Technische Hochschule Ingolstadt

Module manual

Sustainable civil engineering

Bachelor full time

Study and examination regulations: SPO 2023

As of: 02/27/2024

Contents

1 Overview

The module handbook describes the individual modules of the Sustainable Civil Engineering course for the 1st semester. It contains all-important explanations about the requirements and types of module examinations. In addition to the course content, the objectives of the course, career profiles and opportunities that arise from studying sustainable civil engineering are described.

In addition to the content of the degree program, the module handbook also contains the study guidelines that lead to successful studies at THI.

The modules of the 3 to 7 semesters are listed as examples because we are in the first study cycle.

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2 introduction

2.1 Objective

Construction includes all underground and above-ground structures - tunnels, bridges, buildings and much more. What they all have in common is that they influence CO2 emissions during the construction and operation of the buildings. The construction industry in Germany alone causes 40% of CO_2 emissions. Legal requirements initiated by the EU aim to reduce the climate impact of construction, particularly through CO_2 reduction.

The bachelor's degree program in Sustainable Civil Engineering is designed to address and address this problem. Among other things, the course includes resource-saving construction and building in the life cycle. This means that climate-friendly planning and construction, which covers everything from use to dismantling of the structure. Other sectors that play a role in the construction industry are shown in Figure 1.

Figure 1.: Sectors of sustainable building

The goal is to be able to deal with society sustainably and responsibly, so that students can put their knowledge and way of thinking into practice and incorporate it.

2.2 Admission requirements

For the bachelor's degree program, the general admission requirements for studying at universities of applied sciences must be met.

The binding regulations for this study plan can be found in:

- Study and examination regulations for the bachelor's degree program in Sustainable Civil Engineering in the version dated December 13, 2021
- Framework Examination Regulations (RaPO)
- General examination regulations (APO) of the Ingolstadt University of Technology
- Matriculation regulations of the Ingolstadt University of Technology. The relevant provisions of the study and examination regulations influence the course of study.

Applicants who have not undergone any practical training (e.g. high school graduates) must provide evidence of practical work (=preliminary practice). Relevant technical vocational training or corresponding practical training from technical and vocational high schools (technology) will be taken into account. In other cases of previous training or professional activity, an application for recognition must be submitted.

According to §9 of the enrollment statutes, the preliminary internship in the Bachelor's degree program in Sustainable Civil Engineering lasts six weeks.

It must be completed by the beginning of the fourth semester of study at the latest.

The preliminary internship can be completed in an industrial, craft or construction company.

2.3 Target group

The course is aimed at young people who:

- are interested in studying that combines the **core content** of **civil engineering** with **sustainability aspects**
- later **sustainable construction carry and establish** in the company
- actively address the **challenges** of increasing urbanization and strive to develop future-proof concepts in the sense of economic, ecological and socio-cultural sustainability
- Bear responsibility for our society
- Use raw materials sustainably and promote recycling
- understand and live the overall concept of **sustainable building**

2.4 Study structure

The study of sustainable civil engineering is studied in a total of seven semesters and ends with the degree: Bachelor of Engineering.

The course is designed in such a way that it covers all components of conventional civil engineering, so that nothing stands in the way of an engineering career - the special feature of this course is that the traditional modules are designed to be sustainable. Modules that cover the sustainable and innovative construction sectors supplement the course.

In the first semester, for example, in the Sustainability module, rethinking is brought into the lecture hall by various speakers from science and practice. This way of thinking is taught technically on the economic and ecological pillar of sustainability but also on the empathetic socio-cultural pillar.

The course covers sustainability in construction and also covers the entire life cycle. The life cycle of a building begins with the construction product phase (production of building materials), the construction phase (construction and use) and the disposal phase (see Figure 2).

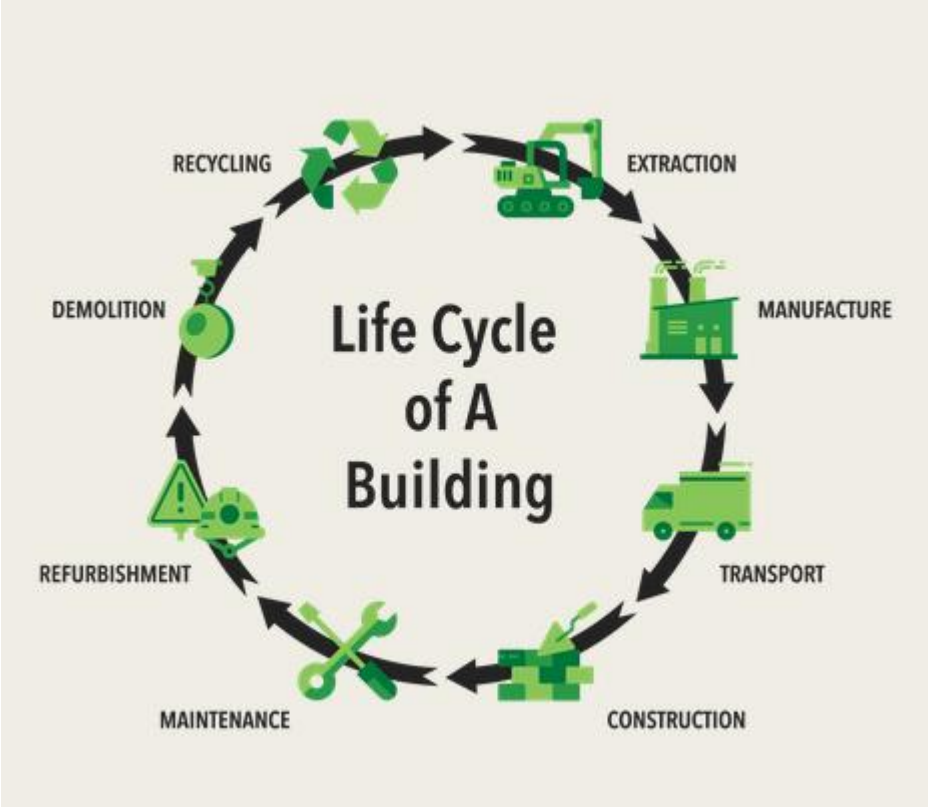

Figure 2.: Building life cycle

These sectors are incorporated into the course concept (see Figure 3), so that in addition to sustainability, traditional construction is also covered in terms of sustainability.

In particular, in the first 4 semesters, the foundations are created for the implementation and the first collaboration in the companies, so that in the fifth semester the interaction between teaching, theory and practice is created through a practical semester. The students are given the first opportunity to develop independently by choosing appropriate practical partners and to query and apply what they have studied. In the 6th and 7th semesters, elective subjects are offered that address, for example, life cycle costs or digital appointment management, until the bachelor's thesis is completed .

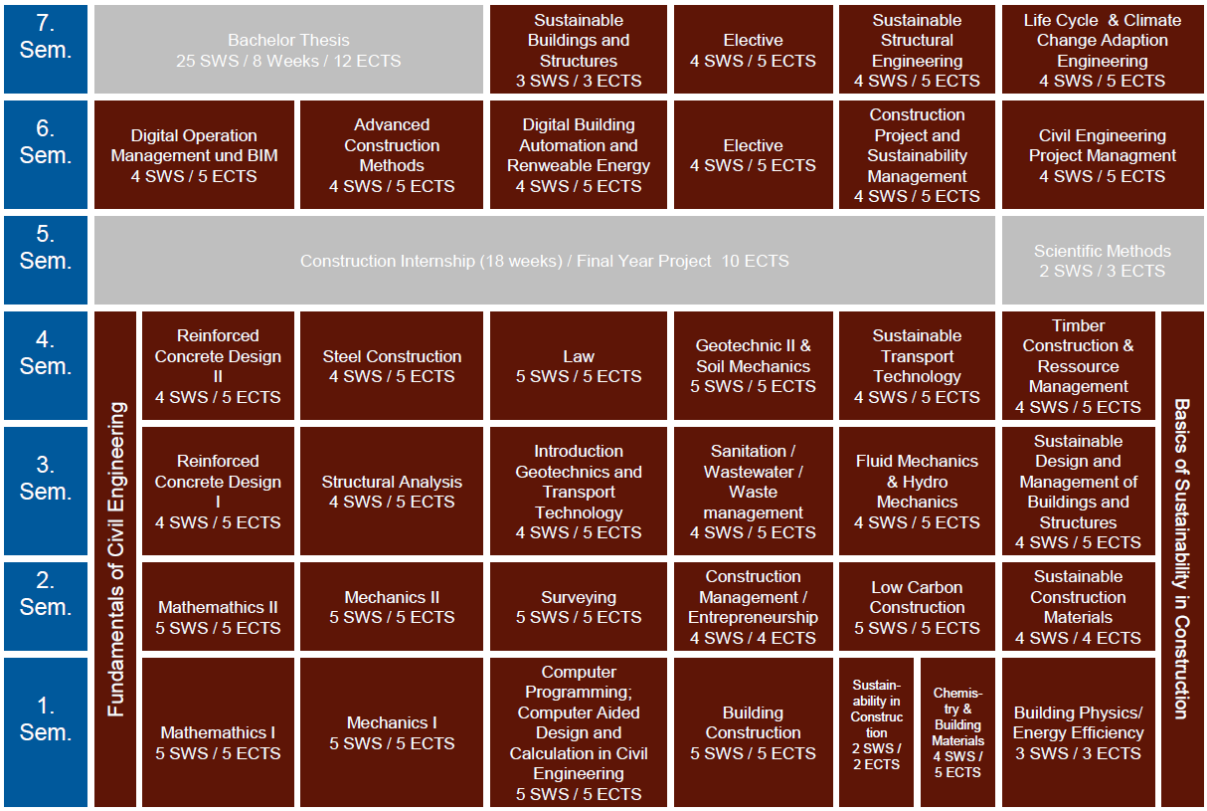

Figure 3.: Construction course concept

(Description: red=sustainable construction; gray=interface modules)

2.5 Advancement requirements

Only those who have completed at least 42 ECTS credit points from the modules of the first study period are eligible to enter the third semester of study. Only those who have achieved at least the grade "sufficient" in all examinations and relevant course-related proof of achievements in the first phase of study and have completed at least 20 ECTS credit points from the compulsory modules in the second phase of study are entitled to enter the internship.

2.6 Conception and expert advisory board

The course was designed by THI experts with the involvement of practitioners and is continually being developed further.

3 Qualification profile

3.1 Mission statement

3.1.1 THI's mission statement

The course of study directly addresses the general mission statement of the THI "Personalities and innovations –
for a future worth living." and its concept is aimed at the individual focal points:

- We develop personalities for the professional world of the future.
- We create innovations and live sustainability – technology and business are our focus.
- We shape the transfer in the economy and society.
- We teach, research and work internationally and in an interdisciplinary manner.
- We act humanely, passionately and open to the world.

3.2 Study objectives

The aim of the study is to prepare civil engineers for their future professional field so that they can design, plan, build and operate our infrastructure sustainably, innovatively, creatively and with a high sense of responsibility. The course content is adapted to constantly advancing technical developments. This increases the career prospects of our graduates, and not just at the national level.

During their studies, students should be trained to become independent personalities who are characterized in practice by their strong communication skills, grit and perseverance. You take on responsibility and have social skills.

3.2.1 Subject-specific competencies of the course of study

The graduates of the course have

- a very great technical understanding of the calculation, construction and dimensioning of buildings
- an expanded understanding of **building material technology**
- a **strong mindset** for implementing **sustainability processes in construction**
- the ability to implement new **technologies, models** and integrate them into **construction projects**
- Application knowledge of **digital methods** in civil engineering
- the ability to develop **holistic and sustainable solutions** in the design, planning and implementation of construction projects

3.2.2 Interdisciplinary competencies of the course

The graduates of the course have

- the know-how **to work scientifically**
- High level of expertise to see construction projects as a whole and to communicate with the relevant construction planners and construction partners
- Strong communication between sustainability managers and energy consultants
- the ability to **analyze problems** , recognize **overarching connections , implement engineering findings** when solving problems, find **technical, ecological and economic solutions to evaluate** and prepare **decision templates**
- the ability to **solve complex tasks independently**
- the ability to **work in a team**
- Possibility to apply physical-mathematical models to practice-oriented structures that lead to lean and sustainable structures
- the ability **to appear confident and respectful towards one another**
- a **convincing** and assertive demeanor
- analytical **and solution-oriented thinking skills**

3.2.3 Examination concept of the course of study

The forms of examination enable the assessment of the transfer of knowledge in addition to the seminar form of teaching.

3.2.4 Application relevance of the course of study

The course was designed in close coordination with practice, relies on teaching staff with practical experience, conveys practice-oriented content and enables students to gain their own practical experience at a high level of intensity.

3.2.5 Contribution of individual modules to the course objectives

The modules are organized under sustainability aspects linked to the traditional modules of civil engineering in order to achieve the study goals.

3.3 Possible career fields

Graduates of the course are prepared for specialist and management positions in the following areas:

- Expert in structural engineering, geotechnics, traffic planner
- Expert in resource-poor construction, recycling
- Expert in energy efficient construction

- Lead management of projects in the areas of existing construction, new construction projects, etc.
- **Management** of medium-sized construction companies
- **Control** of sustainability processes in the construction industry

Graduates' professional areas of focus will be in the following areas:

- **Engineering offices** for specialist services
- **Large companies** in the construction and building materials industries
- **Companies in the recycling industry**
- **Large transport companies**
- **Civil engineering offices**
- **Real estate companies**
- public institutions such as **municipalities** and **building authorities**
- **Start up Company**

4 Module descriptions

4.1 Introductory explanations

1. Overarching legislation

The study plan explains the course of study in detail and describes the individual modules in detail. Above the curriculum, reference is made to the valid study and examination regulations for the course of study as well as the valid general examination regulations for the technical colleges in Bavaria.

2. Frequency of offer

The frequency of the offer is stated in each module description under "Frequency of the module offered ".

3. Requirements for participation

Requirements for participation are stated in the admission requirements. In this context, express reference is made to the valid study and examination regulations.

5. Usability of the module

The usability of the module is limited to the Sustainable Civil Engineering course of study. If the module can also be used for other study programs, this will be stated separately.

4.2 1st semester

4.2.1 Introductory project

Introductory project						
Module name	Introductory project				**Module number**	1.1
Lecturer / Module responsible	Jana Sue Bochert					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	Introductory week Winter semester					
Courses of the module	Introductory project					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	No					
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.					
Usability of the module for this as well as for other	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	1	2	12		13	25
Type of test/requirements tongues for the award of credit points	coursework					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of the monduls	The students are able to apply the necessary processes as part of a practical project for their studies. By working on a real renovation project, you explain the needs of the builders and thereby learn about renovation options. In addition, the first structural implementations and insights into building material technology are created, as well as the first hand sketches and rough cost estimates. The students learn to translate the accumulated know-how and extended literature research into first drafts and present them.					
Content of module	Introductory event to the course • Overview of the university organization - library - Student Council - Student associations - International Office • Learning and working techniques • Networking with BayKa • First contact with the construction industry: working on a real practical project					

Notice	
Literature	Further relevant literature will be announced at the event .

4.2.2 Mathematics I

Mathematics I						
Module name	Mathematics I			**Module number**	1.2	
Lecturer / Module responsible	Marvin Müller					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of the module	Mathematics					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	None					
Recommended requirements	High school level algebra and geometry..					
Usability of the module within your own as well for other courses	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	5	5	47 h	0 h	78 h	125 h
Type of test/requirements tongues for the award of credit points	written exam: 120 minutes coursework (homework assesment)					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	The students know the essential mathematical terms and procedures relevant to technical studies. They understand the underlying concepts and solve mathematical problems self-dependently using suitable procedures, so that these procedures can contribute solving mechanical problems and setting up programming algorithms. Engineering mathematics therefore is the foundation of engineering studies, especially in the subjects of computer science and structural engineering. The students are particularly able to: - know the different number systems and to deal with real numbers. - deal with functions and know basic limit theoremss. - solve equations and inequalities with one variable. - calculate the first and higher order derivatives of basic and special functions. - know methods of Integration and solve problems in integral calculus.					

Content of module	The engineering mathematics I module conveys the typical mathematics content for an economically and technically experienced course of study. Vector algebra, matrices and linear equation systems are used to create the basis for structural engineering, especially the decomposition of forces and the equilibrium conditions. Furthermore, differential equations, differential calculations and integral calculations are solved in order to then convert them into programmable algorithms. In addition, analytical geometry teaches the breakdown of forces and descriptive geometry teaches spatial thinking about engineering problems. The module includes: ○ Linear Algebra: matrices, systems of linear equations ○ Geometry & Vector algebra ○ Basic functions and their properties, limits of functions and sequences ○ Differential calculus (differentiable functions, derivatives of special functions, higher order derivatives) ○ Integral calculus (Riemann integrals, primitive functions, definite and indefinite integrals, basic integration methods)
Notice	
Literature	• Riley K. F., Hobson M. P., Bence S. J., Mathematical Methods for Physics and Engineering: A Comprehensive Guide, 3rd ed. Cambridge University Press, 2006, e-book, ISBN 978-0-511-16842-0 • Friedman M., Kandel A., Calculus light, 2011, Springer, Berlin, PDF e-Book, ISBN 978-3-642-17848-1, 978-3-642-17847-4, https://doi.org/10.1007/978-3-642-17848-1. • Rahmani-Andebili M, Calculus: Practice Problems, Methods, and Solutions, 2021, Springer International Publishing, PDF e-Book, ISBN 978-3-030-64980-7, https://doi.org/10.1007/978-3-030-64980-7. Further relevant literature will be announced during the lecture.

4.2.3 Mechanics I

Mechanics						
Module name	Mechanics I			**Module number**	1.3	
Lecturer / Module responsible	Jana Sue Bochert, Dr.-Ing. Tareq Hatahet					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of themodule	Structural statics					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	None					
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.					
Usability of the module within your own as well for other courses	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	5	5	47 h	0 h	78 h	125 h
Type of test/requirements tongues for the award of credit points	Written exam: 90 minutes coursework (homework assesment)					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of the module	The students master the handling of force systems and can statically calculate simple structural models. Modeling and reality are brought into harmony, so that theory is connected to practice. The focus of this module is the support calculation, center of gravity calculation and internal force determination. In doing so, students develop analytical skills so that they can apply them to plausibility checks in computer-aided structural analyses.					

Content of the module	The module Structural Analysis teaches the basics of mechanics. The contents of the 1st semester deal with Newton's axioms in advance, building on this, the basics of free cutting, forces and their decomposition, the elements as well as the setting up of e quilibrium conditions, calculations of support reactions and internal forces of statically determined systems are dealt with. With this knowledge, computer-aided structural analysis is introduced. In the context of this module, the basics of mechanical understanding and structural analysis are given: - Static basics: Forces, moments and their composition or decomposition. - Equilibrium on structural elements - Sectional principle - Calculation of the center of gravity - Support reactions and internal forces of statically determined systems, - Area moments of inertia - Statically determinate and indeterminate structures - Introduction to computer-aided structural analysis
Notice	
Literature	• Gross, D.; Hauger, W.; Schnell, W., Schröder, J.: Engineering Mechanics 1: Statics Springer Verlag, 2012. • Schnell, W.; Gross, D.; Hauger, W.: Statics – Formulas and Problems: Engineering Mechanics 1;; Springer Verlag, 2017. • Lecture Notes • Further relevant literature will be announced in the course.

4.2.4 Building construction

Building construction						
Module name	Building construction			**Module number**	1.4	
Lecturer / Module responsible	Andreas Haese					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of themodule	Building construction					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	None					
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.					
Usability of the module within your own as wellfor other courses	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort andhis composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 h	125 h
Type of test/requirements tongues for the award of credit points	Written exam: 120 minutes coursework (homework assesment)					
Weighting of the individual grade inthe Overall grade	See SPO					
Qualification objectives of the mo-duls	Students understand how buildings function in terms of supporting structure, bracing, foundation, building envelope, building physics and fire protection for different construction types and materials. Simple buildings can be represented in plans using CAD, taking into account the basic rules of architectural drawings and 3-dimensional planning. With an introduction to building regulations, students learn the basics of applying building legislation and design standards.					
Content of module	The students get to know the basic elements of structures and buildings and also the functionality and interaction of the individual components, in particular the elements of the supporting structure for various material-dependent construction methods. In addition, essential elements of the building envelope, the sealing and the finishing work are explained. Through exercises in descriptive geometry and the basics of architectural drawing, students learn to create simple construction drawings themselves. As a basis for the application of design standards, an introduction to building regulations is given.					

	The module also includes the contents: - Functions of a building; Construction methods, structural elements - Load transfer and bracing of buildings, excavation pits, foundations, seals, drawing technics in construction, masonry, mortar - Constructive geometry - Basics of design, technical drawings - Introduction to technical regulations, design codes, building regulations - Fire protection
Notice	
Literature	• Allen E., Iano J,: Fundamentals of Building Construction: Materials and Methods, Wiley 2019. • McGraw-Hill: Building Design and Construction Handbook, Mc-Graw-Hill Professional 2006 • Schneider, K.-J.: Bautabellen für Ingenieure; Werner, 2021. • Neufert, E. Bauentwurfslehre, Springer Vieweg 2021 • Frick, Knöll, Neumann, Weinbrenner: Baukonstruktionslehre, Teil 1 und 2, Verlag B.G. Teubner Vieweg +Teubner, 2018. Further relevant literature will be announced during the course.

4.2.5 Computer Programming, Computer Aided Design and Calculation in Civil Eingineering

Computer Programming, Computer Aided Design and Calculation in Civil Eingineering						
Module name	Computer Programming, Computer Aided Design and Calculation in Civil Eingineering			**Module number**		1.5
Lecturer / Module responsible	Jana Sue Bochert					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of themodule	Computer Programming, Computer Aided Design and Calculation in Civil Eingineering					
teaching and learning methods module	SU/Ü/Pr - seminar teaching/exercise/internship					
Requirements for the partial take according to SPO	No					
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.					
Usability of the module within your own as wellfor other courses	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort andhis composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	5	5	47 h	0 h	78 h	125 h
Type of test/requirements tongues for the award of credit points	Written exam: 90 minutes					
Weighting of the individual grade inthe Overall grade	See SPO					
Qualification objectives of the mo-duls	Students are shown the spectrum of computer-aided calculations in the construction and business sectors. This includes the areas of structural analysis for load-bearing structures, construction planning with CAD software and planning and construction with BIM systems. By learning a programming language, mathematical algorithms and data structures are applied and transferred to construction-specific or general EDP tasks.					

Content of module	The students get to know construction-specific application software for static verifications and carry out plausibility checks - especially with regard to the calculation of load-bearing structures. Structures are drawn using CAD programmes and recorded in Building Information Modelling (BIM) systems. Different programming languages, with algorithms and data structures, are introduced, which contribute to finding construction-specific solutions. Similarly, computer algebra systems are introduced that contribute to the handling of numerical and analytical calculations. Practically relevant techniques of data storage, data exchange via networks complete the module. - Functionality of a high-level programming language - Techniques for data exchange via networks - Building-specific application software for special fields of civil engineering - Computer algebra systems and their possible applications - Algorithms and data structures - Object-oriented programming - data security
Notice	
Literature	• Logofatu, D.: Algorithms and problem solving with C++, Vieweg+Teubner Verlag; 2009 • Werkle , H. et al.: Mathcad in structural planning, Vieweg+Teubner Verlag, 2012. • Ottmann , T., Widmayer, P.: Algorithms and data structures, Springer Vieweg, 2017. • Lecture notes Further relevant literature will be announced at the event.

4.2.6 Chemistry & Building materials

Chemistry & Building materials						
Module Title	Chemistry & Building materials			**Coder**	XX	
Lecturer / Responsible	Oliver Blask					
Language	English					
Type	Compulsory Subject					
Duration / Frequency	1 semester / only winter term					
Courses of themodule	Chemistry & Building materials					
Teaching and learning methods	SU/P - seminar like lecture / experimental					
Requirements for the participation according to SPO	None					
Recommended prior knowledge	No knowledge beyond college entrance requirements is required.					
Usability of the module for this as well as for other courses	The contents of the module serve as basis for other modules in the degree program.					
Total work effort and it's composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 h	125 h
Type of test/requirements for the award of credit points	written exam: 90 minutes					
Weighting of the individual grade in the overall grade	See SPO (examination regulation)					
Learning objectives of the module	The students learn the basic principles of chemistry and chemical reactions. They know the structure of materials and its connection to material properties. They know the manufacturing processes of important building materials and the impact on the environment. They know the mechanical and physical properties of important building materials. They can select building materials for an application based on their properties and estimate their durability. They know the challenges of recycling of building materials and the use of secondary materials.					
Content of the module	• Basics of general and inorganic chemistry: chemistry of aqueous solutions, pH value and reactions of acids and bases, REDOX reactions, electrochemical processes, metal corrosion and corrosion protection • Raw materials, production and properties of building materials: physical states, microstructure, atoms and bonding types and the resulting macroscopic properties. Production processes with reference to their ecological impact. • Durability of building materials: Corrosion resistance of mineral building materials, corrosion resistance of metallic building materials. • Recycling of building materials and use of secondary materials • Practical experiments: Production of sustainable concrete					

Notice	
Literature	• Timberlake K. C., Chemistry : an introduction to general, organic, and biological chemistry, 12. ed., 2015, Pearson, Boston, ISBN 978-1-292-06132-0 • Pauling L., General Chemistry, 2011, BN Publishing,ISBN 978-1607962984 • Huheey J.E., Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., 2008, Pearson, ISBN 978-8177581300 • Kultermann E., Spence W., Construction Materials, Methods and Techniques, 4th ed., 2016, Cengage Learning, ISBN 978-1305086272. • Taylor G. D., Materials in Construction: An Introduction, 3rd ed., 2016, Taylor & Francis, ISBN 978-1138835467 Further relevant literature will be announced during the lecture.

4.2.7 Building Physics / Energy Efficiency

Building Physics / Energy Efficiency						
Module Title	Building Physics / Energy Efficiency			**Module number**		XX
Lecturer / Responsible	Oliver Blask, Petra Goschenhofer / Oliver Blask					
Language	English					
Type	Compulsory Subject					
Duration / Frequency	1 semester / only winter term					
Courses of themodule	Building Physics / Energy Efficiency					
Teaching and learning methods	SU/Ü/Pr - seminar teaching/exercise/practical exercises					
Requirements for the participation according to SPO	None					
Recommended prior knowledge	No knowledge beyond college entrance requirements is required.					
Usability of the module for this as well as for other courses	The contents of the module serve as basis for other modules in the degree program.					
Total work effort and it's composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	3	3	24 h	0 h	51 h	75 h
Type of test/requirements for the award of credit points	written exam: 90 minutes coursework (homework assesment)					
Weighting of the individual grade in the overall grade	See SPO (examination regulation)					
Learning objectives of the module	The students know the basic principles of building physics and their connection with indoor climate and deterioration of structures. In addition, they are able to carry out calculations on heat transfer and moisture content and use computer programs to create a simple energy certificate in accordance with the GEG.					
Content of the module	• Basics of building physics • Basics of thermal insulation: Principles of heat transfer, temperature profile in the section, thermal conductivity, U-value, thermal protection in summer: the meaning of heat capacity, identify thermal connections, create a certificate according to GEG • Aims of moisture protection in buildings, determining the saturation pressure of water vapor depending on the temperature, specify criteria for mold formation, humidity, condensation in segments and on surfaces. • <u>practical exercises:</u> ○ Excursion to a passive house ○ Air tightness measurement (blower door test) and thermography ○ Software exercises: Creating GEG certificates					

	○ Thermal connections, calculation by software
Notice	
Literature	• Pinterić(2017) Building Physics, Springer, Berlin, https://doi.org/10.1007/978-3-030-67372-7 Further relevant literature will be announced during the lecture.

4.2.8 Sustainability in Construction

Sustainability in Construction

Module name	Sustainability in Construction	**Module number**	1.8
Lecturer / Module responsible	Jana Sue Bochert, Oliver Blask		
teaching language	German		
Art the Course	Compulsory subject		
Duration of the module / frequency of the offer of the module	1 semester Winter semester		
Courses of the module	Sustainability in Construction		
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises		
Requirements for the partial take according to SPO	No		
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.		
Usability of the module within your own as well for other courses	The contents of the module serve as a general basis for all other modules in the degree program.		

Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	2	2	24 0	0 h	26 h	50 h

Type of test/requirements tongues for the award of credit points	Oral exam; 15 minutes
Weighting of the individual grade in the Overall grade	See SPO
Learning objectives of Mon duls	The students learn how to rethink, which is essential in the construction industry, through lectures by experts from science and business. The experts talk about their experiences and the need for sustainable construction. The students discuss with the experts and are made aware of the paradigm shift so that the way of thinking they gain can be transferred and applied to the other modules. In this way, you will recognize the problems whose solutions will be discussed in the course of your studies.
Content of module	The Sustainability in Construction module conveys new content that has only become more important in recent years. Under the term sustainable construction, guidelines and standards, responsibility goals and methods are discussed so that these tools and procedures are used accordingly and a rethinking of sustainable construction is required. This rethinking requires know-how, which must be fed into the companies. Listed individually, the module includes lectures by experts: • Introduction to sustainability models

	• Sustainable buildings and their guidelines • Sustainability in the planning and construction process • Practical design energy efficiency, climatic design, increasing resource efficiency • Raising awareness of current topics in sustainable building
Notice	
Literature	Notes during the lectures Further relevant literature will be announced at the event .

4.3 2nd semesters

4.3.1 Mathematics II

Mathematics II						
Module Title	Mathematics II				**Module number**	XX
Lecturer / Responsible	Marvin müller					
Language	English					
Type	Compulsory subject					
Duration / Frequency	1 semester / only summer term					
Courses of the module	Engineering Mathematics II					
Teaching and learning methods	SU/Ü - seminar teaching / exercises					
Requirements for the participation according to SPO	None					
Recommended prior knowledge	Successful participation in the Mathematics I module.					
Usability of the module for this as well as for other courses	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort and it's composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	5	5	47 h	0 h	78 h	125 h
Type of test/requirements for the award of credit points	written exam: 90 minutes, coursework (homework assesment)					
Weighting of the individual grade in the overall grade	See SPO (examination regulation)					
Learning objectives of the module	The students know the essential mathematical terms and procedures relevant to technical studies. They understand the underlying concepts and solve mathematical problems self-dependently using suitable procedures, so that these procedures can contribute solving mechanical problems and setting up programming algorithms. The studets know the basic concepts of statistic, can calculate position and scatter parameters and know the basic concepts of probability. Engineering mathematics therefore is the foundation of engineering studies, especially in the subjects of computer science and structural engineering. The students are particularly able to: • Apply methods of differential and integral calculus of multiple variables to engineering tasks. • To solve problems of multiple variables in the area of differential and integral calculus. • To solve ordinary differential equations of the first order.						

Content of the module	The Engineering Mathematics II module provides advanced mathematics content for a technically advanced course of study. The ability to calculate vibrations is taught using the differential and integral calculus of several variables. • Differential and integral calculus of functions of several variables Functions of several variables, differentiation (partial derivatives of the 1st order and higher order, tangential plane, total differential (local extreme values and saddle points, extreme value problems), multiple integrals (double integrals, triple integrals (volume, center of gravity, moments) • Differential equations basic terms (initial value and boundary value problems), 1st order differential equations (homogeneous and inhomogeneous linear differential equations with constant coefficients), 2nd order differential equations (homogeneous and inhomogeneous linear differential equations with constant coefficients (mechanical vibrations) • Basics of statistics and data analysis basic concepts, mean values, measures of dispersion, correlation, elementary probability theory, statistical test.
Notice	
Literature	• Riley K. F., Hobson M. P., Bence S. J., Mathematical Methods for Physics and Engineering: A Comprehensive Guide, 3rd ed. Cambridge University Press, 2006, e-book, ISBN 978-0-511-16842-0 • Friedman M., Kandel A., Calculus light, 2011, Springer, Berlin, PDF e-Book, ISBN 978-3-642-17848-1, 978-3-642-17847-4, https://doi.org/10.1007/978-3-642-17848-1. • Rahmani-Andebili M, Calculus: Practice Problems, Methods, and Solutions, 2021, Springer International Publishing, PDF e-Book, ISBN 978-3-030-64980-7, https://doi.org/10.1007/978-3-030-64980-7. Statistics • Schiefer, H. ; Schiefer, F., Statistics for Engineers: An Introduction with Examples from Practice, 1st ed., Springer, Wiesbaden, 2021, PDF e-book, ISBN 978-3-658-32397-4, https://doi-org.thi.idm.oclc.org/10.1007/978-3-658-32397-4. • Ewens, W. J.; Brumberg, K., Introductory Statistics for Data Analysis, 1st ed., Springer Nature, 2023, PDF e-book, ISBN 978-3-031-28189-1, https://doi-org.thi.idm.oclc.org/10.1007/978-3-031-28189-1. • Kronthaler, F., Statistics Applied With Excel : Data Analysis Is (Not) an Art, 1st ed., 2023, Springer, Heidelberg, 2023, PDF e-book, ISBN 978-3-662-64319-8, https://doi-org.thi.idm.oclc.org/10.1007/978-3-662-64319-8. Further relevant literature will be announced during the lecture.

4.3.2 Mechanics II

Mechanics						
Module name	Mechanics II			**Module number**	1.10	
Lecturer/ module manager verbal	Jana Sue Bochert					
teaching language	English					
Type of course	Compulsory subject					
Duration of the module / frequency of offering the module	1 semester summer semester					
Courses of the module	Mechanics II					
Teaching and learning methods of the module	SU/Ü- seminar teaching/exercise					
Requirements for participation according to SPO	No					
Recommended requirements	Mechanic I					
Usability of the module within your own course of study and for other degree programs	The contents of the module serve as a general basis for all other modules in the degree program.					
Total workload and its composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	5	5	47 h	0 h	78 h	125 h
Type of examination / requirements for awarding credit points	written exam: 90 minutes coursework (homework assesment)					
Weighting of the individual grade in the overall grade	See SPO					
Learning objectives of the module	Elastostatics and strength of materials provide the basis for the construction and dimensioning of buildings and components as part of stability and usability verification. The students know the basics of strength of materials as well as the associated theoretical background. More complex, statically determined systems are analyzed and how to deal with deformation and stress calculations is outlined . In the group exercises, the students acquired the ability to verbalize mechanical questions and to discuss and classify the task, the solution and the results with fellow students and teachers.					

Contents of the module	The following content is developed through seminar-style teaching, supplemented by group work and discussion: • Terms and basic relationships in elastostatics • One- and multi-dimensional stress and strain states • Transformation of tensions and distortions • Constitutive law of the linear elasticity theory • Elementary elastostatics of rods and beams • shear stresses, center of shear, • Differential equation of the bending line • Dimensioning of compression rods (torsion of circular profiles)
Notice	
Literature	Causing obligation: • Gross D., Hauger W., et al.: Technical Mechanics 2 (Elastostatics), 14th edition, Berlin: Springer Verlag, 2021 • Spura, C.: Technical Mechanics 2. Elastostatics, Berlin: Springer Verlag, 2019 Additionally: • Gabbert U., Raecke I.: Technical mechanics for industrial engineers, 8th edition, Munich: Hanser, 2021 Further relevant literature will be announced at the event .

4.3.3 Surveying

Surveying						
Module name	Surveying			**Module number**		1.11
Lecturer / Module responsible	Tobias Liepert					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester summer semester					
Courses of themodule	Geodesy and surveying					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	No					
Recommended requirements	Mathematics I					
Usability of the module within your own as well for other courses	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	5	5	47 h	0 h	78 h	125 h
Type of test/requirement tongues for the award of credit points	Written exam: 90 minutes coursework (homework assesment)					
Weighting of the individual grade in the Overall grade	See SPO					
Qualification objectives of the mo-duls	Students understand the basic concepts of surveying activities (reference systems, point determination, height measurement methods) as well as how traditional surveying devices (tachymeters, leveling) and modern measuring methods (GNSS) work. The students are able to carry out simple surveying tasks (longitudinal leveling of a route, setting out an excavation pit) and determining measurement errors caused by the method.					
Content of module	Basics: geodesy and geoinformation, measurements, map and plan Electronic tachymeters: direction and angle measurement, electronic distance measurement Reference systems: reference surfaces, coordinate systems (geographical coordinates, Gauss - Kruger coordinates, UTM coordinates) Geodetic calculations: fixed point field and network compression, coordinate calculation Position measurements and setting out: tachymetry, polar methods, coordinate transformation, area calculation, setting out, building law Height measurement: reference surface and height systems, geometric leveling, longitudinal and transverse profiles, surface leveling, slope information, trigonometric height determination Digital terrain model: triangular meshing, soil quantity calculation					

	Satellite surveying: GNSS system structure, position determination Routing: Polygon close to the route, circular arc calculation Practical part: Using levels and electronic tachymeters; Working with geodetic calculation software.
Notice	
Literature	• Möser M.: Handbuch Ingenieurgeodäsie (Grundlagen), Wichmann Berlin • Witte B., Sparla P.: Vermessungskunde und Grundlagen der Statistik für das Bauwesen, Wichmann Berlin • Knickmeyer: E.: Geodätisches Rechnen. Vorlesungsmanuskript, Hochschule Neubrandenburg. • Gruber, F. und Joeckel, R.: Formelsammlung für das Vermessungswesen, 16. Aufl., Springer Vieweg, Wiesbaden, 2012 • Albert A.: Schneider Bautabellen für Ingenieure. 23. Auflage, Bundesanzeiger Verlag • DVW – Gesellschaft für Geodäsie, Geoinformation und Landmanagement e.V.: Schriftenreihe, Bühl • DVW – Gesellschaft für Geodäsie, Geoinformation und Landmanagement e.V.: Leitfaden – Geodäsie und BIM, Version 3.0, Bühl, 2021 • Möser M.: Geodäsie, Studiengang Bauingenieurwesen, Fernstudium, Technische Universität Dresden, Studienjahr 2022/2023, Vorlesungsskript Further relevant literature will be announced at the event .

4.3.4 Construction Management and Entrepreneurship

Construction Management and Entrepreneurship						
Module name	Construction Management and Entrepreneurship			**Module number**		1.12
Lecturer / Module responsible	Tobias Liepert / Markus Scholand					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester summer semester					
Courses of themodule	Construction Management and Entrepreneurship					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	No					
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.					
Usability of the module within your own as well for other courses	The module serves as the basis for further construction-oriented modules in the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	4	47 h	0 h	53 h	100 h
Type of test/requirement tongues for the award of credit points	Written exam: 90 minutes					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of the module	The students know the different perspectives as well as management and control tasks of the client or building owner and contractor. You know the processes and tasks in the various project phases (planning, tendering, awarding, billing, operation) and can apply the corresponding methods in the project. In the part on entrepreneurship, students know different types of business models and different approaches to entrepreneurship and starting a business. They critically discuss the opportunities and challenges that exist for start-ups.					
Content of module	The following content is developed through seminar-style teaching, supplemented by group work and practical lectures as well as their discussion: • Project phases according to HOAI • Project control methods • Process and capacity planning • Basics of awarding • Basics of billing • Basics and theory of entrepreneurship • (Sustainable) entrepreneurship as a driver for innovation and sustainability					

Notice	
Literature	• Harris F., McCaffer R.: Modern Construction Management, Wiley-Blackwell 2013 • Hardin B.: BIM and Construction Management: Proven Tools, Methods, and Workflows, Wiley 2015 • Jackson B.: Construction Management JumpStart - The Best FirstStep Toward a Career in Construction Management, Wiley 2020 • Liebchen J. H. et al.: Baumanagement und Bauökonomie, Teubner Verlag 2007 • Bergmann C.: Prozesse Entwerfen, Birkhäuser Verlag, Basel 2019 • Rösel W. et al.: AVA-Handbuch, Springer Vieweg, Wiesbaden 2020 Further relevant literature will be announced at the event .

4.3.5 Low Carbon Building Design

Low Carbon Building Design						
Module name	Low Carbon Building Design				**Module number**	1.13
Lecturer / Module responsible	Andreas Haese					
teaching language	German					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester summer semester					
Courses of the module	Low Carbon Building Design					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	No					
Recommended requirements	Module building construction (1) and module sustainability in construction					
Usability of the module within your own as well for other courses	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	5	5	47 h	0 h	78 h	125 h
Type of test/requirement tongues for the award of credit points	Written exam: 120 minutes coursework (homework assesment)					
Weighting of the individual grade in the Overall grade	See SPO					
Qualification objectives of the mo-duls	The students understand how buildings work and know the essential construction types for the building structure and the inner design. After completing the module, they will be able to independently design simple constructions and present them appropriately in detail. The students understand the safety concept of the applicable design standards and can determine the different loads and load combinations for buildings. They know the essential criteria and certification bases for assessing the sustainability of designs and can apply these to specific objects and types of construction..					

Content of module	The students extend their knowledge of how buildings work and the interaction between construction, statics and building physics. Important construction details are discussed in detail and the students are enabled to assess them and design them themselves. As part of a coursework, the correct representation of buildings and details in construction drawings will be practiced as a basis for building applications. Through exercises on wind, snow and traffic loads, they learn to determine load assumptions for buildings and combine them correctly. By introducing students to the criteria and the essential principles of certification of the sustainability of buildings, students learn to take the aspect of sustainability into account in all planning steps.
Notice	
Literature	• Cotterell J., Dadeby A.: The Passivhaus Handbook: A practical guide to constructing and retrofitting buildings for ultra-low energy performance, Green books 2012 • U.S. Green Building Council (USGBC): Green Building Design and Construction, 2009 • Kubba S.: Handbook of Green Building Design and Construction, Butterworth-Heinemann 2016 • Schwarz M., Bauer M., Mösle P.: Green Building, Springer Verlag, Berlin 2009 • Schneider, K.-J.: Bautabellen für Ingenieure; Werner, 2021. • Neufert, E. Bauentwurfslehre, Springer Vieweg 2021 • Frick, Knöll, Neumann, Weinbrenner: Baukonstruktionslehre, Teil 1 und 2, Verlag B.G. Teubner Vieweg +Teubner, 2018. • Weller, B.: Baukonstruktion im Klimawandel, Springer Vieweg, 2016. Further relevant literature will be announced during the course.

4.3.6 Sustainable Cnstruction Materials

Sustainable Construction Materials						
Module name	Sustainable Construction Materials			**Module number**		1.14
Lecturer / Module responsible	Oliver Blask					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester summer semester					
Courses of the module	Sustainable Construction Materials					
teaching and learning methods module	SU/Ü/Pr - seminar teaching/exercise/internship					
Requirements for the partial take according to SPO	No					
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.					
Usability of the module within your own as well for other courses	Successful participation in the Chemistry and Building Materials module.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	4	47	0 h	53 h	100 h
Type of test/requirements tongues for the award of credit points	written exam: 90 minutes coursework (homework assesment)					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	The students learn about conventional and new building materials that are characterized by their particular sustainability. Students learn to estimate the sustainability of building materials based on durability, emissions and resource consumption. They know the difference between empirical and performance-based concepts in lifecycle management. The students know the principles of recycling building materials and the use of secondary materials.					
Content of module	• Sustainable mineral building materials Climate-friendly binders, cement substitutes, recycled materials e.g. AAMs, geopolymers, calcined clays, clay, ... • Renewable organic building materials e.g. wood, straw, ... • Durability of building materials as a sustainability criterion corrosion processes in mineral , metallic and organic building materials • Recycling of building materials and use of secondary materials • Practical exercises: Production of sustainable concrete					

Notice	
Literature	General literature • Kultermann E., Spence W., Construction Materials, Methods and Techniques, 4th ed., 2016, Cengage Learning, ISBN 978-1305086272. • Taylor G. D., Materials in Construction: An Introduction, 3rd ed., 2016, Taylor & Francis, ISBN 978-1138835467 Mineral building materials • Provis J.L.; van Deventer J.S.J.: Alkali Activated Materials, Springer, Heidelberg, 2014 • Martirena , F.; Favier, A.; Scrivener, K.: Calcined Clays for Sustainable Concrete, Springer, Dordrecht, 2018. Organic building materials • Green, M.; Taggart , J.: Tall Wood Buildings: Design, Construction and Performance., Birkhäuser, Basel, 2020. Further relevant literature will be announced during the lecture .

4.4 3rd semester

4.4.1 Reinforced Concrete Design I

Reinforced Concrete Design 1						
Module name	Reinforced Concrete Design 1			**Module number**		
Lecturer / Module responsible	Andreas Haese					
teaching language	German					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of themodule	Reinforced Concrete Design 1					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Building Construction 1, Mechanics II, Chemistry and Building Material					
Usability of the module within your own as well for other courses	The content is further expanded in solid construction 2.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 hours	125 hours
Type of test/requirement tongues for the award of credit points	Written exam: 120 minutes certificate of achievement					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of the module	Students gain a basic understanding of the load-bearing behavior of reinforced concrete structures. The design methods for bending and shear force in the limit state of the load-bearing capacity for simple load-bearing systems in solid construction are dealt with on flat static systems. In addition, the basics of reinforcement routing and construction in reinforced concrete construction are taught. Upon completion of the course, students will be able to dimension common single-axis structural components in building construction, as well as prepare or read corresponding construction plans.					
Content of module	In the "Concrete Construction I" module, the theoretical basics are covered with practical examples of the components that regularly appear in general building construction. The following subject areas are dealt with: • Materials of reinforced concrete construction • Impacts on structures • Safety concept in structural engineering					

	• Load-bearing behavior of reinforced concrete elements • Load case superimposition, design internal forces • Ultimate limit state due to bending and longitudinal force, transverse force • Basics of reinforcement management and structural training • Commonly used structural elements such as beams, single-axis slabs, unreinforced foundations
Notice	
Literature	Causing obligation: • DIN EN 1992-1-1 (EC 2); Bemessung von Stahl- und Spannbetontragwerken • Schneider, K.-J.: Bautabellen für Ingenieure; Werner, 2021 • Baar S., Ebeling K.: Lohmeyer – Stahlbetonbau • Zilch & Zehetmaier: Bemessung im konstruktiven Betonbau nach DIN 1045-1 und EN 1992-1-1, 2. Auflage, Springer Verlag, Berlin, 2010 Further relevant literature will be announced at the event .

4.4.2 Structural Analysis

Structural analysis						
Module name	Structural Analysis			**Module number**	1.10	
Lecturer/ module manager **verbal**	Jana Sue Bochert					
teaching language	English					
Type of course	Compulsory subject					
Duration of the module / frequency of offering the module	1 semester summer semester					
Courses of the module	Structural statics					
Teaching and learning methods of the module	SU/Ü/Pr - seminar teaching/exercise/internship					
Requirements for participation according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Module Mechanics I and Mechanics II					
Usability of the module within your own course of study and for other degree programs	The contents of the module serve as a general basis for all other modules in the degree program.					
Total workload and its composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 h	125 h
Type of examination / requirements for awarding credit points	written exam: 90 minutes, coursework (homework assesment) It is possible to voluntarily acquire up to 6 bonus points, which will be credited towards the points achieved in the written examination.					
Weighting of the individual grade in the overall grade	See SPO					
Learning objectives of the module	Structural statics provides the future civil engineer with the necessary tools to be able to calculate general structures. Particular attention is paid to matrix methods, which are the basis of modern computer programs. Traditional methods of structural analysis, which were developed before IT for calculations with the classic slide rule, are also treated, as they are necessary for checking computer calculations and for understanding structural analysis .					

Contents of the module	In the compulsory module "Structural Analysis" students are given... based on the knowledge of mathematics and Mechanics the calculation of statically determinate and indeterminate structures (2D and 3D). There are path sizes (displacements and twists) and the rotation angle method under general stresses (load and deformation effects) in the center. Other contents of the lecture include, for example: Modeling of supporting structures, safety concept in structural engineering, limit states, Partial safety concept, modeling of Impacts and loads, as well as the calculation of flat and spatial bar structures, disks and Disks with various computer programs. - Partial safety concept, influences and resistances - replacement rod method, spring models, - Spatial systems - Support gratings - Working sets - Virtual work - Path size method, angle of rotation method - Bar structures according to second order theory - load method
Notice	
Literature	Causing obligation: • Krätzig, Wilfried B., Harte Reinhard H., et al.: Baustatik 2 , 5. Auflage, Berlin: Springer Verlag, 2021 • Dinkler, D.: Grundlagen der Baustatik, Berlin: 6. Auflage, Springer Verlag, 2019 Additionally: • Dallmann R.: Baustatik 1, 5. Auflage, München: Hanser, 2020 • Dallmann R.: Baustatik 2, 5. Auflage, München: Hanser, 2022 Further relevant literature will be announced at the event .

4.4.3 Introduction Geotechnics and Technical Transport

Introduction Geotechnics and Technical Transport						
Module name	Introduction Geotechnics and Technical Transport			**Module number**		
Lecturer / Module responsible	Jana Sue Bochert , Dr. Maximilian Lerch, Christoph Gastl					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semesters Winter semester					
Courses of the module	Introduction to geotechnical engineering and traffic technology					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.					
Usability of the module within your own as well for other courses	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 h	125 h
Type of test/requirements tongues for the award of credit points	Written exam: 90 minutes certificate of achievement					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	**Geotechnics:** The students are taught the basics of geology and the special features of soil as a building material. The students gain knowledge about the characteristics and properties of soils, as well as the determination in the laboratory and in situ. In addition, knowledge about the multi-phase building material soil and the effects of water in the soil is conveyed. The students gain knowledge about the determination of the total and effective stresses in the half-space and about the shear strength of soils. The students should be able to apply the teaching content to problems in earthworks and foundation engineering. **Transport technology:** The students know the basics of traffic planning and accident parameters. The students get a rough understanding of the most important factors in routing. Students can use simple verification of traffic quality. The students learn about the theoretical approaches to designing the road superstructure. Students can apply standardized superstructure design to specific tasks. Students can apply the requirements for permanently stable and					

	load-bearing roads . Students are taught the basics of street drainage. The students learn about the construction of roads with asphalt, concrete and paving surfaces and can determine the correct use of materials
Content of module	**Geotechnics:** • Introduction to engineering geology: formation, naming and description of soils • Classification of soils: basics, grain size distribution, sludge analysis, consistency limits, classification of soils according to ATV • Geotechnical field and laboratory tests: Uniaxial compression test, density determination, direct shear test, triaxil test, Proctor test, permeability test, ram sounding, load plate pressure test, balloon method, soil exposures • Water in the soil and dewatering • Shear strength of soils: friction and cohesion, Mohr-Coulomb limit criterion, consolidation of soils • Stresses in the ground: Determination of total and effective stresses in the half-space, settlement calculation, deformation properties **Transportation technology** • Introduction: o Development and importance of road construction, requirements for the road (objectives, traffic safety, environmental compatibility) • Road and traffic planning: o Legal basics, basics of road planning, planning process in road construction, traffic loads • Routing of roads: site plan, profile plan, cross-sectional design, proof of traffic quality (only very rough) • Renewal of roadways: assessment of the existing paving, construction of the frost-proof superstructure, new construction of other roads • Roadway constructions: o Traffic loads, road structure, stress on the road, load classes, etc. • Earthworks and drainage: o Soil exploration, soil classification, subsoil requirements, soil improvement measures, road drainage • Base layers: Frost-proof structure, base layers with and without binders, asphalt roads (mix types, asphalt layers, construction work, etc.), concrete roads, paved roads
Notice	Multimedia lectures, excursions
Literature	**Geotechnics:** • Boley, C. [Herausgeber].2012. Handbuch Geotechnik. Wiesbaden: Vieweg und Teubner, 2012. • Engel, J., v. Soos, P. 2017. Eigenschaften von Boden und Fels – ihre Ermittlung im Labor. In: Grundbau-Taschenbuch Band 1. Berlin: Ernst und Sohn, 2017. • Möller, G. 2016. Geotechnik - Bodenmechanik. Berlin: Ernst und Sohn, 2016. **Transport technology:** - Richtlinien (z.B. RAA, RAL), Merkblätter, Empfehlungen, Hinweise und Arbeitsanleitungen der Forschungsgesellschaft für Straßen- und Verkehrswesen. RStO 12; Ausgabe 2012 RASt 06; Ausgabe 2006 - Handbuch für die Bemessung von Straßenverkehrsanlagen,Forschungsgesellschaft für Straßen- und Verkehrswesen 2015 - Erich Schmidt Verlag 2016: Straube/Krass/Karcher/Jansen – Straßenbau und

	Straßenerhaltung - Skriptum zur Lehrveranstaltung mit weiteren Literaturhinweisen

4.4.4 Sanitation, Waterwaste and waste management

Sanitation, Waterwaste and waste management						
Module name	Sanitation, Waterwaste and waste management			**Module number**		
Lecturer / Module responsible	Jana Sue Bochert , Mathilde Hagl, Christian Hiller, Sebastian Senner					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semesters Winter semester					
Courses of the module	Sanitation, wastewater and waste management					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.					
Usability of the module within your own as well for other courses	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 h	125 h
Type of test/requirements tongues for the award of credit points	Project work					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	Imparting basics, specialist knowledge and methods Practical implementation and application based on examples Application of calculation methods and models Sharpening understanding of complex relationships					
Content of module	Habitat settlement Water supply with demand, extraction, conveyance, storage , distribution and structural aspects Urban drainage with drainage processes, wastewater, infiltration systems, sewers, rain relief and sewer maintenance Waste management with waste avoidance, collection and transport, Waste and recydable material treatment, disposal of waste and					

	waste management in the construction industry e
Notice	
Literature	- Lecture notes for the course with further literature references

4.4.5 Fluid Mechanics and Hydro Mechanics

Fluid Mechanics and Hydro Mechanics						
Module name	Fluid Mechanics and Hydro Mechanics			**Module number**	3.2	
Lecturer/ module manager verbal	Jana Sue Bochert , Markus Grünzner					
teaching language	English					
Type of course	Compulsory subject					
Duration of the module / frequency of offering the module	1 semester Winter semester					
Courses of the module	Fluid Mechanics and Hydro Mechanics					
Teaching and learning methods of the module	SU/Ü - seminar-like lessons/exercises					
Requirements for participation according to SPO	Participants must have achieved at least 42 ECTS from the first part of the course.					
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.					
Usability of the module within your own course of study and for other degree programs	No					
Total workload and its composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 h	125 h
Type of examination / requirements for awarding credit points	written exam: 90 minutes					
Weighting of the individual grade in the overall grade	See SPO					
Learning objectives of the module	The students are capable • to understand planning and construction tasks in the field of hydraulic engineering and water management. • to independently develop and evaluate simple measures in the area of river and dam construction. • Understand the basics of hydrostatics and hydromechanics. • to dimension and plan simpler hydraulic engineering systems mathematically.					

Contents of the module	A comprehensive overview of the fundamental areas of hydraulic engineering and water management is provided (river barriers, dams, operating facilities, hydroelectric power plants, river engineering, flow conditions and sediment transport). The formation of precipitation and runoff (water cycle) is explained, as are stochastic methods for estimating the formation of floods. Introduction / basics of hydrostatics, mechanics, as well as pipe and channel hydraulics. Hydraulic engineering measures such as the construction of dams and river barriers, as well as flood retention basins, dikes and flood polders as flood protection measures are also discussed, as well as river engineering with the areas of flow calculation, bedload problems and natural measures. The legal basis, regulations and standards are also presented.
Notice	
Literature	• T. Strobl, F. Zunic. Wasserbau: Aktuelle Grundlagen, neue Entwicklungen. Springer Verlag, Berlin, 2006. • G. Bollrich: Technische Hydromechanik, Grundlagen. Verlag Bauwesen, Berlin, 2000 • G. Jirka, C. Lang: Einführung in die Gerinnehydraulik. Universitätsverlag Karlsruhe, 2009. Further relevant literature will be announced at the event.

4.4.6 Sustainable Design and Management of Building Stuctures

Sustainable Design and Management of Building Stuctures						
Module name	*Sustainable Design and Management of Building Stuctures*			**Module number**		
Lecturer / Module responsible	Andreas Haese					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of themodule	Sustainable construction planning and sustainable construction operations					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Construction Management, Building Construction, Low Carbon Building Design					
Usability of the module within your own as well for other courses	The content can be further deepened in the master's program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 h	125 h
Type of test/requirement tongues for the award of credit points	Written exa: 90 minutes					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of the module	In the module sustainable planning and sustainable construction operations, the essential criteria for sustainable construction methods are discussed and deepened and the basis for the planning phase and the execution phase is derived from them. Using an example project, variants are examined and compared with regard to sustainability criteria. By completing the module, students will be able to recognize and evaluate the interrelationships between sustainability aspects and possible conflicting goals in building construction projects and develop solution strategies.					
Content of module	• Key sustainability aspects • Interaction between sustainability aspects and conflicting goals • Life cycle assessment • Rating systems • Certification systems • Funding landscape and criteria • EU taxonomy					

Notice	
Literature	Causing obligation: • Pfeiffer, M. et. al.: Nachhaltiges Bauen: wirtschaftliches, umweltverträgliches und nutzungsgerechtes Bauen, Hanser Verlag; München 2022 • Hauke, Bernhard (Hrsg.): Nachhaltigkeit, Ressourceneffizienz und Klimaschutz: konstruktive Lösungen für das Planen und Bauen: aktueller Stand der Technik, Verlag Ernst & Sohn, Berlin 2021. Further relevant literature will be announced at the event .

4.5 4th semester

4.5.1 Reinforces Concrete Design II

Reinforces Concrete Design II						
Module name	Reinforces Concrete Design II				**Module number**	
Lecturer / Module responsible	Andreas Haese					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester summer semester					
Courses of themodule	Reinforces Concrete Design II					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Reinforces Concrete Design 1					
Usability of the module within your own as well for other courses	The content can be further deepened in the master's program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 h	125 h
Type of test/requirement tongues for the award of credit points	Written exam: 90 minutes certificate of achievement					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of the module	Building on the Solid Construction 1 module, students deepen their knowledge in the area of reinforced concrete construction. After completing the module, students are able to independently calculate, dimension and design typical reinforced concrete structures, even for more complex boundary conditions. The students are familiar with the limit states of usability. They are able to limit the stresses, crack widths and deformations of reinforced concrete components in accordance with standards. The general reinforcement rules and the construction rules for typical components are known. The students are able to derive appropriate reinforcement designs from the design results and represent them.					
Content of module	• Design of common reinforced concrete components in building construction • Limiting voltages • Limitation of crack widths • Limitation of deformations • General reinforcement rules • Construction rules for typical components					

	• Development and graphical representation of the reinforcement of reinforced concrete structures
Notice	
Literature	Causing obligation: • DIN EN 1992-1-1 (EC 2); Bemessung von Stahl- und Spannbetontragwerken • Schneider, K.-J.: Bautabellen für Ingenieure; Werner, 2021 • Baar S., Ebeling K.: Lohmeyer – Stahlbetonbau • Zilch & Zehetmaier: Bemessung im konstruktiven Betonbau nach DIN 1045-1 und EN 1992-1-1, 2. Auflage, Springer Verlag, Berlin, 2010 Further relevant literature will be announced at the event .

4.5.2 Steel Construction

Steel Construction						
Module name	Steel Construction				**Module number**	XX
Lecturer / Module responsible	Jana Sue Bochert					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of the module	Steel Construction					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Mechanik I and II, Structural Analysis					
Usability of the module within your own as well for other courses	The module serves as the basis for the other modules of the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0	78 h	125 h
Type of test/requirements tongues for the award of credit points	written exam: 90 minutes certificate of achievement					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	The students are able to name and classify the structurally relevant steel properties, analyze steel cross sections and use them for the associated calculation method. They recognize stability cases, can calculate the load-bearing capacity of rod-shaped steel components taking simple stability cases into account, know the relevance of the deformation of steel components and have knowledge of corrosion and fatigue behavior. You have the ability to independently design steel cross-sections by determining the shape, dimensions and material for specified systems.					
Content of module	• Basics and areas of application of steel construction • Material properties: steel products, building material characteristics, building material tests • Safety concept and elementary load-bearing safety evidence • Cross-sectional analysis and calculation methods • Design and proof of simple connection details. • Basic principles of stability and durability					

Notice	
Literature	literature • Laumann, J., Feldmann, M., Frickel, J.: Petersen Stahlbau: Grundlagen der Berechnung und baulichen Ausbildung von Stahlbauten, Vieweg-Verlag, Wiesbaden, 2022 • Wagenknecht, G.: Stahlbau-Praxis nach Eurocode 3, Band 1 + 2. Bauwerk-Verlag, 2014 • Kindmann, R., Krüger; U.: Stahlbau / 1. Grundlagen mit Beispielen nach Eurocode 3, Ernst u. Sohn, Berlin, 2013 Further relevant literature will be announced at the event .

4.5.3 Law

Law						
Module name	Law			**Module number**	4.5	
Lecturer / Module responsible	Jana Sue Bochert , Dr. jur. Andreas Höckmayr Korbinian Meier					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester summer semester					
Courses of themodule	Law					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	No knowledge beyond the (technical) high school diploma is required.					
Usability of the modulewithin your own as wellfor other courses						
Total work effort andhis composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	5	5	47h	0h	78h	125h
Type of examination / requirements for the award of credit points	Written exam: 90 minutes It is possible to voluntarily acquire up to 6 bonus points, which will be credited towards the points achieved in the written examination.					
Weighting of the individual grade inthe Overall grade	See SPO					
Learning objectives of the module	Private construction law: Students recognize the legal problems that typically arise when carrying out construction work (from the perspective of the client and the contractor) and solve them correctly. The students know construction contract law according to the BGB and VOB/B, the basics of procurement law, the law of architects and engineers, and legal protection. Public building law: Students learn the basics of building planning and building regulations law. They are proficient in assessing whether a specific project can be approved based on public law provisions. The students are prepared for the tasks associated with the building permit authorization. Environmental lawThe students master the basic principles of environmental law. They will be sensitized to environmental law issues in their future professional activities and will become familiar with environmental law problems in construction projects . The central provisions of environmental procedural law and the most important legal areas of special environmental law are explained.					

Content of module	The following content is developed through seminar-style teaching, supplemented by group work and discussion: Private building law • Conclusion of the construction contract according to BGB and VOB/A • Construction contract and general terms and conditions remuneration for the construction contract (unit price and flat-rate price contract, quantity deviations, changes, additional services) • Delays, termination of the construction contract, billing and payment, defects and claims for defects by the client • Law of architects and engineers, responsibility of several people involved in construction for defects, securities, legal protection (dispute resolution with and without court) Public building law • Building planning law (urban development law), municipal land-use planning (plan preparation procedures, types of building land-use plans, approval requirements), application of planning replacement regulations, procedural law (building authorities, approval requirements, building authority sovereign acts, sanctions, construction burden) • Material requirements of building regulations (distance area regulation and parking space verification) • Legal protection against building authority acts, environmental law, basic principles of general environmental law and environmental procedural law
Notice	
Literature	Causing obligation: • Ulrich Battis, Öffentliches Baurecht und Raumordnungsrecht, Kohlhammer-Verlag, 5. Auflage, 2019 • Schwartmann/Pabst: Umweltrecht, C.F. Müller, 2. Auflage 2011, Further relevant literature will be announced at the event.

4.5.4 Geotechnics II and Soil Mechanics

Geotechnics II and Soil Mechanics

Module name	Geotechnics II and Soil Mechanics	**Module number**	
Lecturer / Module responsible	Jana Sue Bochert, Dr. Maximilian Lerch, Dr. Roman Zorn		
teaching language	English		
Art the Course	Compulsory subject		
Duration of the module / frequency of the offer of the module	4 semesters summer semester		
Courses of the module	Geotechnics II		
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises		
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.		
Recommended requirements	Introduction to Geotechnics and Technical Transport		
Usability of the module within your own as well for other courses	The contents of the module serve as a general basis for all other modules in the degree program.		

Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 h	125 h

Type of test/requirements tongues for the award of credit points	Written exam: 90 minutes certificate of achievement
Weighting of the individual grade in the Overall grade	See SPO
Learning objectives of Monduls	Learning ojectives • Determine stress propagation in the ground • Apply the safety concept in geotechnics • to prove the load-bearing capacity and usability for individual and strip foundations • using earth pressure theory to design, dimension and provide the associated verifications for shallow and deep-founded supporting structures
Content of module	**Settlements and deformations:** Types of settlement, stress propagation, direct and indirect settlement calculation, **safety concept in earthworks and foundation engineering** **Shallow foundations:** Bedding modulus method, tension trapezoid method, simplified verification, slip resistance, foundation fracture safety **Earth pressure:** Active and passive earth pressure, earth pressure at rest **Support structures:** Heavy weight walls, angle retaining walls, measurements and verifications

	Trench shoring **Construction pit shoring:** Sheet pile walls, diaphragm walls, beam pile walls, bored pile walls, anchors, stiffeners, Dimensions and verifications, hydraulic foundation failure, verification of the deep sliding joint
Notice	Multimedia lectures, excursions
Literature	• Möller, G. 2016. Geotechnik - Bodenmechanik. Berlin: Ernst und Sohn, 2016. • Normen, Richtlinien und Merkblätter • Boley, C. [Herausgeber].2012. Handbuch Geotechnik. Wiesbaden: Viewegund Teubner, 2012. • Weißenbach A., Hettler A. 2011. Baugruben. Berlin: Ernst und Sohn, 2011. • Ziegler, M. 2012. Geotechnische Nachweise nach EC 7 und DIN 1045. Berlin: Ernst und Sohn, 2012. • Lecture notes (with further references)

4.5.5 Sustainable Transport Technology

Sustainable Transport Technology						
Module name	Sustainable Transport Technology				**Module number**	3.3
Lecturer / Module responsible	Werner Huber ; Slavica Grosanic, Christoph Gastl					
teaching language	english					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Summer semester					
Courses of themodule	Sustainable Transport Technology					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Only those who have completed at least 42 ECTS credit points from the modules of the first part of the study are entitled to participate.					
Recommended requirements	Introduction to Geotechnics and Transportation Technology					
Usability of the module within your own as well for other courses						
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 h	125 h
Type of test/requirements tongues for the award of credit points	Project work certificate of achievement					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of the module	The Sustainable Transport Technology module aims to provide students with comprehensive knowledge and understanding of the principles and challenges of sustainable transport planning and transport technology. This includes: - Understand the fundamentals of sustainable transport planning and technology; Understand the key concepts of sustainability in the transport sector including ecological, economic and social aspects. - To understand and apply planning and decision-making processes, with a particular understanding of the role of transport policy and planning in promoting sustainable transport solutions. - Understand and analyze technological innovations; Ability to evaluate current and future technologies and intelligent transport systems in the area of sustainable transport. - Understanding environmental impacts. Develop practical application skills for the content learned.					

Content of module	The following content is developed through seminar-style teaching, supplemented by group work and discussion: • Basic concepts of traffic planning and traffic engineering • Historical development of road traffic and traffic planning as well as their contributions to the sustainability of transport systems (Athens Charter, New Leipzig Charter) • Data collection systems in traffic • Traffic management • traffic flow outside of town; Traffic control outside of town (NBA, SBA, KBA) • Economic feasibility study of traffic-influencing measures on the highway (ex-ante / ex-post economic feasibility study, FMEA, SWAT analysis, ...) • Traffic effects, traffic safety parameters • Individual and collective traffic management systems • Practical example for the basic determination, preliminary planning and draft planning of a traffic system • Public transport • Inner-city streets • Nodes • Computer-assisted routing (with AutoCAD Civil 3D) • Base layers • Cover layers • Traffic noise protection
Notice	
Literature	Causing obligation: • Schnabel, W.; Lohse, D. (2011): Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung- Band 1 Straßenverkehrstechnik. Beuth Verlag GmbH, Berlin, Wien, Zürich. • Köhler, U. (2014): Einführung in die Verkehrsplanung. Fraunhofer IRB Verlag, Stuttgart. ISBN (Print): 978-3-8167-9041-9 • Richtlinien (z.B. RAA, RAL), Merkblätter, Empfehlungen, Hinweise und Arbeits-anleitungen der Forschungsgesellschaft für Straßen- und Verkehrswesen. RStO 12; Ausgabe 2012; RASt 06; Ausgabe 2006 • Treiber, Kesting (2010): Verkehrsdynamik und -simulation, Springer Verlag ISBN 978-3-642-32459-8 · 2010 Additionally: • Dorsch, M. (2021): Verkehrswirtschaft - Eine Einführung mit Fallstudien. UVK Verlag München • Straßenverkehrstechnik / Straße und Autobahn – Zeitschrift (für Studenten kostenlos)

4.5.6 Timber Construction and Ressource Managegement

Timber Construction and Ressource Managegement						
Module name	*Timber Construction and Ressource Managegement*			**Module number**		XX
Lecturer / Module responsible	Jana Sue Bochert , Hisham Al Hanaoun					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Summer semester					
Courses of the module	*Timber Construction and Ressource Managegement*					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Only those who have completed at least 42 ECTS credit points from the modules of the first part of the study are entitled to participate.					
Recommended requirements	Mechanic I and II, Structural Analysis					
Usability of the module within your own as well for other courses	The module serves as the basis for the other modules of the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47	0	78	125
Type of test/requirements tongues for the award of credit points	written exam: 90 minutes certificate of achievement					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	The students are able to name and classify the properties of wood, explain wood materials and determine modification values according to EC5 depending on the situation. You can recognize cases of stability, calculate the load-bearing capacity of rod-shaped wooden components with normal force and bending stress, taking stability into account, and analyze the usability of bending beams. You have the ability to independently carry out calculations and verifications of simple beams and supports made of wood .					

Content of module	• Basics and areas of application of timber construction • Material properties: wood products, structure and construction, building material tests • Basics of design according to Eurocode 5: Safety concepts in timber construction, limit states of load-bearing capacity, stability of individual components, deflection verifications, connections in timber construction • Wood protection: influence on load-bearing capacity, usage classes, structural wood protection
Notice	
Literature	literature • Colling, François: Holzbau – Grundlagen, Bemessungshilfen. Vieweg + Teubner, 2008. • Colling, François: Holzbau – Beispiele: Musterlösungen, Formelsammlung, Bemessungstabellen. Vieweg + Teubner, 2004. • Peter, M.: Holzbau-Taschenbuch / 1. Grundlagen, Ernst + Sohn, Berlin, 2021. • Neuhaus, H.: Ingenieurholzbau: Grundlagen – Bemessung – Nachweise – Beispiele, Springer, Wiesbaden, 2017. • : basics – design – evidence – examples, Springer, Wiesbaden, 2017. Further relevant literature will be announced at the event .

4.6 5th semester

4.6.1 Construction Internship

Construction Internship						
Module name	Construction Internship				**Module number**	5.1
Lecturer / Module responsible	NN					
teaching language	English					
Art the Course	Practical semester					
Duration of the module / frequency of the offer of the module	1 semester winter semester					
Courses of themodule	Construction practice					
teaching and learning methods module						
Requirements for the partial take according to SPO	Admission to the practical semester requires that the student has passed all examinations and relevant course-related certificates of achievement in the first stage of the course must be at least the grade "sufficient" has been achieved and that at least 20 ECTS credit points from the compulsory modules of the second stage of studies.					
Recommended requirements	Successful participation in the modules of semesters 1-4					
Usability of the module within your own as wellfor other courses						
Total work effort andhis composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
		27	H	0h	H	18 weeks
Type of test/requirements tongues for the award of credit points	Internship report					
Weighting of the individual grade inthe Overall grade	See SPO					
Learning objectives of the module	The students are introduced to the work of an engineer using specific tasks. The students get an overview of the technical and operational processes of a company with an industrial focus.					

Content of module	• Independent collaboration on projects and problems whose topics are closely related to the completed studies or represent a valuable addition. • Application and deepening of knowledge, methods and procedures that are taught and conveyed in theoretical studies.
Notice	
Literature	Mandatory: Company specific

4.6.2 Scientific Methods

Scientific Methods						
Module name	Scientific Methods				**Module number**	XX
Lecturer / Module responsible	NN					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of themodule	Scientific work					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO						
Recommended requirements	Successful participation in the modules from semesters 1 to 4.					
Usability of the module within your own as wellfor other courses	The contents of the module serve as the basis for subject-specific elective modules in the degree program and the bachelor's thesis.					
Total work effort andhis composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47h	0h	78h	125h
Type of test/requirements tongues for the award of credit points	The performance record (LN) is alternatively a project work (Proj), an oral examination (mdlP) or a written examination.					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of the module	After successful participation in this module, students are able to design a scientific paper on a specific question. For this purpose, they are able to carry out a literature research and weight individual literature references according to their importance for the question. You will be able to plan any necessary practical experiments and estimate the material and time required. They are able to prepare protocols and reports that make their work understandable for experts. They know the forms of quoting and can use them. You are able to write scientific publications about your own work or other people's work (reviews). You are able to design and give lectures and presentations.					
Content of module	The following content is developed through seminar-style teaching, supplemented by group work and discussion: • Methodical introduction to scientific work, hypothesis formation, objectivity, accuracy, logic • Literature research methods					

	• Forms and standards of citation • Creating work plans, minutes and reports • Preparation of scientific publications • Conception and implementation of lectures and presentations
Notice	
Literature	Mandatory: • Brink, A., 2013: Anfertigung wissenschaftlicher Arbeiten. Ein prozessorientierter Leitfaden zur Erstellung von Bachelor-, Master- und Diplomarbeiten. Wiesbaden: Springer Gabler • Sandberg, B., 2016: Wissenschaftliches Arbeiten von Abbildung bis Zitat. Lehr- und Übungsbuch für Bachelor, Master und Promotion. Berlin/Boston: DeGruyter/Oldenburg Verlag • Stickel-Wolf, C./Wolf, J., 2016: Wissenschaftliches Arbeiten und Lerntechniken. • Seifert, Josef W. (2009): Visualisieren. Präsentieren. Moderieren Offenbach, Gabal Verlag, 23.Auflage • Negrino, T. (2005): Präsentationen mit PowerPoint. München: Markt+Technik Bastian, J./Groß, L., 2012: Lerntechniken und Wissensmanagement. Konstanz: ZVK Verlagsgesellschaft • Veith, D., Die wissenschaftliche Arbeit: für Studierende der Ingenieurwissenschaften, Hanser, München, 2022. Further relevant literature will be announced at the event.

4.7 6th semester

4.7.1 Digital Opertaion Management and BIM

Digital Opertaion Management and BIM						
Module name	Digital Opertaion Management and BIM			**Module number**		6.1
Lecturer / Module responsible	NN					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester summer semester					
Courses of themodule	Digital construction process management and BIM					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Successful participation in the modules of semesters 1-5.					
Usability of the module within your own as wellfor other courses						
Total work effort andhis composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47h	0h	78h	125h
Type of examination / requirements for the award of credit points	Written exam: 90 minutes					
Weighting of the individual grade inthe Overall grade	See SPO					
Learning objectives of the module	Students can apply methods of digital planning and lean design in the planning process of buildings and create a responsibility-based collaborative planning process based on the pull principle. The students are able to carry out essential project controlling tasks. The students can describe traditional and collaborative planning and differentiate between them. The students will be able to explain the application and effectiveness of Lean in planning. Students can describe, select and use digital tools to support lean planning. Students can apply methods of digital planning and lean design in the planning process of buildings.					

Content of module	The following content is developed through seminar-style teaching, supplemented by group work and discussion: •Use of digital tools •How Lean works in planning • Basics of digital models of a building • Use of relevant information and data about the building throughout its entire life cycle • Modeling and coordination of building data models • Use of IT solutions for BIM processes • Application of BIM organization in the company • Implementation of model-based planning, calculation, billing and controlling
Notice	
Literature	Causing obligation: • Wieland Appelfeller: Die difigalte Transofmraation des Unternehmens, Springer Gabler, 2018 • Chrisitan Hoftsatdler: Aglie Digialtisierung im Baubetrieb, Springer Vieweg, 2021 • Alcay Kamis: Digitalisierung in der Wohnugns- und Immobilienwirtschaft: Haufe, 2019 • Andre Borrmann: Building Information Modeling, Springer Vieweg, 2015 • Amir Abbaspor: Digitales Bauen mit BIM: Use Case Management im Hochbau, Beuth, 2021 Further relevant literature will be announced at the event.

4.7.2 Alternative Construction Methods

Alternative Construction Methods						
Module name	Alternative Construction Methods			**Module number**	XX	
Lecturer / Module responsible	NN					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Summer semesters					
Courses of the module	Alternative Construction Methods					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies					
Recommended requirements	Successful participation in the modules of semesters 1-5.					
Usability of the module within your own as well for other courses						
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h		78 h	125 h
Type of test/requirements tongues for the award of credit points	written exam: 90 minutes certificate of achievement					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	The students know important construction methods in building construction, civil engineering and infrastructure construction. You can determine suitable construction methods based on ecological, technical and economic criteria. You can use ecological, technical and economic criteria to evaluate whether renovation, conversion or new construction makes sense.					
Content of module	• Resource-saving and durable construction of buildings. • Building in existing buildings • Climate-neutral construction • Climate-adapted building • Construction methods: Wood construction techniques, masonry construction, modular construction methods, (wooden) solid construction, lightweight construction, bionic architecture, 3D printing, half-timbered construction					
Notice						

Literature	• Knippers, J., Speck, T., Schmid, U.: Bionisch bauen: von der Natur lernen, Birkhäuser, Basel, 2019. Further project-specific literature will be announced at the event .

4.7.3 Digital Building Automation and Renwable Energy

Digital Building Automation and Renwable Energy						
Module name	Digital Building Automation and Renwable Energy			**Module number**		XX
Lecturer / Module responsible	NN					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Summer semester					
Courses of the module	Digital building technology					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Successful participation in the modules of semesters 1-5.					
Usability of the module within your own as well for other courses						
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0	78 h	125 h
Type of test/requirements tongues for the award of credit points	written exam: 90 minutes					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	The students know the individual trades of technical building equipment (TGA) and their dependencies as well as essential parameters of the devices and systems used. You can dimension basic TGA systems and assess interfaces between the TGA and the supporting structure. You know and avoid potential conflicts between the trades. You are able to carry out the planning implementation of building technology systems.					
Content of module	• Electrical engineering (high and low current systems, lightning protection, lighting) • Building automation • Elevator systems • Structural fire protection and fire extinguishing systems • Sanitary technology: drinking water, industrial water, wastewater, protection against backflow • Air conditioning systems as well as air conditioning and refrigeration technology					

	• Heating technology with a focus on renewable energies • Photovoltaics
Notice	
Literature	literature • Laasch T., Haustechnik : Grundlagen, Planung, Ausführung, 13. Aufl., 2013, Teubner, Stuttgart. • Bohne D., Gebäudetechnik und Technischer Ausbau von Gebäuden, 12. Aufl., 2022, Springer, Wiesbaden. Further relevant literature will be announced at the event .

4.7.4 Construction Project and Sustainability Management

Construction Project and Sustainability Management						
Module name	Construction Project and Sustainability Management			**Module number**		2.2
Lecturer / Module responsible	NN					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Summer semester					
Courses of themodule	Construction Project and Sustainability Management					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Building Construction, Construction Management					
Usability of the module within your own as well for other courses	The module deepens the basics from the construction management module and expands them to include the aspect of sustainability.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0 h	78 hours	125 hours
Type of test/requirement tongues for the award of credit points	Written exam: 90 minutes					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of the module	The students know the different perspectives and phases of construction projects and can apply the corresponding methods of project management and project control in the project. In addition, they know the key sustainability goals and associated measures in planning and execution. After completing the module, students will be able to integrate and apply the methods for achieving sustainability goals in construction projects in all project phases, taking into account any possible funding.					
Content of module	The following content is developed through seminar-style teaching, supplemented by group work and practical lectures as well as their discussion: • Project phases according to HOAI • Basics of project management • Methods of project control and management • Sustainability aspects in construction projects • Basics of DGNB and BNB • Lean Construction Management / Last Planner • Contract management, contract drafting					

	• Project alliance, multi-party contracts • Funding landscape/funds
Notice	
Literature	Causing obligation: • Liebchen J. H. et al.: Baumanagement und Bauökonomie, Teubner Verlag 2007 • Bergmann C.: Prozesse Entwerfen, Birkhäuser Verlag, Basel 2019 • Rösel W. et al.: AVA-Handbuch, Springer Vieweg, Wiesbaden 2020 • Köchendorfer et. al.: Bau-Projekt-Management, Springer Vieweg, Wiesbaden 2018 • Martin Fiedler (Hrsg.): Lean Construction – Das Managementhandbuch, Springer Gabler, Berlin 2018 Further relevant literature will be announced at the event .

4.7.5 Civil Engineering and Project Management

Civil Engineering and Project Management						
Module name	Civil Engineering and Project Management				**Module number**	XX
Lecturer / Module responsible	NN					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Summer semesters					
Courses of the module	Practical project / application project					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Successful participation in the modules of semesters 1-5.					
Usability of the module within your own as well for other courses						
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h		78 h	125 h
Type of test/requirements tongues for the award of credit points	project work					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	The students work in a team to solve a self-contained, demanding technical task on their own responsibility over the course of a semester. They can independently familiarize themselves with a topic that is new to them and successfully work on it independently using their basic knowledge. You are able to structure the task in a team, prioritize sub-steps and implement them into methodical steps. As a team, you can independently develop an overall solution that is relevant to the task. Every team member is able to verbally explain the overall solution, justify it and present the results. You will master the use of project management methods to solve tasks in groups within a given time frame.					

Content of module	• Working on a semester-long project task in a team. • The project tasks differ from semester to semester. Several different project topics are offered, from which students can choose one depending on availability. • The topics are typical, complex, practice-relevant tasks from civil engineering with a connection to sustainability.
Notice	The project topics are assigned to the groups by the lecturer based on availability. The group division is done by the lecturer.
Literature	• Hemmrich, A., Harrant, H.: Projektmanagement: in 7 Schritten zum Erfolg, Hanser, München, 2015. Further project-specific literature will be announced at the event .

4.8 7th semester

4.8.1 Sustainable Buildings and Structures

Sustainable structural planning						
Module name	Sustainable Buildings and Structures			**Module number**		1.9
Lecturer / Module responsible	NN					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of the module	Sustainable Buildings and Structures					
teaching and learning methods module	SU/Ü/Pr - seminar teaching/exercise/internship					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Successful participation in the course in engineering mathematics, building materials technology, building mechanics, building statics					
Usability of the module within your own as well for other courses	The contents of the module serve as a general basis for all other modules in the degree program.					
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h		78 h	125 h
Type of test/requirements tongues for the award of credit points	written exam: 90 minutes certificate of achievement					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	The content of the module includes, among other things, building in existing buildings, building with renewable raw materials, recycling building materials and testing the load-bearing behavior of new building materials. After completing the module, students have in-depth knowledge of the material-ecological comparison of load-bearing construction materials, strategies and tools for optimization in structural design, and the life cycle analysis of load-bearing structures according to ISO 14040/14044. After expanding their knowledge, students can carry out condition monitoring (according to DIN ISO 17359) using Structural Health Monitoring (SHM) in order to examine the load-bearing capacity of new building materials. Case studies for existing structures.					

Content of module	The following content is developed through seminar-style teaching, supplemented by group work and discussion: • Sustainability criteria in structural planning • Strategies and tools for optimization in structural design • Material-ecological comparison of load-bearing construction materials • Life cycle analysis of supporting structures according to ISO 14040/14044 • Sustainability ductility earthquakes • SHM • Case studies for existing structures (conversion, expansion, renovation)
Notice	
Literature	• DIN EN ISO 14040:2021-02 • Hauke B. (Hrsg.): Nachhaltigkeit, Ressourceneffizienz und Klimaschutz, Wiley, 2021 • Pfeiffer, M., Bethe A. Pfeidrder C.: Nachhaltiges Bauen, Hanser, 2022. • Friedrichsen, S.: Nachhaltiges Planen, Bauen und Wohnen, Sringer Berlin Heidelberg, 2018 Further relevant literature will be announced at the event .

4.8.2 Sustainable Stuctural Enineering

Sustainable Stuctural Enineering						
Module name	Sustainable Stuctural Enineering			**Module number**		2.2
Lecturer / Module responsible	NN					
teaching language	German					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of themodule	Sustainability of buildings					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies.					
Recommended requirements	Building Construction, Construction Management					
Usability of the module within your own as wellfor other courses	The module brings together the sustainability methods previously learned in the modules mentioned above and deals with them on specific buildings.					
Total work effort andhis composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	3	3	24 h	0 h	51 h	75 h
Type of test/requirement tongues for the award of credit points	certificate of achievement					
Weighting of the individual grade inthe Overall grade	See SPO					
Learning objectives of the module	Students can assess buildings and construction measures based on a wide range of criteria with regard to sustainability aspects and goals, both in building construction and civil engineering projects. You can carry out a structured investigation into the implementation of sustainability aspects in all phases of a construction project and, based on this, develop strategies for achieving sustainability goals.					
Content of module	The following content is developed through seminar-style teaching, supplemented by group work and practical lectures and case studies as well as their discussion: • Sustainability aspects in construction projects • Criteria according to DGNB and BNB • Dealing with conflicting goals • Sustainability strategies in planning, execution and operation • Contract management/multi-party contracts • case studies on projects in planning/construction/operation					

Notice	
Literature	Causing obligation: • Martin Fiedler (Hrsg.): Lean Construction – Das Managementhandbuch, Springer Gabler, Berlin 2018 • Pfeiffer, M. et. al.: Nachhaltiges Bauen: wirtschaftliches, umweltverträgliches und nutzungsgerechtes Bauen, Hanser Verlag; München 2022 • Hauke, Bernhard (Hrsg.): Nachhaltigkeit, Ressourceneffizienz und Klimaschutz : konstruktive Lösungen für das Planen und Bauen : aktueller Stand der Technik, Verlag Ernst & Sohn, Berlin 2021. Further relevant literature will be announced at the event .

4.8.3 Life Cycle & Climate Chance Adaption Engineering

Life Cycle & Climate Adapted Engineering						
Module name	Life Cycle & Climate Adapted Engineering			**Module number**		XX
Lecturer / Module responsible	NN					
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester Winter semester					
Courses of the module	Life Cycle & Climate Adapted Engineering					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must have obtained at least 42 ECTS from the first stage of their studies					
Recommended requirements	Successful participation in the modules of semesters 1-6.					
Usability of the module within your own as well for other courses						
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
	4	5	47 h	0	78 h	125 h
Type of test/requirements tongues for the award of credit points	written exam: 90 minutes certificate of achievement					
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of Mon duls	The students know the factors of durability and life cycle costs of buildings. You can weigh up and optimize life cycle costs and resource use. They can plan buildings in such a way that later conversion or reuse is easily possible, and they know renovation concepts to extend their useful life. They know the influencing factors of the climate and the properties of different construction methods and can choose the most suitable construction method in terms of energy requirements, living quality and durability.					
Content of module	• Life span measurement • Reuse of buildings (circular economy) • Conversion and renovation concepts • Durability of components • Structural building protection • Interaction of buildings with the environment					

Notice	
Literature	literature Relevant literature will be announced at the event .

4.8.4 Bachelor Thesis

Bachelor Thesis						
Module name	Bachelor Thesis			**Module number**	7.1	
Lecturer / Module responsible						
teaching language	English					
Art the Course	Compulsory subject					
Duration of the module / frequency of the offer of the module	1 semester summer semester					
Courses of themodule	Bachelor Thesis					
teaching and learning methods module	SU/Ü - seminar-like lessons/exercises					
Requirements for the partial take according to SPO	Participants must complete their practical semester and the scientific seminar module have successfully completed work.					
Recommended requirements	Successful participation in the modules of semesters 1-6.					
Usability of the module within your own as well for other courses						
Total work effort and his composition	**SWS**	**ECTS**	**Presence time**	**WBT Expense**	**Self-study**	**Total effort**
						12 weeks
Type of examination / requirements for the award of credit points						
Weighting of the individual grade in the Overall grade	See SPO					
Learning objectives of the module	The students deepen the methods of scientific work in engineering and are enabled to carry out methodical literature research. In a short period of time , the students develop a clear structure as the basis for the bachelor's thesis and conduct technical discussions on the thematic structure.					
Content of module	The academic requirements of the bachelor's thesis are explained by the respective academic advisors or representatives ("Guidelines for bachelor's thesis") • Introduction to research and documentation techniques • Topic selection: Individual choice of topic and supervisor • Independent contact with companies and professors • Create and coordinate a schedule for the bachelor's thesis • Prepare an outline for your bachelor's thesis • Prepare registration for your bachelor's thesis					
Notice						

Literature	