Technische Hochschule Ingolstadt

Module manual

Sustainable Civil Engineering

Bachelor full time

Study and examination regulations: SPO 2023

As of: 31/07/2024

Stand: 2025-02-11

Inhalt

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 4 to 7 semesters are listed as examples because we are in the first study cycle.

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Update status:

Version 1: 09/14/23
Version 2: 02/27/24
Version 3:07/31/24

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
- 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).

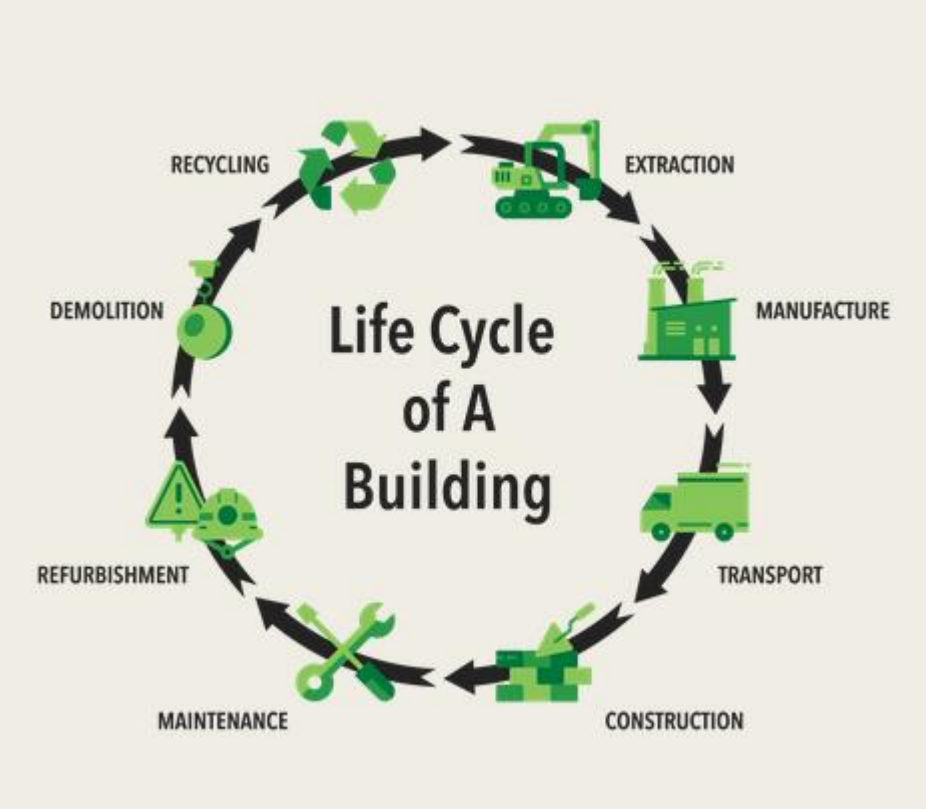

Figure 2.: Building life cycle

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 .

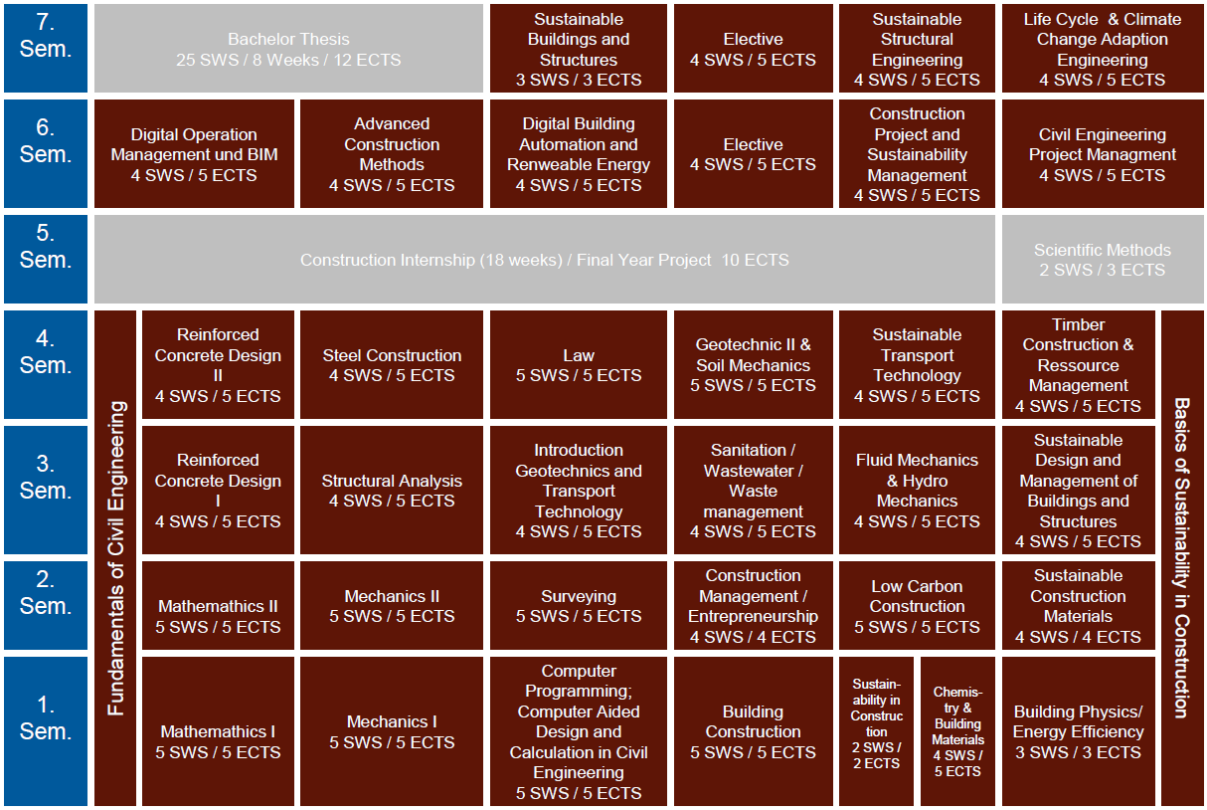

Figure 3.: Construction course concept

(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 profil

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.

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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

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**

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

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.

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 Description of Modules

4.1 Compulsory modules

Introduction Project

Module abbreviation:	SCE_IP	**Reg.no.:**	1
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	1

Responsible for module:	Blask, Oliver		
Lecturer:	Blask, Oliver		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	2 ECTS / 1 SWS		
Workload:	Contact hours: 12 h Self-study: 38 h Total: 50 h		
Subjects of the module:	1: Introduction Project		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

LN - colloquium before exam period

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

Introductory event to the course

- overview of the university organization
  - library
  - student council
  - student associations
  - internantional office
- learning and working techniques
- networking with BayKa
- First contact with the construction industry working on a real practical project

Literature:
Will be specified at the beginning
Additional remarks:
None

Mathematrics I

Module abbreviation:	SCE_Ma	**Reg.no.:**	2
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	1

Responsible for module:	Müller, Marvin		
Lecturer:	Müller, Marvin (SCE_Ma) Müller, Marvin (SCE_Ma_AR)		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 5 SWS		
Workload:	Contact hours: 57 h Self-study: 68 h Total: 125 h		
Subjects of the module:	2: Mathematrics I 2: Mathematics I (admission requirement)		
Lecture types:	Mathematrics I: SU/Ü - lecture with integrated exercises Mathematics I (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Mathematrics I: schrP120 - written exam, 120 minutes
Mathematics I (admission requirement): Student research project without presentation

Additional Explanation:

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

The students learn about the key mathematical concepts and methods relevant to a technical degree program. They understand the underlying principles and independently solve mathematical problems using the necessary methods.

The students are particularly capable of:

- Confidently working with real and complex numbers.
- Solving equations and inequalities with one variable.
- Identifying function types relevant to engineering.
- Applying methods of differential and integral calculus of one variable to engineering problems.
- Solving problems in the field of differential and integral calculus.
- Performing basic matrix and vector operations.
- Examining matrices for invertibility.
- Determining solution sets of linear systems of equations.

Content:

The module "Mathematics I" covers the typical mathematical content for a study program with a focus on both economic and technical expertise.

It addresses fundamental techniques and methods of mathematics essential for engineering studies, particularly from the field of (applied) calculus, where the concept of limits serves as a central theme throughout the course. Sections on continuous functions, differential calculus, and integral calculus provide the mathematical foundation for more advanced topics.

Vector algebra, matrices, and linear systems of equations form the basis for geometric visualization as well as the theoretical foundation for more complex topics addressed in the second part of the course.

Specifically, the module includes:

- Fundamentals of mathematics (sets and functions, properties of important number systems, introduction to complex numbers)
- Elementary functions and their properties, limits of functions and sequences
- Differential calculus (differentiability, differentiation rules, applications of differential calculus)
- Integral calculus (antiderivatives, definite and indefinite integrals, basic integration rules)
- Fundamentals of linear algebra
- Vector algebra and matrices
- Linear mappings and linear systems of equations

Literature:

- RILEY, Kenneth F., Michael P. HOBSON and Stephen J. BENCE, 2006. *Mathematical methods for physics and engineering*. Cambridge [u.a.]: Cambridge Univ. Press. ISBN 978-0-521-86153-3, 0-521-86153-5
- FRIEDMAN, Menahem, KANDEL, Abraham, 2011. *Calculus light* [online]. Berlin [u.a.]: Springer PDF e-Book. ISBN 978-3-642-17848-1. Available via: https://doi.org/10.1007/978-3-642-17848-1.
- RAHMANI-ANDEBILI, Mehdi, 2021. *Calculus: Practice Problems, Methods, and Solutions* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-030-64980-7. Available via: https://doi.org/10.1007/978-3-030-64980-7.

Additional remarks:

None

Building Constructions I

Module abbreviation:	SCE_BuildCon	**Reg.no.:**	4
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	1

Responsible for module:	Haese, Andreas		
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	4: Building Constructions I		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

schrP120 - written exam, 120 minutes

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

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 finish-ing 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 regu-lations 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, draw-ing technics in construction, masonry, mortar
- Constructive geometry
- Basics of design, technical drawings
- Introduction to technical regulations, design codes, building regulations
- Fire protection

Literature:

- ALLEN, Edward and Joseph IANO, 2019. *Fundamentals of building construction: materials and methods*. Hoboken, New Jersey: Wiley. ISBN 978-1-119-44619-4
- MERRITT, Frederick S. and Jonathan T. RICKETTS, 2001. *Building design and construction handbook*. New York: McGraw-Hill. ISBN 0-07-041999-X, 9780070419995
- ALBERT, Andrej, Klaus-Jürgen SCHNEIDER and Alfons GORIS, 2022. *Bautabellen für Ingenieure: mit Berechnungshinweisen und Beispielen*. 25. edition. Köln: Reguvis. ISBN 978-3-8462-1316-2
- NEUFERT, Ernst and others, 2022. *Bauentwurfslehre: Grundlagen, Normen, Vorschriften über Anlage, Bau, Gestaltung, Raumbedarf, Raumbeziehungen, Maße für Gebäude, Räume, Einrichtungen, Geräte mit dem Menschen als Maß und Ziel : Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernenden*. 43. edition. Wiesbaden: Springer Vieweg. ISBN 978-3-658-34236-4, 3-658-34236-6
- , . *Frick, Knöll, Neumann, Weinbrenner: Baukonstruktionslehre, Teil 1 und 2, Ver-lag B.G. Teubner Vieweg +Teubner, 2018.*.

Additional remarks:

None

Computer Programming; Computer Aided Design and Calculation in Civil Engineering

Module abbreviation:	SCE_CPCADC	**Reg.no.:**	5
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	1

Responsible for module:	Bochert, Jana Sue		
Lecturer:	Al Hanoun, Hisham; Bochert, Daniel; Bochert, Jana Sue		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 5 SWS		
Workload:	Contact hours: 59 h Self-study: 66 h Total: 125 h		
Subjects of the module:	5: Computer Programming; Computer Aided Design and Calculation in Civil Engineering		
Lecture types:	SU/Ü/PR - seminar based teaching/Exercise course/laboratory		
Availability of the module:	None		

Examinations:

schrP90 - written exam, 90 minutes

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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 palnning 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:

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 calcultions. Practically relevant techniques of data storage data exchange via networks complete the module

- functionality of a hihg 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
Literature:
Will be specified at the beginning
Additional remarks:
None

Chemistry & Building Materials

Module abbreviation:	SCE_C&BM	**Reg.no.:**	6
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	1

Responsible for module:	Blask, Oliver		
Lecturer:	Blask, Oliver		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 60 h Self-study: 65 h Total: 125 h		
Subjects of the module:	6: Chemistry & Building Materials		
Lecture types:	SU/Ü/PR - seminar based teaching/Exercise course/laboratory		
Availability of the module:	None		

Examinations:

schrP90 - written exam, 90 minutes

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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.

Content:

- 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.
- Metallic Building Materials (steel, aluminum, copper, etc.)
- Mineral Building Materials (cement, lime, gypsum, concrete)
- Organic Building Materials (plastics, bitumen)
- Practical experiments: Production of sustainable concrete

Literature:
• TIMBERLAKE, Karen C., 2019. *Chemistry: an introduction to general, organic, and biological chemistry*. New York: Pearson. ISBN 978-1-292-22886-0, 1-292-22886-5 • PAULING, Linus, 2011?. *General chemistry*. [Place of publication not identified]: BN Pub.. ISBN 978-1-60796-298-4, 1607962985 • HUHEEY, J.E., 2008. *Inorganic Chemistry: Principles of Structure and Reactivity*. Boston: Pearson. ISBN 978-8177581300 • KULTERMANN, Eva and William P. SPENCE, 2022. *Construction, materials, methods, and techniques: building for a sustainable future*. Boston, MA: Cengage. ISBN 978-0-357-51383-5 • TAYLOR, G.D., 2013. *Materials in Construction: an introduction* [online]. New York: Routledge PDF e-Book. ISBN 978-1-315-83915-8. Available via: https://doi.org/10.4324/9781315839158.
Additional remarks:
None

Building Physics/Energy Efficiency

Module abbreviation:	SCE_BP/EE	**Reg.no.:**	7
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	1

Responsible for module:	Blask, Oliver		
Lecturer:	Blask, Oliver		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	3 ECTS / 3 SWS		
Workload:	Contact hours: 45 h Self-study: 30 h Total: 75 h		
Subjects of the module:	7: Building Physics/Energy Efficiency		
Lecture types:	SU/Ü/PR - seminar based teaching/Exercise course/laboratory		
Availability of the module:	None		

Examinations:

LN - written exam, 90 minutes

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

- 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.
- practical exercises:
  - Excursion to a passive house
  - Air tightness measurement (blower door test) and thermography

○ Software exercises: Creating GEG certificates ○ Thermal Bridges, calculation by software
Literature:
• PINTERIĆ, Marko, 2021. *Building Physics: From physical principles to international standards* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-030-67372-7. Available via: https://doi.org/10.1007/978-3-030-67372-7.
Additional remarks:
None

Sustainability in Construction

Module abbreviation:	SCE_SiC	**Reg.no.:**	8
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	1

Responsible for module:	Bochert, Jana Sue		
Lecturer:	Blask, Oliver; Bochert, Jana Sue		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	2 ECTS / 2 SWS		
Workload:	Contact hours:		24 h
	Self-study:		26 h
	Total:		50 h
Subjects of the module:	8: Sustainability in Construction		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

mdlP - oral exam, 15-20 minutes

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

the students learn how to rethink which is essential in the construction industry, through lectures by experts from science and business. the esperts 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 recogniize the problems whose solutions will be discussed in the course of your studies.

Content:

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
Literature:
Will be specified at the beginning
Additional remarks:
None

Mathematics II

Module abbreviation:	SCE_Ma_II	**Reg.no.:**	9
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	2

Responsible for module:	Müller, Marvin		
Lecturer:	Müller, Marvin (SCE_Ma_II) Müller, Marvin (SCE_Mech_II_AR)		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 5 SWS		
Workload:	Contact hours: 57 h Self-study: 68 h Total: 125 h		
Subjects of the module:	9: Mathematics II 9: Mathematics II (admission requirement)		
Lecture types:	Mathematics II: SU/Ü - lecture with integrated exercises Mathematics II (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Mathematics II: schrP90 - written exam, 90 minutes
Mathematics II (admission requirement): Student research project without presentation

Additional Explanation:

Students must achieve 50% of the possible points in a homework assignment (submitted individually). The deadline for completing the assignment will be announced during the course.

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

The students are familiar with the key mathematical concepts and methods relevant to a technical degree program. They understand the underlying principles and independently solve mathematical problems using the necessary methods.

The students are particularly capable of:

- Applying methods of differential and integral calculus for multiple variables to engineering problems.
- Solving problems in the field of differential and integral calculus.
- Solving first-order differential equations and corresponding initial value problems, including:
  - Linear differential equations.
  - Differential equations with separable variables.

- Determining fundamental systems for linear differential equations with constant coefficients (up to second order).

Content:

The module "Mathematics II" provides advanced mathematical content for a technically oriented degree program.

Topics covered include:

- Functions of Several Variables
- Differential and integral calculus of functions of several variables.
  - Differentiation: Partial derivatives (first-order and higher-order), local extrema and saddle points, optimization problems.
  - Multiple integrals: Double integrals, triple integrals (applications such as volume, center of mass, moments).
- Differential Equations
  - Fundamental concepts (initial value problems).
  - First-order differential equations: Homogeneous and inhomogeneous linear differential equations.
  - Second-order differential equations: Homogeneous and inhomogeneous linear differential equations with constant coefficients (applications to mechanical oscillations).

Literature:

- RILEY , K. F. , HOBSON , M. P., BENCE , S. J., 2006. *Mathematical Methods for Physics and Engineering: A Comprehensive Guide* [online]. PDF e-Book. ISBN ISBN 978-0-511-16842-0 .
- FRIEDMAN, M., KANDEL , A., 2011. *Calculus light* [online]. Berlin: Springer PDF e-Book. ISBN ISBN 978-3-642-17848-1, 978-3-642-17847-4, . Available via: https://doi.org/10.1007/978-3-642 17848-1. .
- RAHMANI-ANDEBILI , M., 2021. *Calculus: Practice Problems* [online]. PDF e-Book. ISBN ISBN 978-3-030-64980-7. Available via: https://doi.org/10.1007/978-3-030-64980-7.
- SCHIEFER, H., SCHIEFER, F., 2021. *Statistics for Engineers: An Introduction with Examples from Practice* [online]. Wiesbaden: Springer PDF e-Book. ISBN ISBN 978-3-658 32397-4. Available via: https://doi-org.thi.idm.oclc.org/10.1007/978-3-658-32397-4. .
- EWENS, W. J. , BRUMBERG, K., 2023. *Introductory Statistics for Data Analysis* [online]. PDF e-Book. ISBN ISBN 978-3-031-28189-1. Available via: https://doi org.thi.idm.oclc.org/10.1007/978-3-031-28189-1. .

Additional remarks:

None

Mechanics II

Module abbreviation:	SCE_Mech_II	**Reg.no.:**	10
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	2

Responsible for module:	Bochert, Jana Sue		
Lecturer:	Burger, Uli (SCE_Mech_II) Bochert, Jana Sue (SCE_Mech_II_AR)		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 5 SWS		
Workload:	Contact hours: 59 h Self-study: 66 h Total: 125 h		
Subjects of the module:	10: Mechanics II 10: Mechanics II (admission requirement)		
Lecture types:	Mechanics II: SU/Ü - lecture with integrated exercises Mechanics II (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Mechanics II: schrP90 - written exam, 90 minutes
Mechanics II (admission requirement): Student research project without presentation

Additional Explanation:
None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

The Elastostatics and strength of materials theory provide the fundamentals for the design and dimensioning of structures and components within the framework of stabil-ity and serviceability verifications. The students know the basic knowledge of strength theory as well as the correspond-ing theoretical background. More complex, statically determined systems are analysed andthe handling of deformation and stress calculations are outlined. In the group exercis-es, the students have students have acquired the ability to verbalise questions from mechanics, discuss and classify the problem, the solution and the results with fellow students and teachers and to classify the results.

Content:

The following contents will be developed through seminar teaching, supple-mented by group work and discussion:- Terms and basic relations of elastostatics - One- and multi-dimensional state of stress and distortion- Transformation of stresses and distortions- Material law of linear elasticity theory- Elementary elastostatics

of bars and beams- Shear stresses, shear centre,- Differential equation of the bending line- Dimensioning of compression members (torsion of circular profiles)
Literature:
• GROSS, D. and W. HAUGER, 2021. *Engineering Mechanics: Vol.2 Elastostatics* . 14. edition.
Additional remarks:
None

SCE_Surveying

Module abbreviation:	SCE_Survey	**Reg.no.:**	11
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	2

Responsible for module:	Liepert, Tobias		
Lecturer:	Liepert, Tobias (SCE_Survey) Liepert, Tobias (SCE_Survey_AR)		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 5 SWS		
Workload:	Contact hours: 59 h Self-study: 66 h Total: 125 h		
Subjects of the module:	11: SCE_Surveying 11: Surveying (admission requirement)		
Lecture types:	SCE_Surveying: SU/Ü - lecture with integrated exercises Surveying (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

SCE_Surveying: schrP90 - written exam, 90 minutes
Surveying (admission requirement): Student research project without presentation

Additional Explanation:

In six hands-on sessions, practical handling of the various surveying techniques is learned in small groups. The survey results of the hands-on sessions are to be compiled and evaluated by the students in the context of a peer assessment. For this purpose, the survey results are to be submitted one week after the hands-on session. The peer assessment takes place after all groups have gone through all the stations. The peer assessment is carried out in small groups for an assigned station. The results of the survey and the findings from the peer assessment are to be presented. The admission requirement is granted if all survey results have been submitted by the deadline and the peer assessment has been presented in class.

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

The students are able to:

- explain the functionalities of measurement methods.
- apply selected surveying methods for length, angle, and height measurements.
- organize surveying data from different sources in a georeferenced overall project.
- incorporate surveying information into existing projects or derive from them.
- differentiate survey data in terms of their origin and quality.

Upon completion of the module, the students:

- are trained in practical handling of surveying equipment.
- have improved their teamwork skills.

Content:

- Coordinate systems: Reference systems for altitude and position
- Measurements fundamentals: Measurement principles and methods, measurement tolerances Handheld
- Measuring devices: Creation of a simple dimension using a tape measure and meter stick
- Total station: staking out and surveying of buildings
- Laser scanner: Generation and processing of point clouds
- GNSS: Surveying of objects
- Leveling: Transfer and verification of height benchmarks for the establishment of a height reference
- Photogrammetry: Object reconstruction using the example of a facade

Literature:

- GILLINS, Daniel T., Michael L. DENNIS and Allan Y. NG, 2022. *Surveying and geomatics engineering: principles, technologies, and applications*. Reston, Virginia: American Society of Civil Engineers. ISBN 978-0-7844-8400-5, 978-0-7844-8422-7
- JAROSCH, Monika, 2023. *Vermessung im Bauwesen: eine Einführung für Bauingenieure und Architekten* [online]. Wiesbaden: Springer Vieweg PDF e-Book. ISBN 978-3-8348-2118-8. Available via: https://doi.org/10.1007/978-3-8348-2118-8.
- KADEN, Robert, 2023. *Leitfaden Geodäsie und BIM: Version 3.2 (2023)*. Augsburg: Wißner-Verlag. ISBN 978-3-95786-346-1, 3-95786-346-5
- PIMPI, Julian, 2023. *Rapid Prototyping für Anwendungen in der Ingenieurgeodäsie*. Neubiberg: Institut für Geodäsie der Universität der Bundeswehr München.

Additional remarks:

None

Construction Management/Entrepreneurship

Module abbreviation:	SCE_Con_Man_Eship	**Reg.no.:**	12
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	1

Responsible for module:	Reiter, Thomas		
Lecturer:	Liepert, Tobias; Reiter, Thomas		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	4 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 53 h Total: 100 h		
Subjects of the module:	12: Construction Management/Entrepreneurship		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

schrP120 - written exam, 120 minutes

Additional Explanation:

It is possible to voluntarily acquire up to 10 bonus points, which are credited towards the points achieved in the written examination.

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

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
Literature:
Will be specified at the beginning
Additional remarks:
None

Low Carbon Construction

Module abbreviation:	SCE_Low_CC	**Reg.no.:**	13
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	2

Responsible for module:	Haese, Andreas		
Lecturer:	Haese, Andreas (SCE_Low_CC_AR)		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 5 SWS		
Workload:	Contact hours: 59 h Self-study: 66 h Total: 125 h		
Subjects of the module:	13: Low Carbon Construction 13: Low Carbon Construction (admission requirement)		
Lecture types:	Low Carbon Construction: SU/Ü - lecture with integrated exercises Low Carbon Construction (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Low Carbon Construction: schrP120 - written exam, 120 minutes
Low Carbon Construction (admission requirement): Student research project without presentation

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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 independantly 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:

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.

Literature:

- COTTERELL, Janet and Adam DADEBY, 2012. *The passivhaus handbook: a practical guide to constructing and retrofitting buildings for ultra-low energy performance*. Totnes, Devon: Green Books. ISBN 978-0-85784-019-6
- , 2009. *Green building design and construction: LEED reference guide for green building design and construction ; for the design, construction and major renovations of commercial and institutional buildings including core & shell and K-12 school projects*. 2009. edition.
- KUBBA, Sam, 2017. *Handbook of green building design and construction: LEED, BREEAM, and Green Globes*. Amsterdam: Elsevier. ISBN 978-0-12-810433-0
- BAUER, Michael, MÖSLE, Peter, SCHWARZ, Michael, 2013. *Green building: Leitfaden für nachhaltiges Bauen* [online]. Wiesbaden: Springer Vieweg PDF e-Book. ISBN 978-3-642-38297-0. Available via: https://doi.org/10.1007/978-3-642-38297-0.
- ALBERT, Andrej, Klaus-Jürgen SCHNEIDER and Alfons GORIS, 2022. *Bautabellen für Ingenieure: mit Berechnungshinweisen und Beispielen*. 25. edition. Köln: Reguvis. ISBN 978-3-8462-1316-2
- NEUFERT, Ernst and others, 2022. *Bauentwurfslehre: Grundlagen, Normen, Vorschriften über Anlage, Bau, Gestaltung, Raumbedarf, Raumbeziehungen, Maße für Gebäude, Räume, Einrichtungen, Geräte mit dem Menschen als Maß und Ziel : Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernenden*. 43. edition. Wiesbaden: Springer Vieweg. ISBN 978-3-658-34236-4, 3-658-34236-6
- , . *Frick, Knöll, Neumann, Weinbrenner: Baukonstruktionslehre, Teil 1 und 2, Ver-lag B.G. Teubner Vieweg +Teubner, 2018.*.
- WELLER, Bernhard, FAHRION, Marc-Steffen, HORN, Sebastian, NAUMANN, Thomas, NIKOLOWSKI, Johannes Nils, 2016. *Baukonstruktion im Klimawandel* [online]. Wiesbaden: Springer Fachmedien Wiesbaden PDF e-Book. ISBN 978-3-658-13011-4. Available via: https://doi.org/10.1007/978-3-658-13011-4.

Additional remarks:

None

Sustainable Construction Materials

Module abbreviation:	SCE_Sus_Con_Mat	**Reg.no.:**	14
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	2

Responsible for module:	Blask, Oliver		
Lecturer:	Blask, Oliver		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	4 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 53 h Total: 100 h		
Subjects of the module:	14: Sustainable Construction Materials		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

schrP90 - written exam, 90 minutes

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

Succesful completion of the odule Chemistmry & Building Materials

Objectives:

the students learn about conventional and new building materials that are charcterized 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:

- sustainable mineral building materials climate friendly binders, cement substitutes, recycled materials, e.g. AAMs, geopolymers, calcined clays, earthen materials,...
- 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
- pracitical exercises: production of sustainable concrete

Literature:
• BLAß, H. J. and C. SANDHAAS, 2018. *Timber Engineering*. Karlsruhe: KIT Scientific Publishing. ISBN 978-3-7315-0673-7 • GREEN, Michael and Jim TAGGART, 2020. *Tall Wood Buildings*. Basel: Birkhäuser. ISBN 978-3-0356-1885-3 • SCHROEDER, Horst, 2016. *Sustainable Building with Earth*. Heidelberg: Springer. ISBN 978-3-319-19490-5 • MARTIRENA-HERNANDEZ, Jose Fernando, ALUJAS-DÍAZ, Adrian, AMADOR-HERNANDEZ, Meylin, 2020. *Proceedings of the International Conference of Sustainable Production and Use of Cement and Concrete: ICSPCC 2019* [online]. Cham: Springer International Publishing PDF e-Book. ISBN 978-3-030-22034-1. Available via: https://doi.org/10.1007/978-3-030-22034-1. • PROVIS, John L., VAN DEVENTER, Jannie S. J., 2014. *Alkali Activated Materials: State-of-the-Art Report, RILEM TC 224-AAM* [online]. Dordrecht: Springer Netherlands PDF e-Book. ISBN 978-94-007-7672-2. Available via: https://doi.org/10.1007/978-94-007-7672-2.
Additional remarks:
None

Reinforced Concrete Design I

Module abbreviation:	SCE_ReinfConcrDesignI	**Reg.no.:**	15
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	3

Responsible for module:	Feucht, Thilo		
Lecturer:	Feucht, Thilo (SCE_ReinfConcrDesignI)		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	15: Reinforced Concrete Design I 15: Reinforced Concrete Design I (admission requirement)		
Lecture types:	Reinforced Concrete Design I: SU/Ü - lecture with integrated exercises Reinforced Concrete Design I (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Reinforced Concrete Design I: schrP120 - written exam, 120 minutes
Reinforced Concrete Design I (admission requirement): LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

In the "Concrete-Construction" 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 strtural 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
Literature:
Will be specified at the beginning
Additional remarks:
None

Structural Analysis

Module abbreviation:	SCE_StructuralAnalys	**Reg.no.:**	16
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	3

Responsible for module:	Bochert, Jana Sue		
Lecturer:	Al Hanoun, Hisham; Kessler, Jörg (SCE_StructuralAnalys)		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	16: Structural Analysis 16: Structural Analysis (admission requirement)		
Lecture types:	Structural Analysis: SU/Ü - lecture with integrated exercises Structural Analysis (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Structural Analysis: schrP120 - written exam, 120 minutes
Structural Analysis (admission requirement): LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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.

Content:

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
Literature:
Will be specified at the beginning
Additional remarks:
None

Introduction Geotechnics and Transport Technology

Module abbreviation:	SCE_IntroGeoTT	**Reg.no.:**	17
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	3

Responsible for module:	Gastl, Christoph		
Lecturer:	Gastl, Christoph (SCE_IntroGeoTT) Gastl, Christoph; Lerch, Maximilian (SCE_IntroGeoTT_AdRequ)		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 59 h Self-study: 66 h Total: 125 h		
Subjects of the module:	17: Introduction Geotechnics and Transport Technology 17: Introduction Geotechnics and Transport Technology (admission requirement)		
Lecture types:	Introduction Geotechnics and Transport Technology: SU/Ü - lecture with integrated exercises Introduction Geotechnics and Transport Technology (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Introduction Geotechnics and Transport Technology: schrP90 - written exam, 90 minutes
Introduction Geotechnics and Transport Technology (admission requirement): LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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 loadbearing 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:

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:
  - Development and importance of road construction, requirements for the road (objectives, traffic safety, environmental compatibility)
- Road and traffic planning:
  - 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:
  - Traffic loads, road structure, stress on the road, load classes, etc.
- Earthworks and drainage:
  - Soil exploration, soil classification, subsoil requirements, soil improvement measures, road drainage

Literature:

Will be specified at the beginning

Additional remarks:

None

Sanitation/Wastewater/Waste Management

Module abbreviation:	SCE_SWWMgm.	**Reg.no.:**	18
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	3

Responsible for module:	Liepert, Tobias		
Lecturer:	Hagl, Mathilde; Liepert, Tobias; Senner, Sebastian		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	18: Sanitation/Wastewater/Waste Management		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Project report and oral presentation 15 min.

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

- 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:

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 recyclable material treatment, disposal of waste and waste management in the construction industry

Literature:

Will be specified at the beginning

Additional remarks:
None

Fluid Mechancis & Hydro Mechanics

Module abbreviation:	SCE_FluidMechanicsHydro	**Reg.no.:**	19
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	3

Responsible for module:	Liepert, Tobias		
Lecturer:	Grünzner, Markus; Liepert, Tobias		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	19: Fluid Mechancis & Hydro Mechanics		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

schrP90 - written exam, 90 minutes

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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.

Content:

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.

Literature:
Will be specified at the beginning
Additional remarks:
None

Sustainable Design and Management of Buildings an Structures

Module abbreviation:	SCE_SustDesignManagBuildStruc	**Reg.no.:**	20
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	3

Responsible for module:	Reiter, Thomas		
Lecturer:	Reiter, Thomas		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	20: Sustainable Design and Management of Buildings an Structures		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

schrP90 - written exam, 90 minutes

Additional Explanation:

There is the possibility to voluntarily acquire up to 10 bonus points, which are credited to the points achieved in the written examination.

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

- Key sustainability aspects
- Interaction between sustainability aspects and conflicting goals
- Life cycle assessment
- Rating systems
- Certification systems
- Funding landscape and criteria

• EU taxonomy
Literature:
Will be specified at the beginning
Additional remarks:
None

Reinforced Concrete Design II

Module abbreviation:	SCE_ReinforcedConcrDesignII	**Reg.no.:**	21
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	4

Responsible for module:	Liepert, Tobias		
Lecturer:	Liepert, Tobias (SCE_ReinforcedConcrDesignII)		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	21: Reinforced Concrete Design II 21: Reinforced Concrete Design II (admission requirement)		
Lecture types:	Reinforced Concrete Design II: SU/Ü - lecture with integrated exercises Reinforced Concrete Design II (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Reinforced Concrete Design II: schrP90 - written exam, 90 minutes
Reinforced Concrete Design II (admission requirement): LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

- 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
Literature:
Will be specified at the beginning
Additional remarks:
None

Steel Construction

Module abbreviation:	SCE_SteelConstr	**Reg.no.:**	22
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	4

Responsible for module:	Feucht, Thilo		
Lecturer:	Feucht, Thilo (SCE_SteelConstr)		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	22: Steel Construction 22: Steel Construction (admission requirement)		
Lecture types:	Steel Construction: SU/Ü - lecture with integrated exercises Steel Construction (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Steel Construction: schrP120 - written exam, 120 minutes
Steel Construction (admission requirement): LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

At the end of the course, students will be familiar with the properties of steel as a material and will be able to perform load-bearing capacity analyses of beams, bolts and welds in accordance with the Eurocode, taking into account the applicable safety concepts. They will be able to recognise stability cases and calculate the load-bearing capacity of bar-shaped steel components, taking into account simple stability cases. Students know the relevance of the deformation of steel components. They will be able to independently design steel cross-sections by determining the shape, dimensions and material for given systems.

Content:

- Basics and applications of steel construction
- Steel as a material: origin and laws
- Safety concept
- Load-bearing capacity analyses of bending beams, bolts and weld seams

• Basics of stability theory and stability analyses
Literature:
Will be specified at the beginning
Additional remarks:
None

Law

Module abbreviation:	SCE_Law	**Reg.no.:**	23
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	4

Responsible for module:	Heeschen, Matthias		
Lecturer:	Heeschen, Matthias		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 5 SWS		
Workload:	Contact hours:		59 h
	Self-study:		66 h
	Total:		125 h
Subjects of the module:	23: Law		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

schrP90 - written exam, 90 minutes

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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 law: the 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:

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.

Literature:

Will be specified at the beginning

Additional remarks:

None

Geotechnic & Soil Mechanics

Module abbreviation:	SCE_GeotechSoilMech	**Reg.no.:**	24
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	4

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 59 h Self-study: 66 h Total: 125 h		
Subjects of the module:	24: Geotechnic & Soil Mechanics 24: Geotechnic & Soil Mechanics		
Lecture types:	Geotechnic & Soil Mechanics: SU/Ü/PR - seminar based teaching/Exercise course/laboratory Geotechnic & Soil Mechanics: SU/Ü/PR - seminar based teaching/Exercise course/laboratory		
Availability of the module:	None		

Examinations:

Geotechnic & Soil Mechanics: schrP120 - written exam, 120 minutes
Geotechnic & Soil Mechanics: LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

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
Literature:
Will be specified at the beginning
Additional remarks:
None

Sustainable Transport Technology

Module abbreviation:	SCE_SustTranspTechn	**Reg.no.:**	25
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	4

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	25: Sustainable Transport Technology 25: Sustainable Transprot Technology (admission requirement)		
Lecture types:	Sustainable Transport Technology: SU/Ü - lecture with integrated exercises Sustainable Transprot Technology (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Sustainable Transport Technology: schrP90 - written exam, 90 minutes
Sustainable Transprot Technology (admission requirement): LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

Fehler bei HTML-Umwandlung.

Content:

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

Literature:

Will be specified at the beginning

Additional remarks:

None

Timber Construction & Ressource Management

Module abbreviation:	SCE_TimbConstruc&RessManagm	**Reg.no.:**	26
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	4

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	26: Timber Construction & Ressource Management 26: Timber Construction & Ressource Management (admission requirement)		
Lecture types:	Timber Construction & Ressource Management: SU/Ü - lecture with integrated exercises Timber Construction & Ressource Management (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Timber Construction & Ressource Management: schrP90 - written exam, 90 minutes
Timber Construction & Ressource Management (admission requirement): LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

- 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 conceps 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
Literature:
Will be specified at the beginning
Additional remarks:
None

Digital Operation Management in Building Information Modeling			
Module abbreviation:	SCE_DigitOperationManagm_BIM	**Reg.no.:**	27
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	6

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	27: Digital Operation Management in Building Information Modeling		
Lecture types:	SU/Ü/PR - seminar based teaching/Exercise course/laboratory		
Availability of the module:	None		

Examinations:

schrP90 - written exam, 90 minutes

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

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
Literature:
Will be specified at the beginning
Additional remarks:
None

Advanced Construction Methods

Module abbreviation:	SCE_AdvancedConstrMeth	**Reg.no.:**	28
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	6

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	28: Advanced Construction Methods 28: Advanced Construction Methods (admission requirement)		
Lecture types:	Advanced Construction Methods: SU/Ü - lecture with integrated exercises Advanced Construction Methods (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Advanced Construction Methods: schrP120 - written exam, 120 minutes
Advanced Construction Methods (admission requirement): LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

- 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, 3 D printing, half-timbered construction
Literature:
Will be specified at the beginning
Additional remarks:
None

Digital Building Automation and Renewable Energy

Module abbreviation:	SCE_DigBuildAutom_RE	**Reg.no.:**	29
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	6

Responsible for module:			
Lecturer:			
Language of instruction:	German	**Language of exam:**	German
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	29: Digital Building Automation and Renewable Energy		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

schrP90 - written exam, 90 minutes

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

- 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

Literature:
Will be specified at the beginning
Additional remarks:
None

Construction Project and Sustainability Management

Module abbreviation:	SCE_ConstProjSustainManag	**Reg.no.:**	30
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	6

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	30: Construction Project and Sustainability Management		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

schrP90 - written exam, 90 minutes

Additional Explanation:
None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

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
Literature:
Will be specified at the beginning
Additional remarks:
None

Sustainable Buildings and Structures

Module abbreviation:	SCE_SustainBuildStruc	**Reg.no.:**	31
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	7

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	3 ECTS / 3 SWS		
Workload:	Contact hours: 24 h Self-study: 51 h Total: 75 h		
Subjects of the module:	31: Sustainable Buildings and Structures		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

LN - project work

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

Fehler bei HTML-Umwandlung.

Literature:

Will be specified at the beginning

Additional remarks:
None

Sustainable Structural Engineering

Module abbreviation:	SCE_SustainStructEngin	**Reg.no.:**	32
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	7

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	32: Sustainable Structural Engineering 32: Sustainable Structural Engineering (admission requirement)		
Lecture types:	Sustainable Structural Engineering: SU/Ü - lecture with integrated exercises Sustainable Structural Engineering (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Sustainable Structural Engineering: schrP90 - written exam, 90 minutes
Sustainable Structural Engineering (admission requirement): LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

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
Literature:
Will be specified at the beginning
Additional remarks:
None

Life Cycle & Climate Change Adaption Engineering			
Module abbreviation:	SCE_LifeCycleClimateChangeAdapEng	**Reg.no.:**	33
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	7

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	33: Life Cycle & Climate Change Adaption Engineering 33: Life Cycle & Climate Change Adaption Engineering (admission requirement)		
Lecture types:	Life Cycle & Climate Change Adaption Engineering: SU/Ü - lecture with integrated exercises Life Cycle & Climate Change Adaption Engineering (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Life Cycle & Climate Change Adaption Engineering: schrP90 - written exam, 90 minutes
Life Cycle & Climate Change Adaption Engineering (admission requirement): LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:
Interaction of buildings with the environment
Literature:
Will be specified at the beginning
Additional remarks:
None

Civil Engineering Project Management			
Module abbreviation:	SCE_CivilEnginProjManag	**Reg.no.:**	34
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	6

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	5 ECTS / 4 SWS		
Workload:	Contact hours: 47 h Self-study: 78 h Total: 125 h		
Subjects of the module:	34: Civil Engineering Project Management		
Lecture types:	SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

SA - Seminar paper with oral examination (15min) and written elaboration (8-15 pages)

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

The topics are typical, complex, practice-relevant tasks from civil engineering with a connection to sustainability.

Literature:

Will be specified at the beginning

Additional remarks:
None

Bachelor Thesis Seminar

Module abbreviation:	SCE_BachelorThesisSem	**Reg.no.:**	37
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	7

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	2 ECTS / 2 SWS		
Workload:	Contact hours: 24 h Self-study: 26 h Total: 50 h		
Subjects of the module:	37: Bachelor Thesis Seminar		
Lecture types:	S - seminar		
Availability of the module:	None		

Examinations:

LN - participation without/with success

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

The students:

- deepen the methods of scientific work in engineering sciences;
- are enabled to conduct methodical literature research;
- develop a clear structure as a basis for the bachelor thesis in a short period of time;
- conduct technical discussions on the thematic structure;

Dual students have also familiarised themselves with the specific requirements of the partner company.

regarding the preparation of a scientific paper. You have ensured that

that the topic and structure of their work is agreed between their supervisor in the company and the supervising

Professor at the university.

Content:
Introduction / Information event:The academicquality of the Bachelor`s thesis is assessed by the respective academic advisors or treter explains ( Guidelnes for Bachelor`s theses), legal framework for auditing: introduction toresearch and documentation techniques (brief presentation of the services of university library)finding topics: individual choice of topic and supervisor, independant contact with companies and professors training , individual contact with the supervising lecturer and topic suggestion, familiarization and written formulation of the topic, create and coordinate a schedule for the bachelor thesis, structure of the bachelor thesis, prepare registration for the bachelor thesis.
Literature:
Will be specified at the beginning
Additional remarks:
None

Bachelor Thesis

Module abbreviation:	SCE_BachelorThesis	**Reg.no.:**	36
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	7

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	12 ECTS / 0 SWS		
Workload:	Contact hours:		0 h
	Self-study:		300 h
	Total:		300 h
Subjects of the module:	36: Bachelor Thesis		
Lecture types:	BA - Bachelor Thesis		
Availability of the module:	None		

Examinations:

Bachelor-Thesis

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

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
- independant 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

Literature:
Will be specified at the beginning
Additional remarks:
None

Construction Internship (18 Weeks)

Module abbreviation:	SCE_ConstructionInternsh	**Reg.no.:**	38
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	5

Responsible for module:			
Lecturer:			
Language of instruction:	German	**Language of exam:**	German
Credit points / SWS:	27 ECTS / 0 SWS		
Workload:	Contact hours: 0 h Self-study: 675 h Total: 675 h		
Subjects of the module:	38: Construction Internship (18 Weeks)		
Lecture types:	Pr - laboratory		
Availability of the module:	None		

Examinations:

Internship report

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

- 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

Literature:

Will be specified at the beginning

Additional remarks:

None

Scientific Methods

Module abbreviation:	SCE_ScientificMethods	**Reg.no.:**	39
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	5

Responsible for module:			
Lecturer:			
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	3 ECTS / 2 SWS		
Workload:	Contact hours: 24 h Self-study: 51 h Total: 75 h		
Subjects of the module:	39: Scientific Methods		
Lecture types:	S - seminar		
Availability of the module:	None		

Examinations:

LN - project work

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

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:

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
Literature:
Will be specified at the beginning
Additional remarks:
None

Mechanics I (admission requirement)

Module abbreviation:	SCE_Mech_AR	**Reg.no.:**	3
Curriculum:	**Programme**	**Module type**	**Semester**
	Sustainable Civil Engineering (SPO WS 23/24)	Compulsory Subject	1

Responsible for module:	Bochert, Jana Sue		
Lecturer:	Al Hanoun, Hisham		
Language of instruction:	English	**Language of exam:**	English
Credit points / SWS:	0 ECTS / 0 SWS		
Workload:	Contact hours: 59 h Self-study: 66 h Total: 125 h		
Subjects of the module:	3: Mechanics I (admission requirement)		
Lecture types:	Mechanics I (admission requirement): SU/Ü - lecture with integrated exercises		
Availability of the module:	None		

Examinations:

Mechanics I (admission requirement): Student research project without presentation

Additional Explanation:

None

Prerequisites according examination regulation:

None

Recommended prerequisites:

None

Objectives:

To be determined

Content:

To be determined

Literature:

Will be specified at the beginning

Additional remarks:

None