Hochschule Bremen
City University of Applied Sciences
Faculty 2: Architecture, Civil and Environmental Engineering

HSB

Civil Engineering - Sustainable Planning and Building M.Sc.

Bremen 31.01.2024

Table of Contents

1 Modules and Examinations

Extract from the subject-specific part of the master's examination regulations in civil engineering.

1th Semester

No.	Exam. no.	Abbr.	Title of Module	SWS	CP	EXA
1.1	**1110**	PRO1	**Project 1**		**6**	PR
1.1.1			Practice Project	3		
1.1.2			Laboratory	1		
1.2	**1120**	CAEB	**Construction Analysis in existing Buildings**		**6**	TP
1.2.1			Structural inventory and construction diagnostics	2		
1.2.2			Digital construction diagnostic, „digital twin“	2		
1.3	**1130**	DEDR	**Demolition and Disposal, Recycling**		**6**	PR + OE
1.2.1			Demolition technology	2		
1.2.2			Material separation and waste legislation	2		
1.4	**1140**	SDEB	**Structural Design in existing Buildings**		**6**	PF
1.4.1			Reinforced concrete and prestressed concrete construction in existing	2		
1.4.2			Steel construction in existing buildings	2		
1.5	**115x**	CEM1	**Compulsory elective module 1**	**4**	**6**	
				20	**30**	

Compulsory elective modules

No.	Exam.no.	Abbr.	Title of Module	SWS	ECTS	EXA)
1.6	**1151**	MOBB	**Mobility Buildings**		**6**	PR + PRS
1.6.1			Multimodality, accessibility, urban integration	4		
1.7	**1152**	EMSI	**Experiment, Model, Simulation**		**6**	TP
1.7.1			Experimental statics	2		
1.7.2			FEM-Laboratory practical	2		

2nd Semester

No.	Exam. no.	Abbr.	Title of Module	SWS	CP	EXA
2.1	**1210**	PRO2S	**Project 2**		**6**	PR
2.1.1			Project	3		
2.1.2			Laboratory	1		
2.2	**1220**	BIML	**BIM Management and Leadership**		**6**	PF
2.2.1			BIM Management	2		
2.2.2			BIM Laboratory	2		
2.3	**1230**	LCAN	**Life Cycle Analysis**		**6**	PF
2.2.1			Sustainability in the building industry	2		
2.2.2			Life cycle-oriented construction planning	2		
2.4	**1240**	**HEGE**	**Hydraulic Engineering and Geotechnics**		**6**	PF+ OE
2.4.1			Hydraulic Engineering	2		
2.4.2			Geotechnical Engineering	2		
2.5	**125x**	**WPF2**	**Compulsory selective module 2**	**4**	**6**	
				20	**30**	

Compulsory elective module 2

No.	Exam. no.	Abbr.	Title of Module	SWS	CP	EXA
2.6	**1251**	SINF	**Sustainable Planning and Building - Infrastructure**		**6**	PF
2.6.1			Sustainable Mobility	2		
2.6.2			Sustainable Water Cycles	2		
2.7	**1252**	SCON	**Sustainable Planning and Building - Structural Engineering**		**6**	PF
2.7.1			Massive Construction	2		
2.7.2			Steel Construction	2		

3rd Semester

No.	Exam. no.	Abbr.	Title of Module	SWS	CP		EXA
3.1	**1310**	THES	**Thesis and Thesis Seminar**	22		**30**	THES + COL
3.1.2			Thesis Seminar		4		
					4	**30**	

[1)] Rang of hours in one semester hours per week (SWS)
[2)] Credit points (CP) according to ECTS (European Credit Transfer System)
[3)] Examination for Module
[4)] Types of examination services, see AT-MPO and FT-MPO

All modules are also offered in English if required.

The Master's degree course in Civil Engineering comprises 3 semesters with a total of 90 ECTS credits. These are divided into eight compulsory modules (48 ECTS), two compulsory elective modules (12 ECTS) and a Master's thesis. (30 ECTS)

Compulsory elective modules
Two compulsory elective modules can be selected from the four compulsory elective modules offered in the Master's degree program in Civil Engineering from HSB. The compulsory elective modules are only offered if there is a sufficient number of participants.

Alternatively, after consultation with and approval by the Examination Board, modules can also be chosen from the Master's degree programs in Civil Engineering offered by the cooperation partners from the STARS-EU Alliance, e.g. from the Polytechnical Institute of Bragança (Portugal), University of technology Krakow (Poland). The current courses offered by the partner universities are presented at the beginning of the semester.

2 Module descriptions

A module is a self-contained teaching block that enables the acquisition of defined competencies and with which a certain number of credit points (CP) are acquired.

A module can comprise one or more courses and one or more examinations. The course content, knowledge, skills and competences to be acquired are summarized in the module description together with information on the workload, performance records, any module prerequisites, the form of the course and the lecturers in the module.

The module coordinator is responsible for organizing the course and registering the examination results.

M1.1 Project 1 (PRO1)

Module leader:	Prof. Dr.-Ing. Anton Worobei		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory Modul in 1th Semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in winter term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:			

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- *describe the basic scientific approach to construction engineering issues, including problem definition, formulation of scientific hypotheses and application of qualitative and quantitative research methods*
- explain the context of feasibility studies in the construction industry

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- evaluate and specify the relevance of a construction engineering task on the basis of economic, ecological and social criteria.
- work out the underlying problem and condense it into research-guiding hypotheses and questions within the framework of a feasibility study
- select scientific methods on the basis of the defined research questions and use them to answer the research questions posed.
- document, critically reflect on and present the research process and the knowledge gained within the framework of a feasibility study in a manner appropriate to the target group

Communication and cooperation

- *understand the project environment and organize, plan and manage projects accordingly.*
- *identify group dynamic processes, deal constructively and methodically with interpersonal and personal conflicts.*

Reflection of academic and professional identity

- *handle subject-specific laboratory equipment safely*
- *use digital tools to collect, store and analyse research data.*
- *argue objectively and well-founded and represent their point of view in scientific discourse*

Course content:

- *intra- or interdisciplinary subject matter related to the specific current project (to strengthen professional competence in the respective discipline) and methods (to strengthen methodological competence in the respective discipline).*
- *Selected project management methods*

Language of teaching:	*German, English*
Prerequisites:	*None*
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Planning and building in existing buildings	Entire teaching staff	4	Project	Project Report

M1.2 Construction Analysis in existing Buildings (CAEB)

Module leader:	Prof. Dr.-Ing. Marc Gutermann		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module t in the 1th semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in winter term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:			

Learning outcomes:

Knowledge and understanding (broadening knowledge, deepening knowledge, understanding knowledge)

- knowing the legal and technical principles of as-built analysis and being able to name the difference to new construction planning
- knowing the basics of dismantling, recycling and dealing with building pollutants
- knowing sources for researching missing information (literature and diagnostic methods)
- knowing the basics of evaluating and assessing measurement data
- naming digital tools for recording object geometries and explaining how they work

Use, application and generation of knowledge (utilization and transfer, scientific innovation)

- being able to assign analysis methods to the respective fields of application and name method limits
- being able to assign analytical data to epochs and construction methods
- being able to evaluate analysis data and prepare it for computational evaluations using photogrammetry and 3D laser technology to record building geometry,
- creating a digital building information model from the as-built data.
- evaluating empirical data statistically and derive probabilistic statements

Communication and Cooperation

- Being able to plan and carry out as-built surveys in a team

Scientific self-image or professionalism

- understanding tasks, defining work packages and working on them independently
- reflect on own activities and results

Course content:

The module *serves to teach inventory analysis for the practical application, networking and consolidation of basic theoretical knowledge. The following aspects are covered in detail:*

- Fundamentals of building analysis and as-built surveys
- Dealing with hist. Materials, construction methods, inventory documents and sources
- Basics of structural building surveys incl. measuring and testing technology
- Planning processes for building in existing structures
- Stochastic methods for data evaluation
- Basics of risk analysis
- Digital methods for as-built surveys for digital building modelling- “digital twin”

Language of teaching:	*English, German*
Prerequisites:	
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Structural survey and building diagnosis	Prof. Dr.-Ing. Marc Gutermann	1	Seminar	Term Papers
Structural survey and building diagnosis	Prof. Dr.-Ing. Marc Gutermann / Jule Patze	1	Laboratory	
Methods and procedures for as-built surveys and building diagnosis, BIM	Prof. Dr.-Ing. Thomas Rauscher	2	Laboratory	

M1.3 Demolition and Disposal, Recycling (DDRE)

Module leader:	Prof. Dr.-Ing. Marc Gutermann		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module in the 1th semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in winter term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:	…		

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- Name the legal and technical principles of waste and construction law (VOB-C)
- Describe the basics of dismantling, recycling and handling building pollutants
- Explain building demolition procedures
- Name the options and requirements for processing and recycling construction waste
- Explain the tasks of the hazard and safety coordinator (GeSiKo)

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- Recognize and name building pollutants
- analyze construction methods and implement consequences for demolition
- elect building demolition methods, including machine technology, site safety and protective measures
- elect suitable measures and processes for processing and recycling construction waste

Communication and cooperation

- Communicate dismantling, disposal and recycling measures
- Plan projects as a team

Reflection of academic and professional identity

- Understand tasks, define work packages and work on them independently
- Reflect on own activities and results

Course content:

- Building pollutants
- Demolition techniques incl. machine technology and protective measures (noise, dust, pollutants)
- Stability during demolition, incl. special construction methods (e.g. prestressed concrete)
- Material separation and waste legislation (selective demolition, mixing ban, waste recycling)
- Construction waste processing and recycling

Language of teaching:	*English, German*
Prerequisites:	Bachelor of Civil Engineering modules or comparable knowledge and skills
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Demolition technology	*Dr. rer. nat. K. Konertz*	2	Seminar	Project Report + Oral Exam
Material separation and waste legislation	*Dr. rer. nat. K. Konertz*	2	Seminar	

M1.4 Structural Design in existing Buildings (SDEB)

Module leader:	Prof. Dr.-Ing, Stephan Lochte-Holtgreven		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module in the 1th semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in winter term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:			

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- name historical design methods for existing structures and transfer them to today's methods

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- deal with old regulations and construction methods
- analyse the influence of design methods and evaluate the load-bearing behaviour using state-of-the-art methods
- make statements on how structures need to be redesigned for new (re)uses and what remaining useful lives can be expected
- correctly apply well-founded numerical methods from the practice of structural design to existing structures
- evaluate the influence of historical construction methods or materials on the structural behaviour

Communication and cooperation

- solve conflicts independently and strengthen teamwork skills by working in groups
- act responsibly by developing risks and risk analyses for existing buildings

Reflection of academic and professional identity

- cost- and process-optimized evaluation with regard to structural design and to make statements on the further use or conversion of existing buildings for building owners.

Course content:

- Historical calculation methods and safety concepts; recalculation guidelines
- Influence of historical materials on structural design
- Use of modern construction products and standards in existing buildings, in particular for the reinforcement of supporting structures
- Preparation of verifiable static and dynamic calculations in the field of structural and civil eng.
- Load-bearing capacity analyses of existing components using non-linear calculation methods…

Language of teaching:	
Prerequisites:	*None*
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	*Learning materials are provided on Aulis*

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Rein. and prestressed concrete construction	Prof. Rolf Sommer	2	Seminar	Portfolio
Steel construction	Prof. Stephan Lochte-Holtgreven,	2	Seminar	

M1.6 Mobility Buildings (MOBB)

Module leader:	Prof. Dr.-Ing. Sven Uhrhan		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module in the 1th semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in winter term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:	possibility to integrate in master degree architecture		

Learning outcomes:

Knowledge and comprehension (broadening of knowledge, deepening of knowledge, understanding of knowledge)

- collecting, analysing and understanding the mobility needs of urban societies,
- carry out empirical surveys to record mobility needs,
- interpretation of the results of the empirical survey,
- analysis of the essential characteristics of mobility buildings with a special focus on CO2 balances
- investigation of essential components of mobility buildings for the assessment of further periods of use.

Communication and cooperation

- acquisition of technical vocabulary,
- development of tasks alone and in – possibly interdisciplinary – groups
- Presentation of own work results

Course content:

- Multimodality: seamless transition between different modes of transport, such as buses, trains, bicycles and pedestrians.
- Integration: Buildings integrate different modes and services to offer an efficient and well-connected mobility solution.
- Accessibility: special attention is paid to barrier-free access and services to facilitate use for people with reduced mobility.
- Sustainability: the preservation of buildings contributes to the CO2 balance (grey energy)
- Urban integration: the conception and design of buildings so that they fit into the urban environment and contribute to urban development.
- Modularity/flexibility: They can be adapted to different urban planning conditions to meet the specific requirements of a location.
- Excursions to exemplary mobility buildings or existing buildings that can be converted

Language of teaching:	German, English
Prerequisites:	*None*
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Mobility buildings	Prof. Seven Uhrhan	4		Term Paper + Presentation

M1.7 Experiment, Model und Simulation (EMSI)

Module leader:	Prof. Dr.-Ing. Marc Gutermann		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module in the 1th semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in winter term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:			

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- Explain physical and mathematical modeling steps
- Name simulation tools and methods for structural analysis
- Name the basics of experimental investigations (e.g. measurement technology)

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- Perform mathematical physical modeling of structures in civil engineering
- Select and apply suitable numerical methods and solution procedures
- Test and verify the models
- Carry out parameter studies

Communication and cooperation

- Plan, conduct and document experimental studies in a team

Reflection of academic and professional identity

- Develop test strategies, derive analytical solutions for submodels
- Evaluate and reflect on experimental results

Course content:

Mathematical forecasts, process and procedure visualizations as well as parameter studies and data interpretation are carried out on selected models from the construction industry are carried out. The following aspects from the following subject areas are dealt with in detail:

- Modeling of structural systems under static and dynamic loads in civil engineering
- Numerical methods for solving ordinary and partial differential equations
- Analytical methods for solving simple ordinary differential equations
- Model simulations with MATLAB and commercial FE programs
- Measurement-based structural analysis

Language of teaching:	German, English
Prerequisites:	Bachelor of Civil Engineering modules or comparable knowledge and skills
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Experimental Statics	Prof. Dr.-Ing. Marc Gutermann / Jule Patze	2	Seminar and Laboratory	Term Projects
Modeling and Simulation	Prof. Dr.-Ing. Thomas Rauscher	2	Seminar and Laboratory	

M2.1 Project 2 (PRO2)

Module leader:	Prof. Dr. techn. Felipe Riola Parada		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module in the 2nd semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in summer term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:			

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- describe the basic scientific approach to construction engineering issues, including problem definition, formulation of scientific hypotheses and application of qualitative and quantitative research methods
- explain the context of feasibility studies in the construction industry

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- evaluate and specify the relevance of a construction engineering task on the basis of economic, ecological and social criteria.
- work out the underlying problem and condense it into research-guiding hypotheses and questions within the framework of a feasibility study
- select scientific methods on the basis of the defined research questions and use them to answer the research questions posed.
- document, critically reflect on and present the research process and the knowledge gained within the framework of a feasibility study in a manner appropriate to the target group

Communication and cooperation

- understand the project environment and organize, plan and manage projects accordingly.
- identify group dynamic processes, deal constructively and methodically with interpersonal and personal conflicts.

Reflection of academic and professional identity

- handle subject-specific laboratory equipment safely
- use digital tools to collect, store and analyse research data.
- argue objectively and well-founded and represent their point of view in scientific discourse

Course content:

- intra- or interdisciplinary subject matter related to the specific current project (to strengthen professional competence in the respective discipline) and methods (to strengthen methodological competence in the respective discipline).
- Selected project management methods

Language of teaching:	
Prerequisites:	*None*
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Planning and building	Entire teaching staff	4	Project	Project Report

M2.2 BIM Management and Leadership (BIML)

Module leader:	Prof. Dr.-Ing. Anton Worobei		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module in the 2. semester	**Contact hours (h):**	560h
Scope und frequency of teaching:	14 classes in summer term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:			

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- Name various leadership styles and essential leadership competencies.
- Explain key contents and concepts of BIM (Building Information Modelling).
- Define the leadership role of BIM management, place it in the context of overall project execution.

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- designing, planning, and managing a BIM project from the leadership role of BIM management.
- apply methods and IT tools in the BIM management process.
- analyse a leadership situation in the context of BIM and appropriately select, combine, and apply different leadership styles according to the situation.
- communicate in a goal-oriented manner, think and act with a focus on results, and adopt an entrepreneurial approach.

Communication and cooperation

- positively influence cooperative teamwork in BIM projects through personal leadership qualities, expertise, and project management competencies.

Reflection of academic and professional identity

- capable of engaging in well-informed discussions with professionals about the requirements, objectives, and implementation strategies of BIM.
- able to take on leadership roles within a BIM process and demonstrate entrepreneurial initiative.

Course content:

- Role, concepts, processes, and tools of BIM (Building Information Modelling) management including, among others, Employer Information Requirements (EIR) and Use Cases (UC).
- Principles and methods of classical, agile, and hybrid project management in the context of BIM.
- Leadership styles and leadership competencies.
- BIM standards and guidelines.

Language of teaching:	*German, English*
Prerequisites:	*None*
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	*Further information and learning materials can be found on Aulis.*

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
BIM Management and Leadership	Prof. Anton Worobei	3	Seminar	Portfolio
BIM Laboratory	Prof. Anton Worobei	1	Laboratory	

M2.3 Life Cycle Analysis (LCAN)

Module leader:	Prof. Dr.techn. Felipe Riola Parada		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module in the 2nd semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in summer term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:	Architecture (MA),		

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- Know the concepts and principles of sustainability in the construction industry
- Assign and evaluate the environmental impact and protection goals of planning and construction activities

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- Recognize the level of sustainability in the construction industry and be able to apply it as a framework for action
- Know and be able to carry out life cycle-oriented construction planning
- Know and apply certification systems at product and building level
- be able to examine sustainability concepts for building with existing buildings and strategies for decarbonization in the construction industry

Communication and cooperation

- Independently research missing knowledge
- Be able to independently formulate, develop and discuss open questions in the field of sustainability in the construction industry

Reflection of academic and professional identity

- be able to apply, develop and document sustainability concepts in the construction

Course content:

- Fundamentals and concepts of sustainability in the building industry
- Environmental impacts, protection goals and level of sustainability in the construction industry
- Concepts and tools (LCC/LCA) for life cycle-oriented construction planning
- Certification systems at product and building level
- Sustainability concepts for building with existing buildings and strategies for decarbonization in the construction industry

Language of teaching:	
Prerequisites:	*None*
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Sustainability in the building industry	Prof. Riola Parada	2	Seminar	Portfolio
Life cycle-oriented construction planning	Prof. Riola Parada	2	Seminar	

M2.4 Hydraulic Engineering and Geotechnics (HEGE)

Module leader:	Prof. Dr.-Ing. Heiko Spekker		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module in the 2nd semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in summer term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:			

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- Students are able to apply the knowledge they have acquired from basic subjects and the Bachelor's degree program in a practice-oriented manner
- Estimate relevant planning boundary conditions / load variables from water level, swell, currents
- Estimate relevant planning boundary conditions / load variables from groundwater, soil, individual and traffic loads
- Understand and apply basic design methods
- Select the methods of scientific work in the context of a design

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- Select suitable methods for the scientific and technical documentation of the design
- Work on planning engineering tasks in hydraulic engineering and geotechnics using analytical design approaches
- assess planning and approval-relevant boundary conditions in hydraulic engineering and geotechnics
- Students are able to apply their existing knowledge in the course of the practical laboratory course
- describe and scientifically document design results in the required level of detail

Communication and cooperation

- Improving communication skills
- Presenting project results to an audience

Reflection of academic and professional identity

- Carry out, control and monitor practically relevant tasks and projects independently and in a goal-oriented manner
- Apply guidelines and standards of hydraulic engineering and geotechnics

Course content:

In the module, the theoretical principles of the following topics are developed, explained using practical construction examples and deepened using calculation examples.

- Design and calculation of hydraulic engineering structures such as
- Dikes, flood protection systems,
- dams,
- groynes and breakwaters,
- locks and weir structures as well as
- harbour and quay facilities.

with special requirements for subsoil and stability, taking into account

- Support systems with columns and geogrid reinforcement,
- Subsoil-structure interaction (bedding models),
- Material laws of soil mechanics, shear laws,
- subsoil hydraulics,
- Flow forces in the soil,
- Earth pressure and earth resistance in flowing groundwater

Language of teaching:	*German, English*

Prerequisites:	*None*
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	

Courses of the module				
Course title	**Teaching staff**	**Contact hours per week**	**Learning and teaching methods**	**Examination method(s), scope and duration**
Hydraulic Engineering	Prof. Heiko Spekker	2,0	Seminar	Project Report + Oral Exam
Geotechnical Engineering	Prof. Christian Scholz	2,0	Seminar	

M2.6 Sustainable Planning and Building -Infrastructure (SPBI)

Module leader:	Prof. Dr.-Ing. Jana von Horn, Prof. Dr.-Ing. Sven Uhrhan		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module in the 2nd semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in summer term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:			

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- Know, understand, evaluate and design sustainable mobility concepts
- Know, understand, evaluate and design sustainable water cycles
- Know, evaluate and assess usage requirements and conflicts and develop and evaluate possible solutions

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- Students are able to plan urban districts with a focus on sustainable mobility and sustainable water cycles, evaluate variants, draw up specifications and estimate costs for construction measures

Communication and cooperation

- Information acquisition skills, planning management, teamwork skills, self-management, professional flexibility, creativity
- Process-oriented thinking and action; understanding of interrelationships with regard to infrastructure planning; acquisition of the associated methodological skills

Reflection of academic and professional identity

- Simulation of professional practice in the field of infrastructure planning

Course content:

- Sustainable mobility concepts
- Water cycles
- Water reuse, fit for purpose water concepts
- Dependencies in infrastructure planning (urban districts, water & mobility)

Language of teaching:	German, English
Prerequisites:	Dimensioning of sewer system, infiltrate Basics in Mobility Concepts and sustainable mobility, transport systems, knowledges in public transport and road construction
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Sustainable Mobility	Sven Uhrhan	2	Seminar	Portfolio
Sustainable Water Cycles	Jana von Horn	2	Seminar	

M2.7 Sustainable Planning and Building – Engineering Constrution (SPBC)

Module leader:	Prof. Stephan Lochte-Holtgreven		
ECTS points:	6 ECTS	**Workload (h):**	180h
Type of module and position in the course of study:	Mandatory module in the 2. semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	14 classes in summer term	**Self-study (h):**	124h
Type of module and position in other study programs or continuing education offers:			

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- understand and apply realistic engineering models for large structures (bridges, large containers, wind turbines, high-voltage pylons).
- understand the usage and load-bearing behaviour of special structures of the future by applying calculation, design and verification.
- to carry out special verifications for sustainable and future-proof structures (e.g. steel sheets at risk of buckling; shells at risk of stability; dynamically stressed antennas and masts; fatigue problems; composite components)
- carry out and evaluate sustainability and life cycle analyses of sustainable designs

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- Students are able to create verifiable static calculations including construction sketches
- Students can independently familiarize themselves with in-depth numerical methods, apply the methods and check them using manual, higher-level mathematical comparison calculations

Communication and cooperation

- Competencies for information gathering, planning management, teamwork, self-management, professional flexibility, creativity
- Process-oriented thinking and acting; Understanding relationships regarding structural analysis; Acquisition of the associated methodological skills

Reflection of academic and professional identity

- Simulation of professional practice in the field of structural planning

Course content:

- Numerical methods in reinforced concrete, prestressed concrete and steel construction
- Fatigue tests according to Eurocode 2, Eurocode 3
- Use of fracture mechanics
- Dynamic calculation of structures

Language of teaching:	English, German
Prerequisites:	*None*
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Concrete Structures	Prof. Sommer, Rolf	2	Seminar	Portfolio
Steel Structures	Prof. Lochte-Holtgreven Stephan	2	Seminar	

M3.1 Thesis und Thesis Seminar (THES)

Module leader:	Prof. Dr.-Ing. Anton Worobei		
ECTS points:	30 ECTS	**Workload (h):**	900h
Type of module and position in the course of study:	Mandatory module in the 3rd semester	**Contact hours (h):**	56h
Scope und frequency of teaching:	in summer term	**Self-study (h):**	844h
Type of module and position in other study programs or continuing education offers:			

Learning outcomes:

Knowledge and understanding (extension, consolidation and understanding of knowledge)

- Name scientific methods for dealing with the problem

Using, applying and generating knowledge (applying and transferring knowledge, Scientific innovation)

- work independently and systematically on relevant topics in civil engineering and summarize them in a well-founded manner while adhering to scientific principles and diligence,
- evaluate scientific problems methodically and carefully,
- achieve and evaluate solutions to these problems,
- independently conduct and select research on scientific literature using digital media

Reflection of academic and professional identity

- plan and produce the investigation, solution and presentation of problems using time management methods,
- write a thesis as a scientific paper, present it in a factual and well-founded manner, represent their point of view in scientific discourse

Course content:

- Relevant current problems from the field of civil engineering (topic assignment)
- Design of the scientific work "Master's thesis"
- Literature acquisition and evaluation
- Time management
- Presentation and discussion of work results

In the middle of the semester, each Master's student gives a presentation on their topic and presents their approaches, concepts and proposed solutions in a discussion with the other students and university lecturers.

Language of teaching:	*English, German*
Prerequisites:	*Required credit point according to Master's examination regulations*
Preparation/literature:	*Students will receive a reading list at the beginning of the semester.*
Further information:	*Information material is provided on Aulis*

Courses of the module

Course title	Teaching staff	Contact hours per week	Learning and teaching methods	Examination method(s), scope and duration
Master Thesis	Entire teaching staff	4	Seminar	Thesis + Colloquium