and apply: • Moment loaded compression bars in timber. • Lateral torsional buckling in timber beams. • Connections in timber structures – nails and bolts. • tension/compression bars • tapered beams. • trusses and glued thin-flanged beams. • fire resistance calculation. • Diaphragms in timber structures. • Be able to calculate CO2 emission from wood to help with comparison.	perform laboratory experiments and associated reports (laboratory exercises are conducted as a workshop courses).	
CE-VEN1	Ventilation Systems	5	Following completion of the course, the student can: - Identify and explain the indoor climate parameters and their impact on the ventilation and management and thereby the building´s energy demand. - Account for the Building Regulations requirements for building energy demand, indoor climate and building services. - Account for different principles of ventilation (natural, hybrid and mechanical ventilation). - Calculate and choose different component in a ventilation system, including heating/cooling coils, filters and ventilation units. - Identify different controlling strategies for a ventilation system.	Following completion of the course, the student can: - Carry out a justified choice of ventilation principle and automation system based on the function demand. - Design a ventilation system with the necessary components based on the required performance. - Optimize and adjust a ventilation system regarding the required airflow and energy efficiency. - Conduct a sound analyse of a ventilation system and reduce it according to the demand. - Account for BIM and the application of 3D design of a ventilation system.	Following completion of the course, the student can: - Detailed design of ventilation in buildings - Distribution of air in rooms and design of diffusers. - Air treatment processes and Mollier diagram. - Calculation of ducts and design of the air distribution system. - Design of ventilation components (Fans, Heat exchangers, Pumps and Engines). - Estimation of sound in ventilation systems and calculation of attenuators. - Calculation of energy consumption and heat recovery efficiency. - Understand the different ventilation automation and control systems. - Bips work specification tool for ventilation and building automation. - Knowledge of calculation methodology of natural ventilation in buildings.	
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	Students completing this course will be able to: - Define functional units, system boundaries and time scopes for LCA analyses according to the international guidelines (ISO standards 14040 and 14044) - Carry out LCA analyses for simple production or service system scenarios	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 - Discuss the effect and importance of relevant environmental impacts of different (but comparable) scenarios in	

Code	Title	ECTS	Knowledge	Skills	Competencies	Assessment
			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 - The origin and concept of CE and how it differs from the current linear system - How the UN system influences global development within CE - The UN SGDs	according to the international guidelines (ISO standards 14040 and 14044) - Compare competing production or service systems on the basis of 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 international guidelines (ISO standards 14040 and 14044) - Graphically present the end results of LCA analyses and explain how these are related to the former steps of the analyses - Identify barriers to change of CE development - Identify opportunities for CE business development - Formulate individual change of behavior to promote CE - Evaluate business cases in relation to fulfilling the SGD - Promote circular economy as an innovation tool for companies	relation to the environmental and social circumstances under which the scenarios are present - Relate results from LCA analyses with the ideas of CE to suggest sustainable choices in given situations - Discuss how working towards fulfilling the SGDs requires individual as well as a political change of behavior	
SE-STS1	Geothermal Systems	se5	The student will gain knowledge about geothermal systems as a sustainable energy source and obtain an understanding of the physical design, dimensions, functions and operation of these systems.	After the completion of the course, the student must be able to: • Describe the thermal properties of rock and soil. • Explain the working principle of a heat pump. • Calculate thermal conductivity from thermal response test data. • Dimension a geothermal system using the professional software EED. • Calculate COP for a heat pump by measuring produced and spent energy in a system. • Describe the construction of a borehole heat exchanger and identify critical areas. • Identify the various conflicts of interest in relation to ground source heating and cooling.		
SE-TER1	Thernodynamics and Particle Dynamicx	5	The students will get knowledge about: The basis of thermodynamics, ideal gases and reversible processes, the	After completing the course the student will be able to: Analyze a particle dynamic system and/or	After completing the course the student can: Identify which parts of the acquired	

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			second law of thermodynamics and entropy, real substances, steam power plants, refrigeration and heat pumps systems, heat transfer/heat exchangers. Kinematics of a particle and kinetics of a particle, steady flow of a fluid stream and work and energy.	a simple thermodynamic system and identify and select relevant theory so the student is able to perform serial mathematical calculations on variables and main capacities for the system. Solve simple technical problems on the basis of fundamental calculus and dynamic or thermodynamic laws. Follow simple procedures with different techniques of stating and solving dynamic or thermodynamic problems. IT is used in a pedagogical method in the course. The aim is that IT will support the learning process of the students and their understanding of the engineering professional possibilities in, for example, the application of modelling, simulation, etc.	knowledge and skills that´s relevant to a given simple real-world particle dynamic or thermodynamic problem. Relate the acquired knowledge and skills to create simple mathematical models of real-world particle dynamic or thermodynamic problems. Use their acquired skills and knowledge to study more Dynamics and Thermodynamic courses on the Supply Engineering education. Use a commercial mathematical and other software to solve and perform serial technical calculations.	
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.	