Bring Ideas to Life
VIA University College

August 2021

Curriculum

Programme section

Bachelor of Engineering in Civil Engineering

Applicable to students enrolled in August 2021 and later.

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.

CONTENTS

Introduction

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

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

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

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

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

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

1 Identity of the programme

We educate and train the future engineers to 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 including exams is stated in the overview on the next page.

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

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

New students are admitted every year in August.

The study includes:

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

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

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

There are 5 workshops associated with the 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 Preparation of Bachelor Project	CE-SEP6 Semester Project Innovation and Entrepreneurship
5. Internship	CE-INP1 Internship				
4. Urban Infrastructure and Climate Adaptation	CE-SUD1 Sustainable Drainage	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 Theme	Course
4. semester *During the semester*	**PWS5** Workshop 5: The Civil Engineers role and tasks as a consultant engineer, client and as a contractor. Excursions and company visits
3. semester *Prior to the semester*	**PWS3** Workshop 3: Welding and Plumbing, MagiCad
2. and 3. semester *During the two semesters*	**PWS4** Workshop 4: Laboratory activities, fieldwork, workshop and construction site visit Soil work and building site, road building, casting of concrete beams
1. semester *Prior to study start*	**PWS2** Workshop 2: Basic carpentry and masonry work
1. semester *During the semester*	**PWS1** Workshop 1: Company visits, construction site visits and modelling workshop

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 Allowed tools: At 20-40% of the exam, the use of CAS programs is not allowed. For the rest of the exam, the use of CAS programs is permitted. External assessment Danish 7-step-scale Re-exams: Conducted as the ordinary exam
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 Re-exams: Conducted as the ordinary exam

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.	Assessed on the basis of 3 individual assignments during the course, each weighing 25%, as well as a final oral group exam, weighing 25% Internal assessment. Grading based on the Danish 7-Point scale Re-exam: Conducted as the ordinary exam
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 Re-exams: Conducted as the ordinary exam
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	Prerequisite: Submission of written group assignment before deadline. Exam type: Group presentation, 20 min., assessment approx. 20 min./stud. Internal assessment Grading based on the Danish 7-point scale Re-exams: Based on feedback at the ordinary exam, the student should either make a new project or improve the existing project. Grade is given on the basis of the updated or new project without oral defence.

The learning objectives of the courses (knowledge, skills and competencies) can be found 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 design of storm water basins.
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	Prerequisites: Upload in WISEflow of 4 course assignments solved during the course. Individual oral exam, 20 minutes Internal assessment

	Grading based on the Danish 7-point scale Re-exams: Conducted as the ordinary exam
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.	Prerequisites: Upload in WISEflow of selected course assignments solved during course, approximately one week before the oral exam. Individual oral exam, 20 minutes, no aids allowed. Internal assessment Grading based on the Danish 7-point scale Re-exams: Conducted as the ordinary exam
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 Re-exams: Conducted as the ordinary exam or as an oral exam, 25 min.
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 assessment of 3 written individual/ group assignments, weighing 25% and a final exam consisting of a written individual course assignment, weighing 25%. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral exam, 20 minutes Internal assessment
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 sizing of storm water basins and the planning of soil work in a major road project, including planning methods and tools Theme: Cooperation	Prerequisite: Submission of written group assignment before deadline. Oral group exam with individual assessment Group presentation, 20 min., assessment approx. 20 min./stud. External assessment Grading based on the Danish 7-point scale Re-exams: Based on feedback at the ordinary exam, the student should either make a new project or improve the existing project. Grade is given on the basis of the updated or new project without oral defence.

The learning objectives of the courses (knowledge, skills and competencies) can be found 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 Re-exams: Conducted as the ordinary exam (new assignments)
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 Re-exams: Conducted as the ordinary exam or as an oral exam, 25 min.
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 execution of a construction, including in situ cast concrete structures and prefabricated concrete elements.	Ongoing assessment of 6 written assignments and 1 final written exam, all weighing equally. Internal assessment Grading based on the Danish 7-point scale Re-exams: The 7 written assignments are improved, otherwise as ordinary exam.
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., with 20 min. preparation External assessment Grading based on the Danish 7-point scale Re-exams: Conducted as the ordinary exam.
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.	Prerequisite: Submission of written group assignment before deadline. Oral group exam with individual assessment Group presentation, 20 min., assessment approx. 20 min./stud.

- 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	External assessment Grading based on the Danish 7-point scale Re-exams: Based on feedback at the ordinary exam, the student should either make a new project or improve the existing project. Grade is given on the basis of the updated or new project without oral defence.

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

ECTS credits: 30

5.4 4th semester: Urban Infrastructure and Climate Adaptation

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

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

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

Purpose, ECTS and assessment:

Sustainable Drainage (CE-SUD1) – 5 ECTS	**Assessment**
The course aims to provide the students with knowledge on how to implement sustainable solutions to handle an increase of rain/raise of sea water in urban areas.	Ongoing assessment of written assignments, in total weighing 30% and final exam in the form of a major written assignment weighing 70%. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral exam with internal assessment, 20 min.
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 Re-exams: Conducted as the ordinary exam
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 Re-exams: Conducted as the ordinary exam.

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 assessment of 2 written individual/group assignments, weighing 15% and 35% and a final individual written exam, weighing 50%. Internal assessment Grading based on the Danish 7-point scale Re-exams: Individual oral exam, 20 minutes Internal assessment
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. The focus of the teaching in SEP4 is: Study techniques and team-based project work. In addition, professional inputs on risk management of construction projects and installation methods for sheet pile walls Theme: Interprofessional cooperation	Prerequisite: Submission of written group assignment before deadline. 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 Re-exams: Based on feedback at the ordinary exam, the student should either make a new project or improve the existing project. Grade is given on the basis of the updated or new project without oral defence.

The learning objectives of the courses (knowledge, skills and competencies) can be found 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 will find an internship, which must be approved by VIA, who appoints a supervisor for the intern.

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

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

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

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

7 6th-7th semesters

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

Compulsory courses/projects are listed in section 7.1.

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

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

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

7.1 Compulsory courses and projects

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

Purpose, ECTS and assessment:

Title (code)	Purpose / Content	Scope	Exam
Construction Management and Planning (CE-CMP2)	The aim of the course is to introduce Construction Management and Planning.	5 ECTS	Oral group examination with individual assessment. Grading based on the Danish 7-point scale External assessment
Semester project (CE-SEP6)	A compulsory cross-sectoral semester project with the purpose to develop and document a cross-organisational innovation project in collaboration with a company or institution. It is also possible to have a cross-sectoral semester project where work is done on an entrepreneurial process.	10 ECTS	Prerequisite: Submission of written group assignment before deadline. Oral group exam with individual assessment Group presentation, 20 min., assessment approx. 20 min./stud. External assessment Grading based on the Danish 7-point scale Re-exams: Based on feedback at the ordinary exam, the student should either make a new project or improve the existing project.

			Grade is given on the basis of the updated or new project without oral defence.
Bachelor project preparation course (CE-BPR1)	Developing a Project Description for the Bachelor Project (BPR2) that is in accordance with VIA Engineering Guidelines.	5 ECTS	Assessed on the basis of project description for BPR2 Approved / not approved Internal assessment
Bachelor project (CE-BPR2)	Carrying out the project including follow up on the time schedule and completion of the planned activities. Documentation of time used according to the project record. Application of computational technology relevant to the project. Documentation and promotion of the project result in a report. Planning of the oral presentation of the project.	15 ECTS	Prerequisite: Submission of written group assignment before deadline. Oral group exam with individual assessment Group presentation, 20 min., assessment approx. 20 min./stud. External assessment Grading based on the Danish 7-point scale Re-exams: Based on the feedback, the students have received after the ordinary exam, they must prepare a new project, or the failed project must be improved. There will be no guidance in the period up to hand in. The project is assessed at an oral exam.

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

7.2 Electives

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

Electives run if there are sufficient number of registered students.

Purpose, ECTS and assessment:

Navn (kode)	**Indhold**	**Omfang**	**Prøve**
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	5 ECTS	Ongoing assessment of 4 written assignments and a final exam in the form of a written assignment. All weighing 20% Grading based on the Danish 7-point scale. Internal assessment. Re-exams: Oral exam without preparation, 20 min. Internal assessment.

Element Building – Concrete Statics (CE-ELM1)	Statically indeterminate wall structures In-plane stress conditions for reinforced concrete diaphragms The effective design concrete compressive strength Strut and tie model The stringer method Shear walls Diaphragms (the storey partition) Casting joints calculation Design of joints	5 ECTS	Oral exam Danish 7-point scale. Internal assessment. Re-exams: Conducted 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 modeling. 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).	5 ECTS	Ongoing assessment of written assignments, weighing 20% in total, and a final exam in the form of a written mini project, weighing 80%. Grading based on the Danish 7-point scale. Internal assessment. Re-exams: Oral exam without preparation, 20 min. Internal assessment.
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	5 ECTS	Oral exam, 20 min. No exam aids allowed. Internal assessment Grading based on the Danish 7-point scale Re-exams: Conducted as 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	5 ECTS	Ongoing assessment of 3 written individual assignments each weighing 25 % and a final individual written test of 1,5 hours weighing 25 %, no exam aids. Grading based on the Danish 7-point scale Internal assessment Re-exams: Individual oral exam, 20 minutes. No exam aids allowed. Internal assessment
Advanced Geotechnical Design (CE-GEO3)	Analysis of retaining walls by use of FEM (Finite Element Method) Parameter and sensitivity analysis of input parameters for design calculations Retaining walls with multiple support levels Execution of inclinometer measurements Geotechnical design report	5 ECTS	Ongoing assessment of 1 written individual assignment weighing 30 %, 1 written group assignment weighing 40 % and a final individual written test of 1,5 hours weighing 30 %. Grading based on the Danish 7-point scale Internal assessment Re-exams:

			Individual oral exam, 20 minutes. No exam aids allowed. Internal assessment
Indoor Environment (CE-INE1)	Evaluating the indoor environment, by studying the influence of the physical environment, ie. 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.	5 ECTS	Ongoing assessment of 3 written individual/group assignments, weighing 10% each, and a final exam consisting of a written group course assignment weighing 70% Grading based on the Danish 7-point scale. Internal assessment Re-exam: Oral exam, 15 min. with internal assessment.
Basic Railway Planning and Design (CE-INF3)	Regulations: Track engineering rules and railway norms. Railway planning. General layout of a railway line. Open line design. Design of superstructure, earthworks, drainage etc. Speed profile for a railway track	5 ECTS	Ongoing assessment of 3 written individual/ group assignments and an individual written test, weighing 15%, 15% and 20% respectively, and a final individual written test, weighing 50%. Grading based on the Danish 7-point scale Internal assessment Re-exam: Oral exam with internal assessment.
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.	5 ECTS	Ongoing assessment of 1 written assignment and a final individual written test. Both weighing 50% Grading based on the Danish 7-point scale Internal assessment Re-exam: Oral exam with internal assessment.
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	5 ECTS	Ongoing assessment of written individual/group assignments, weighing 60% in total and a final exam in the form of a written test, weighing 40%. Grading based on the Danish 7-point scale Internal assessment Re-exam: Oral exam with an internal examiner.

Post Tensioned Concrete Structures (CE-PTC1)	Introduction to pre-tensioned and post-tensioned concrete. Determination of internal forces in the serviceability limit state in statically determinate and statically indeterminate beams. Ultimate limit state analysis - calculation of the ultimate moment. Choice of concrete section and prestressing force based on the serviceability limit state (uncracked section). The profile of the tendons/ ducts and calculation of contact forces between ducts and tendons.	5 ECTS	Oral exam, 25 min. Internal assessment Grading based on the Danish 7-point scale 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.	5 ECTS	Oral exam. Internal assessment Grading based on the Danish 7-point scale Re-exams: Conducted 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	5 ECTS	Ongoing assessment of 3 written individual/group assignments, weighing 10% each, and a final exam consisting of a written group course assignment weighing 70% Grading based on the Danish 7-point scale. Internal assessment Re-exam: Oral exam, 15 min. with internal assessment.
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 Glued thin-flanged beams Frames and bracing of timber buildings Connections with screws, dowels, glued in bolts, toothed shear plates. Fire resistance	5 ECTS	Oral exam. Internal assessment Grading based on the Danish 7-point scale Re-exams: Conducted 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.	5 ECTS	Ongoing assessment of 2 written individual assignment, each weighing 15%, and a final written group assignment and a subsequently oral group exam of 10 min./stud. together weighing 70%. Internal assessment Grading based on Danish 7-point scale Re-exams: Written individual assignment. Internal assessment
Life Cycle Assessment (SE-LCA1)	Introduction to UNs Sustainable Development Goals, Circular Economony and LCA. Methodes for Life Cycle Assessment (LCA) Impacts from use and reuse of ressources and materials Use of cases to evaluate alternative materials and technologies based on environmental and climate impact	5 ECTS	Individual written exam 48 hours Grading based on the Danish 7-point scale Internal assessment Re-exams: Conducted as the ordinary exam (new assignment)
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).	5 ECTS	Oral exam Grading based on the Danish 7-point scale Internal assessment Re-exams: Conducted as the ordinary exam

The learning objectives of the courses (knowledge, skills and competencies) can be found 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 (SEP6): 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)

7.4 Construction Management and Geotechnical Engineering

Contents
The following 50 ects are compulsory for the specialisation:
− Contractors Financial Management (CE-CMP3)
− Deep Excavations and Slopes in Urban Areas (CE-GEO1)
− Geotechnical Design (CE-GEO2)
− Project and Construction Planning and Management (CE-CMP2)
− 6. semester project (SEP6): Innovation and Entrepreneurship
− Bachelor project (BPR1+2): Project within Construction Management and Geotechnical Engineering

In addition, the following electives are recommended:
− Advanced Geotechnical Design (CE-GEO3)
− Life Cycle Assessment (SE-LCA1)
− Infrastructure – Planning, Design and Maintenance of Road Projects in Urban Areas (CE-INF5)
− Sustainable Drainage (CE-SUD1)

7.5 Infrastructure

Contents
The following 50 ects are compulsory for the specialisation:
− Basic Railway Planning and Design (CE-INF3)
− 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 (SEP6): Innovation and Entrepreneurship
− Bachelor project (BPR1+2): Project within Infrastructure

In addition, the following electives are recommended:
− Contractors Financial Management (CE-CMP3)
− Deep Excavations and Slopes in Urban Areas (CE-GEO1)
− Life Cycle Assessment (SE-LCA1)

7.6 Structural Design

Contents
The following 50 ects are compulsory for the specialisation:
− Element Building – Concrete Statics (ELM1)
− Finite Element Method for Frame and Plate Structures (FEM1)
− Timber Structures (TIM1)
− Project and Construction Planning and Management (CE-CMP2)
− 6. semester project (SEP6): Innovation and Entrepreneurship
− Bachelor project (BPR1+2): Project within Structural Design

In addition, the following electives are recommended:
− Post Tensioned Concrete Structures (PTC1)
− Steel Structures (STU1)
− Deep Excavations and Slopes in Urban Areas (CE-GEO1)
− Geotechnical Design (CE-GEO2)
− Advanced Geotechnical Design (CE-GEO3)

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

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

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 condition for assessment of the bachelor project, BPR2, is that the student has passed all other courses.

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

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

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

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

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

See also section 7.1.

10 Title and issue of degree

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

Code	Title	ECTS	Knowledge	Skills	Competencies
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.
CE-BEN1	Building Physics and Building Energy Demand	5	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).
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.	After the course, the student must: • Be able to perform static analysis by explaining load transfer in simple frame and shear-wall buildings.	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.

Code	Title	ECTS	Knowledge	Skills	Competencies
			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.)	• 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.	
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.
CE-SEP1	Semester project 1	10		Through the design of a minor commercial structure, the student must become familiar with the most common construction principles, choice of materials, the stability of the building and layout according to the building regulations. The student must be able to evaluate the building envelope in terms of energy aspects and design heating installations and ventilations system for scheme design. Through completion of the project, group cooperation, report writing and presentation technique will be put into practice.	At the end of the semester, the students must: - Obtain knowledge on regulations of design of small commercial construction. - Have insight into the calculation methods and analysing tools in relation to the design and planning of small industrial/sports facility building

Code	Title	ECTS	Knowledge	Skills	Competencies
				In the course, IT figures as a pedagogical method. The aim is that IT will support the learning process of the students and their understanding of the engineering–technical possibilities in the application of BIM modelling, simulation etc.	
CE-GEA1	Geotechnical Engineering and Civil Works	5		After completion of the course, the student must: - Have knowledge about the geological processes and resulting materials in Denmark - Have knowledge about strength- and deformation parameters for soil and perform laboratory tests and field tests - Be able to calculate stresses in soil - Be able to use different digital map types and borehole information to assess expected soil layers for a project location - Be able to assess the top-level of deposits that can resist loads and the frost sensitivity of different deposits and how this affects the civil engineering project - Have achieved knowledge about the basic theory of consolidation and methods for determining settlements and time progress of settlements.	
CE-INF1	Infrastructure in Rural Areas	5	After completion of the course, the student must have the knowledge of: • Road types and planning	After completion of the course, the student must have the skills to: • Perform analyses and road planning in rural areas • Determine design parameters for a road project • Propose relevant design of horizontal and vertical alignments, as well as, cross sections • Use MicroStation and OpenRoads Designer for geometrical design of roads and to draw out quantities from the 3D model	After completion of this course, the student must have the competences to: • Determine a road lay-out in regards to Danish Roads Standards and surrounding environment • Design a bypass road in 3D using MicroStation and OpenRoads Designer
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.	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.	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.

Code	Title	ECTS	Knowledge	Skills	Competencies
			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.	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.	
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 • Polar coordinates • Complex numbers • Ordinary differential equations of the 1st and 2nd order • Physical quantities and units • Reference systems • Kinematics of particles • Kinetics of particles • Vehicle dynamics	After completing the course, the student will be able to: • Identify Area, Centroid and Moments of Inertia for a plane region in an x-y coordinate system. • Identify and solve Linear equations systems. • Identify Area, Centroid, Moments of Inertia for a plane region and length of a curve in a polar-coordinate system. • Make simple calculations on complex numbers. • Describe simple problems and solve Ordinary differential equations of the 1st and 2nd order • Identify kinematic relations in the description of motion particles in different reference systems. • Set up and perform serial calculations by using the Laws of Newton. • Analyse the motion of a vehicle treated a particle.	After completing the course, the student will be able to: • Identify which parts of the acquired knowledge and skills that's relevant to a given, simple mathematical or simple real-world particle dynamic problem. • Model simple real-world problems especially particle dynamics problems. • Use their acquired skills and knowledge to study more advanced Calculus, Algebra and Dynamics courses on the Engineering programme. • Use a commercial mathematical software to solve and perform serial technical calculations.
CE-SEP2	Semester project 2	5	The students must obtain an understanding of planning and design of a road construction project in rural areas.	The students will obtain skills • To show understanding of the entire project complexity • To use the gained theoretical knowledge in practical activities • To analyse and use data gathered from practical activities and calculations • To set up, describe and interpret the collected data Through completion of the project, group cooperation, report writing and presentation technique will be put into practice. The course includes IT as a pedagogical method. The purpose is to support the students' learnings processes and their understanding of the engineering opportunities.	At the end of the semester, the students must: • Be able to use the knowledge obtained and the skills achieved during the semester, in order to plan and design construction in open areas

Code	Title	ECTS	Knowledge	Skills	Competencies
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. Explain the method of testing for building air tightness (blowerdoortest and thermography) as well as identifying 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 heating sources. Describe the sustainability principle and explain the Danish sustainability certification method DGNB. Explain BIM and the application of 3D design of building services.	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).Apply and illustrate the concept of integrated energy design when calculating the energy demands of buildings. Calculate and assess a room´s daylight conditions. Illustrate and solve critical points of the structure in relation to the air-tightness and thermal bridges, including 2-dim calculations of heat transfer through thermal bridges. Apply BIM strategy and illustrate 3D design of ventilation, including demonstrating extraction of quantities, collision check and quality assurance.	Following completion of the course, the student can: Design the building services and ventilation (project proposal level) Plan physical coordination of building services and ventilation with respect for building constructions using 3D tools. Design, analyse and reflect on the importance of the various parameters for the building's energy demand, calculated in accordance with the building regulations.
CE-CMP1	Planning of Construction Site design and execution of Construction in In Situ Cast Concrete and Prefabricated Concrete Elements	5	-Methods and principles for planning of construction site -Theories and principles for working with in situ cast concrete as opposed to concrete construction.	- Perform planning of a safe construction site -Perform planning of the contractors' resource management in relation to personnel, equipment and materials	- assist the building management as a construction site engineer in the project's execution phase.
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 Excel. • 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.

Code	Title	ECTS	Knowledge	Skills	Competencies
				• 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-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.
CE-SEP3	Semester project 3	10	The student must obtain an understanding of the planning and design of large buildings as well as become experienced in the implementation of building projects.	Through the project, the student must become familiar with the design, calculations and execution of parts of the construction project and installations in a larger building in concrete and steel. Through completion of the project, group cooperation, report writing and presentation technique will be put into practice. The students will obtain skills – To show understanding of the entire project complexity – To use the gained theoretical knowledge in practical activities – To analyse and use data gathered from practical activities and calculations – To describe and complete a report, including	At the end of the semester, the students must: – Be able to use the knowledge obtained and the skills achieved during the semester, in order to plan and design a large building – Obtain insight into the completion of construction projects and have achieved a certain routine within this area.

Code	Title	ECTS	Knowledge	Skills	Competencies
				presentation material – To present the project material In the project IT figures as a pedagogical method. The aim is that IT will support the learning process of the students and their understanding of the engineering technical possibilities in the application of BIM modeling, simulation etc.	
CE-KON4	Design of simple steel structures and stability of shear wall buildings.		After the course, students must have gained knowledge and understanding to: • be able to demonstrate the global stability of statically determinate multiple story shear wall buildings. • be able to determinate plastic load distribution in statically indeterminate shear wall structures • be able to determinate plastic moment distribution using partly the principle of virtual work as well as superposition • be able to perform plastic load-bearing capacity verification of steel cross-sections • be able to design steel columns subjected to moment • be able to design simple 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. • be able to determinate plastic moment distribution in statically indeterminate beams by means of equilibrium equations. • be able to determinate plastic moment distribution using the principle of virtual work • be able to perform plastic load-bearing capacity verification of steel cross-sections • be able to design columns subjected to moment and axial force. • be able to design simple steel connections.	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 rough estimate of the stability of shear wall buildings.
CE-GEA2	Geotechnical Engineering and Civil Works	5		After completion of the course, the student must: – be able to determine design assumptions, such as soil and groundwater conditions, relevant loads and load combinations – be able to calculate the bearing resistance of an individual pile in a foundation in both ultimate and serviceability limit state according to EC7-1 incl. the Danish national annex – be able to calculate earth pressure on retaining walls – be able to design a sheet pile wall in ultimate limit state according to Eurocode 3, part 5, taking into account bending, corrosion loss and cross sectional class – have knowledge about methods for planning and the execution of infrastructure projects in urban areas, including traffic management and phase plans	

Code	Title	ECTS	Knowledge	Skills	Competencies
				– have knowledge about contaminated soil and how it affects the project	
CE-INF2	Road Design in Urban Areas	5		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 an intersection • Design an intersection	After completion of this course, the student must have the competences to: • Analyse and compare the capacity of intersections • Analyse and compare results from road laboratory- and field tests
CE-SEP4	Semester project 4	5	The students must obtain an understanding of planning and design of an infrastructural construction project. Furthermore, they must be skilled in the execution of projects within this area.	• To show understanding of the entire project complexity • To use the gained theoretical knowledge in practical activities • To analyse and use data gathered from practical activities and calculations • To set up, describe and interpret the collected data Through completion of the project, group cooperation, report writing and presentation technique will be put into practice. The course includes IT as a pedagogical method. The purpose is to support the students' learnings processes and their understanding of the engineering opportunities.	At the end of the semester, the students must: • Be able to use the knowledge obtained and the skills achieved during the semester, in order to plan and design an infrastructure construction.
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:	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.
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 learning environments • promote an engineering-oriented approach during the remaining semesters on the

Code	Title	ECTS	Knowledge	Skills	Competencies
					Bachelor programme • develop personal skills required for the professional career as engineer • form the basis for developing personal/professional network
CE-BPR1	Bachelor Project - Start Up	5	Profound understanding of natural scientific issues, experimental qualifications, IT tools and group processes.	Analyse and explore a technical problem and setup plans and methods for solving it.	Plan and execute the analysis phase necessary for conducting a Project Description. Critically acquire new knowledge within relevant fields of engineering. Define how to solve occurring engineering tasks in a rational manner. Define how to conceive, design and implement technical and technological systems and whenever relevant pay the necessary considerations to social, economic, environmental and occupational health topics.
CE-CMP2	Byggeriets Planlægning og Styring	5		After the course, the student must: – The ability to identify themselves with the directly involved stakeholders and be able to participate in construction management at large -Have knowledge of a building projects contracting and subcontracting relationships. -Have knowledge knowledge of project phases and their contents related to contractual issues. - Be able to perform a tendering procedure using legislation and processes for national (Danish), and international (EU) tenders -be able to use the AB18 system. -Have knowledge of process and risk management	
SE-STS1	Geothermal Systems	se5	The student will gain knowledge about geothermal systems as a sustainable energy source and to obtain an understanding of the physical design, dimensions, functions and operation of these systems.	After the completion of the course, the student must be able to: • Describe the thermal properties of rock and soil. • Explain the working principle of a heat pump. • Calculate thermal conductivity from thermal response test data. • Dimension a geothermal system using the professional software EED. • Calculate COP for a heat pump by measuring produced and spent energy in a system. • Describe the construction of a borehole heat exchanger and identify critical areas.	

Code	Title	ECTS	Knowledge	Skills	Competencies
				• Identify the various conflicts of interest in relation to ground source heating and cooling.	
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-ELM1	Element Building – Concrete Statics	5	After completion of the course, the student must: – have knowledge about statics used for prefabricated concrete element building with the goal of implementing the design of concrete element buildings. – Obtain knowledge on commonly used joints.	After the completion of the course, the student must: – Be able to complete a building structural model comprehend the corresponding calculation model. – Be able to determine the horizontal transfer of forces to walls in a statically determinate and a statically indeterminate wall structure, using elastic or plastic distribution of forces. – Be able to understand and use the effective design concrete compressive strength used in plastic design of concrete structures – Be able to explain the principles of the strut and tie model and to solve simple tasks using it. – Be able to use the Stringer method in the calculation of walls and diaphragms. – Be able to complete stability calculations of walls both for one storey buildings and multiple storey buildings. – Be able to calculate the strength of shear walls (Strut and tie model, the Stringer method and vertical load bearing resistance). – Gain an understanding of casting joints and be able to calculate these in accordance to DS/EN 1992-1-1. – Be able to calculate some of the commonly used joints.	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.
CE-FEM1	Finite Element Method for Frame	5	After completion of the course, the students must:	After the completion of the course, the student must:	After completion of the course, the student must be able to use knowledge and skill within

Code	Title	ECTS	Knowledge	Skills	Competencies
	and Plate Structures		– Have knowledge about theory that covers basic aspects of matrix mechanics including stiffness relations for 2D-beam elements. The theory will be accompanied by MATLAB exercises and followed up by applications on steel, concrete and timber structures using the commercial STAAD PRO software package.	– Transform a conventional structural model into a model appropriate for FE-treatment. – Adopt the procedures of commercial finite element programs in general and the STAAD PRO software in particular.	all subject areas to plan and make relevant choices of techniques and theories in order to solve structural design project.
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-GEO3	Advanced Geotechnical Design	5	Following completion of the course, the student has knowledge of: – Parameter and sensitivity analysis – Serviceability limit state design of geotechnical structures – Retaining walls with more anchor levels – The content of a geotechnical design report – Risk assessment in relation to e. G. CSM procedure – Inclinometer measurements	After completion of the course, the student must have the skills to: – Design retaining walls with more anchor levels/support levels in ultimate limit state and serviceability limit state – Examine the serviceability limit state for excavations – Perform a parameter and sensitivity analysis to determine the effect on the design – Perform calculations in Plaxis – Perform inclinometer measurements and evaluate the results	After the course, the student will be able to apply knowledge and skills to: – Design retaining walls with more anchor levels (Ultimate limit state) and evaluate the deformations (serviceability limit state) according to Eurocodes. – Report the design in a geotechnical design report – Evaluate the results from the parameter and sensitivity analysis in order to select the parameters for the calculations – Critically evaluate the results from Plaxis calculations
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	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	Following completion of the course, the student can: Select and analyse relevant indoor environment design criteria for a specific work environment for planning of ventilation system. Interpret relevant legislation, standards and

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			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	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.	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-INF3	Basic Railway Planning and Design	5	After completion of the course, the student must have the overall knowledge on key elements of railways.	After completion of the course, the student must have the skills to: • Explain and execute the geometrical design of an open line	After completion of this course, the student must have the competences to: • Explain the infrastructure elements of railways • Describe elements in horizontal and vertical alignments, including switches and crossings • Describe elements in a typical ballast track cross section • Propose relevant designs of horizontal and vertical alignments, as well as, cross sections for an open line and a station • Explain the gauge structure and fouling point • Explain the terms cant excess, cant deficiency and ideal cant and describe how they are determined • Propose a speed profile for a track alignment • Calculate the running time of a train • Propose and evaluate timetables for a railway section • Explain the use of track engineering rules (requested-, standard and exceptional regulations) and railway norms (BN1-, BN2- and BN3-regulations), and define design criteria based on these.
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 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	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 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

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				come up with solutions and ideas on how to improve on 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-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). – 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.	After completion of the course, the students must: – Be able to model globally stable structural steel systems. – Be able to calculate buckling of plates, e.g. 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 required to provide lateral stability of beams and compression members (e.g. columns). – Be able to calculate restraint in structural parts subject to compression. – Be able to analyse/calculate some chosen structural steel connections (e.g. welded connections in portal frames, design tension resistance of a T-stub flanges in plate girders).	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.
CE-BET2	Concrete structures	5	The student must achieve knowledge to complete the analysis of simple concrete beams, columns and walls together with slabs in both the ultimate and the serviceability limit states.	Concrete structures: After the completion of this course the students must: - Be able to calculate and use MN-interaction diagrams for reinforced concrete cross-sections. in the serviceability limit state, - possess knowledge of the demands for	The student must be able to use the acquired knowledge and skills within all subject areas during the semester, to collaborate with other student, in the planning, design and performing of the subjects in the semester project. Furthermore, the student must be able to solve simple design tasks during the internship at a consultant engineering company or contractor.

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				concrete structures. - be able to calculate stresses by mean of the "Transformed cross-section method" and - be able to calculate deflections and crack widths in concrete beams and slabs. for columns and walls in the ultimate limit state: - be able to determine the loadbearing capacity of centrally loaded columns - be able to determine the loadbearing capacity of eccentrically and transversely loaded columns using the "Method of nominal stiffness" and "Method II". - be able to calculate walls using the "EC2-simplified method for walls and columns" as well as the "Danish Element formula" - Be able to calculate <u>continuous concrete beams and one-way spanning</u> slabs according to the lower bound solution method from the translated textbook "Bjarne Christian Jensen, Concrete structures in accordance with DS/EN 1992-1-1"- chapter 10.1 and 10.4. - Be able to calculate <u>two-way spanning slabs</u> according to the translated textbook "Bjarne Christian Jensen, Concrete structures in accordance with DS/EN 1992-1-1"- chapter 10.5 (a lower bound solution). - Be able to calculate <u>two-way spanning slabs by means of the Strip Method</u>. (a lower bound solution) - Be able to possess knowledge of curtailment of reinforcement in concrete beams, when taking into consideration the effect of the shear in the Diagonal Compression Field Method. <u>Common for all subject areas:</u> - In all the subjects above, the student must after the course, be able to communicate clearly both orally as well as in writing, especially by being able to visualize the calculations with relevant sketch-es that show	

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				the applied calculation model, preconditions etc.	
CE-PTC1	Post Tensioned Concrete Structures	5	After completion of the course, the student must: – have knowledge about pre-tensioned and post tensioned concrete structures. – be able to understand the static principles of pre-tensioned and post tensioned concrete. – be able to understand the relevance of applying prestressed concrete opposite to reinforced concrete. – be able to understand causes and significance of loss of prestress in prestressed concrete structures	After completing the course, the student must: – be able to apply methods to design prestressed concretes structures in the serviceability and ultimate limit state. – be able to quantify loss of stress in the tendons and estimate the significance of this.	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.
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 responsibilities Assess 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-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. – have knowledge and understanding of the most complex load bearing structures and connections in timber.	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-bearing structures in timber beams and centrally loaded timber columns. • be able to describe materials of Timber based panels	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 perform laboratory experiments and associated reports (laboratory exercises are conducted as a workshop courses).

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				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.	
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-CE-step working process that must be followed when carrying out an LCA analysis - The principles behind defining functional units, system boundaries and time scopes for LCA analyses - Chosen data sources providing data for LCI´s and LCIA´s - Different environmental impact categories	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 according to the international guidelines (ISO standards 14040 and 14044) - Compare competing production or service systems on the basis of an LCA analysis	Students completing this course will be able to: - Define comparable scenarios for competing production/service systems in order to analyse the respective environmental impacts of these - Discuss the effect and importance of relevant environmental impacts of different (but comparable) scenarios in 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

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			- 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	- 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 behaviour to promote CE - Evaluate business cases in relation to fulfilling the SGD - Promote circular economy as an innovation tool for companies	- Discuss how working towards fulfilling the SGDs requires individual as well as a political change of behaviour
CE-SEP6	Semester Project 6th semester	10	After the completion of the project work, the student must be able to: - Describe a given (chosen) engineering problem, list relevant tools (formulas, methods, software, etc.) to clarify the problem, apply the tools, reflect and conclude. - Understand how the conclusion/solution to the given problem influences connected areas theoretically and/or technically.	After the completion of the project work, the student must be able to: - Apply engineering theories and methods within chosen subjects and independently be able to plan and carry out experiments or practical measurements as appropriate. - Acquire new knowledge critically within relevant engineering fields. - Apply quality assurance/critically review data and results - Apply information and computational technology tools to the project - If relevant, make financial estimates for the project/solution. - Present all relevant information in report and appendix, using references and sources of information correctly. - Extract the essence of the project and communicate this clearly orally and in writing.	After the completion of the project work, the students must be able to: • Analyse a given (chosen) problem within the specialization, collect data, select appropriate methods of analysis, put the result into perspective and conclude. • Plan and carry out the project and related activities according to self-defined time schedule
CE-BPR2	Bachelor Project	15	After the completion of the project work, the student must be able to: - Describe a given (chosen) engineering	After the completion of the project work, the student must be able to: - Apply engineering theories and methods	After the completion of the project work, the student must be able to: - Analyse a given (chosen) problem, collect

Code	Title	ECTS	Knowledge	Skills	Competencies
			problem, list relevant tools (formulas, methods, software, etc.) to clarify the problem, apply the tools, reflect and conclude. - Understand how the conclusion/solution to the given problem influences connected areas theoretically and/or technically.	within chosen subjects and independently be able to plan and carry out experiments or practical measurements as appropriate. - Acquire new knowledge critically within relevant engineering fields. - Apply quality assurance/critically review data and results. - If relevant, make financial estimates for the project/solution. - Present all relevant information in report and appendix, using references and sources of information correctly. - Extract the essence of the project and communicate this clearly orally and in writing.	data, select appropriate methods of analysis, put the results into perspective and conclude. - Plan and carry out the project and related activities according to self-defined time schedule.