HAWK Fakultät Bauen und Erhalten Hildesheim

Module Handbook

# Master's Degree in Civil Engineering

Valid since winter semester 2019/20

Hochschule für angewandte Wissenschaft und Kunst Hildesheim/Holzminden/Göttingen
University of Applied Sciences and Arts

www.hawk.de/b

The module handbook lists the modules of the 3-semester Master's program in Civil Engineering at HAWK in Hildesheim. The program is designed as a consecutive Master's program after a 7-semester Bachelor's program in civil engineering, which is evaluated with 210 credit points. Graduates of the wood engineering program (with a specialization in structural timber engineering) are also eligible for this Master's program. As a result, an additional 90 credit points must be earned in the Master's program.

The modules are all advanced modules (elective modules), which are to be carefully combined by the students on their own responsibility. Profiling by choosing a specialization is possible, but not mandatory. The areas of specialization/majors are:

- Structural civil engineering and
- Water and traffic engineering

In order for a specialization to be designated in the final documents, at least 6 associated modules (corresponding to 36 CP) from the catalog according to the examination regulations (BT) as well as the final thesis (30 CP) must be assigned to this specialization. An additional 24 CP must be completed from the other modules offered (including those from the non-selected specialization). The corresponding assignment information can be found in the module descriptions; module descriptions are also included that are not assigned to any specialization and are therefore suitable as supplements for both profiles. It is also possible to not to choose any specific major; then the specialization modules from the offer of the Master's program for Civil Engineering can be combined as desired. If a major is chosen, the combination may be as follows:

| 8th semester | 9th semester | 10th semester |
|---|---|---|
| Module 1 (chosen major) | Module 4 (chosen major) | Master's thesis (from the chosen major) |
| Module 2 (chosen major) | Module 5 (chosen major) | |
| Module 3 (chosen major) | Module 6 (chosen major) | |
| Freely selected module | Freely selected module | |
| Freely selected module | Freely selected module | |

Module descriptions may be revised as required and as decided by the relevant study commission, taking full account of accreditation conditions; in particular, the range of non-compulsory specialization modules (majors) may vary depending on the actual teaching capacity available.

The modules are offered either in the winter or summer semester; this does not apply to the module "Master's thesis", which can be chosen in any semester. Details can be found in the respective module description. Since it is possible to begin studies in both the summer and winter semesters, this must be taken into account in good time when planning your own individual studies. It cannot be guaranteed that all the specialization modules listed will take place in the specified semester in each case; this applies in particular to modules in which the use of teaching assistants is planned.

A basic offer with the required minimum number of specialization modules (there are 3) for the major selected is only ensured in the winter semester; students are not entitled to have any specific specialization modules take place. Specialization modules with fewer than 5 participants cannot be held. These constraints, necessary for the maintenance of an orderly lecture schedule, must be taken into account by the students in the individual planning of their course of study.

The following applies to the counting method: subject modules are assigned to the 8th (summer) and 9th (winter) semesters of the regular study program, and the final thesis is written in the 10th semester.

It is strongly recommended that students choose the modules as well as the final thesis with great care and that they combine their courses in the best possible way. Students are strongly advised to seek academic advising. Academic advising is also recommended with regard to later professional practice and a possible further qualification.

The Master's degree awarded upon completion of the program is the second professional qualifying degree at Level 2 of the Qualifications Framework for German Higher Education Qualifications. The degree earned with a good overall mark qualifies the student to enter studies at Level 3 (doctoral programs). The Master's degree with a preceding Bachelor's degree in civil engineering with a total of 10 standard semesters is an essential prerequisite to be able to enter the preparatory service for the career of the higher technical administrative service of the civil engineering disciplines designated there (e.g. railroad engineering, road engineering, water engineering, environmental engineering) in accordance with the relevant legal regulations of the federal states. The regulations of the Higher Technical Administrative Service Examination Office must be observed.

## Module overview:

| Module no. | Module name | Credit points | WS/SS | Work load | Course attendance time | Home study | Type of examination |
|---|---|---|---|---|---|---|---|
| Majors modules in general | | | | | | | |
| MBV 61 | Building climatology (currently not offered) | 6 | SS | 180 | 60 | 120 | PA |
| MBV 62 | Building energy design (currently not offered) | 6 | SS | 180 | 60 | 120 | PA |
| MBV 63 | Building services energy design (currently not offered) | 6 | SS | 180 | 60 | 120 | PA |
| MBV 65 | Measurement technology in building physics (currently not offered) | 6 | WS | 180 | 60 | 120 | PA |
| MBV 77 | Concrete technology I | 6 | WS | 180 | 90 | 90 | K2 + PA |
| MBV 78 | Concrete technology II | 6 | SS | 180 | 90 | 90 | K2 + R |
| MBV 89 | Tunnel, shaft and gallery construction | 6 | SS | 180 | 60 | 120 | ST |
| MBV 90 | Digital planning and building | 6 | SS | 180 | 60 | 120 | PA |
| MBV 91 | Land surveying | 6 | WS | 180 | 60 | 120 | ST |
| MBV 92 | Construction Management, AVA | 6 | SS | 180 | 60 | 120 | K2 |
| MBV 93 | Research in civil engineering | 6 | WS | 180 | 60 | 120 | ST |
| MBV 94 | Geotechnics 3, Process engineering | 6 | SS | 180 | 60 | 120 | ST |
| MBV 96 | R&D in civil and wood engineering | 6 | SS | 180 | 60 | 120 | ST |
| MBV 97 | Management techniques | 6 | WS | 180 | 60 | 120 | R |
| MBV 98 | Special project | 6 | WS + SS | 180 | 60 | 120 | PA |
| MBV 99 | Master's thesis | 30 | WS + SS | 750 | 8 | 742 | AA |
| Major: *Structural engineering* | | | | | | | |
| MBV 01 | Project Solid construction | 6 | WS | 180 | 60 | 120 | PA |
| MBV 02 | Steel engineering | 6 | WS | 180 | 60 | 120 | ST |
| MBV 03 | Special fields of solid construction | 6 | WS | 180 | 60 | 120 | K2 |
| MBV 04 | Prestressed concrete bridge construction | 6 | SS | 180 | 60 | 120 | ST |
| MBV 07 | Surface support structures | 6 | WS | 180 | 60 | 120 | ST |
| MBV 08 | Prestressed concrete construction 2 | 6 | SS | 180 | 60 | 120 | K2 |
| MBV 10 | Technical mechanics, Static 4, Structural engineering 4 | 6 | SS | 180 | 60 | 120 | K2 |
| MBV 13 | Composite construction | 6 | SS | 180 | 60 | 120 | K2 |
| Major: *Water and traffic engineering** | | | | | | | |
| MBV 31 | Project for major in Water engineering | 6 | WS | 180 | 60 | 120 | PA |
| MBV 32 | Process engineering in urban water management | 6 | SS | 180 | 60 | 120 | ST |
| MBV 33 | Multifunctional hydraulic engineering facilities | 6 | SS | 180 | 60 | 120 | R |
| MBV 34 | Sustainable water resources management | 6 | WS | 180 | 60 | 120 | M |
| MBV 35 | Water quality management | 6 | SS | 180 | 60 | 120 | ST |
| MBV 36 | Plant engineering in urban water management | 6 | WS | 180 | 60 | 120 | M |
| MBV 37 | Mobility management (currently not offered) | 6 | SS | 180 | 60 | 120 | ST |
| MBV 38 | Mobility impact (currently not offered) | 6 | WS | 180 | 60 | 120 | ST |
| MBV 39 | Local public transportation (currently not offered) | 6 | WS | 180 | 60 | 120 | K2 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MBV 40 | Road traffic engineering | 6 | SS | 180 | 60 | 120 | ST |
| MBV 41 | Urban streetscape planning | 6 | WS | 180 | 60 | 120 | ST |
| MBV 42 | Municipal traffic concepts | 6 | SS | 180 | 60 | 120 | ST |
| MBV 43 | Design and maintenance of railroad facilities | 6 | SS | 180 | 60 | 120 | ST |
| MBV 44 | Railway engineering | 6 | WS | 180 | 60 | 120 | ST |

* For the recognition of one of the two specializations (structural engineering or water and transport engineering), at least six modules belonging to the respective major must be selected; in addition, the Master's thesis must be completed in this specialization. Otherwise, "General" will be designated as the major.

Note: The list of specialization modules in the elective (compulsory) area is not exhaustive; further modules can be added according to demand. Modules are only offered according to current teaching capacity; in this respect, there is no entitlement to the implementation of all or any specific specialization modules. Modules with fewer than five participants will not be carried out.

| Abbreviation | Name |
|---|---|
| AA | Final thesis with colloquium |
| K2 | 2-hour written exam |
| M | Oral examination |
| ST | Student research paper according to module description |
| PA | Project work according to module description |
| R | Seminar paper |

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Project Solid construction** | **MBV 01** | | 01.09.2018 |

| Study semester | Offered in | Credit points | Semester week hours |
|---|---|---|---|
| 9th semester | WS | 6 CP | 4 SWS |

| Allocation to study specialization | Responsible for module | Type of teaching, group size, if applicable |
|---|---|---|
| Structural civil engineering | Prof. Dr.-Ing. Martin Klaus | Project work with supervision in groups |
| Can also be credited to study program: - | | Language of instruction: German |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Bachelor's degree with a major in structural engineering |

| Study/examination achievements/ examination types | If applicable, weighting of the study/examination achievements |
|---|---|
| Project work with colloquium<br>- | |

**Module objectives/desired learning outcomes:**

Independent processing of a practical project until it is ready for execution.

Students are able to work independently on a project in the field of structural engineering, also across construction types, until it is ready for execution. They are able to deal with the tasks of structural design on a concrete object from an engineering point of view and to work on this in sub-areas until it is ready for execution.
They have further developed their learning strategies and have practiced expanding their knowledge independently using current literature. They have learned to improve their teamwork skills within a team and to present and objectively justify their opinions to others in professional discussions.

**Contents:**

Working on a concrete project from practice in the field of structural or civil engineering, students are to work out selected planning phases according to HOAI independently in sub-areas. They are to develop new areas of knowledge independently using literature. They make reference to the various aspects that must be taken into account in the realization of construction projects. This concerns selected structural and design aspects and aspects of economic efficiency combined with scheduling issues. To do so, planning meetings are held on a weekly basis, at which the planning statuses and facts that have been worked out must be presented and justified in groups.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. M. Klaus | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | | Course accompanying and exam preparation | 120 h |
| | - | Exercise | | | |
| | - | Other | 60 h | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Steel engineering** | **MBV 02** | | 01.09.2018 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Structural civil engineering | Responsible for module: Prof. Dr.-Ing. Stefanie Steppeler | Type of teaching, group size, if applicable: Lecture with integrated exercises | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Bachelor's degree with a major in structural engineering |
| Study/examination achievements/ examination types: Student research paper with colloquium - | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

Students
- know different construction principles of steel construction as well as structural glass construction,
- are able to independently develop possible solutions for design details,
- learn about special connection techniques of load-bearing structures,
- can implement the principles of structural design using CAD programs,
- acquire basic knowledge of corrosion protection and material selection in steel construction as well as the verification of fatigue-endangered bar-shaped components in steel construction.

**Contents:**

- Presentation of basic construction principles and possibilities of constructive formation of connections in steel and glass construction
- Dimensioning and design of selected connections for structural engineering and connections for special applications
- Corrosion protection systems and corrosion protection design
- Fatigue and fatigue-appropriate design
- Structural glass engineering
- Structural design with CAD in steel construction

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. S. Steppeler | 2 LVS | Course attendance time | | Home study | |
| L. B. | 2 LVS | Lecture | 60 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

Software training in CAD

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Special fields of solid construction** | **MBV 03** | | 31.05.2021 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Structural civil engineering | Responsible for module: Prof. Dr.-Ing. Michael Hansen | Type of teaching, group size, if applicable: Lecture and exercise | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Bachelor's degree with a major in structural engineering |
| Study/examination achievements/ examination types: Written examination (K2) - | If applicable, weighting of the study/examination achievements: BB 3-7 (Solid construction 1), BB 4-6 (Solid construction: 2), BBV 33 Solid construction 3 |

**Module objectives/desired learning outcomes:**

Students gain in-depth knowledge in the calculation of reinforced concrete components. They are able to calculate and dimension statically indeterminate bracing systems in building construction. In addition, solid structures for which the Bernoulli hypothesis is no longer valid can be dimensioned and designed correctly. Students know how to apply nonlinear calculation methods in solid construction. They have studied crack width limitation in reinforced concrete construction in depth and can apply these skills to impermeable structures, among others.

**Contents:**

- Design and dimensioning of bracing systems in solid construction (Bracing systems part 2)
- Disc-type components (part 2)
- Bar models and design of discontinuity areas (part 2)
- Moment-curvature relationships in reinforced concrete structures
- Nonlinear calculation (geometric/physical) of reinforced concrete compression members
- Verification of serviceability limit state design (crack width limitation, part 2)
- Special features of waterproof concrete structures

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr.-Ing. habil. Michael Hansen | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 30 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 30 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Prestressed concrete bridge construction** | **MBV 04** | | 01.03.2021 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Structural civil engineering | Responsible for module: Prof. Dr.-Ing. Martin Klaus | Type of teaching, group size, if applicable: Lecture and exercise | | |
| Can also be credited to study program: - | | Language of instruction: German | | |
| Requirements according to examination regulations | | Recommended prerequisites: Prestressed concrete construction 2 | | |
| Study/examination achievements/ examination types: Student research paper with colloquium - | | If applicable, weighting of the study/examination achievements | | |

**Module objectives/desired learning outcomes:**

Design and calculation of reinforced concrete and prestressed concrete bridges for road traffic

The students are familiar with different load-bearing systems and bearing types of solid bridges and their reasonable cross-section design. They are familiar with the load assumptions of road bridges and know the regulations in road bridge construction. They are able to design simple solid bridges (with and without prestressing; significantly with plate or plate-beam cross-section) and calculate them using commercial software. They are able to prepare a verifiable structural analysis of simple bridge superstructures.

**Contents:**

- Overview of different bridge systems (overlapping types)
- Regulations in road bridge construction
- Design of simple solid bridges in longitudinal and transverse direction
- Bearing concepts for solid bridges
- Impacts on road bridges
- Load transfer in bridge structures and estimation of internal forces
- Model building in bridge construction
- Internal force calculation using modern commercial bridge design software
- Fatigue checks for solid bridges
- Design of solid bridges with plate or plate-beam cross-section
- Preparation of execution plans

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. M. Klaus | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Surface support structures** | **MBV 07** | | 01.03.2021 |

| Study semester | Offered in | Credit points | Semester week hours |
|---|---|---|---|
| 9th semester | WS | 6 CP | 4 SWS |

| Allocation to study specialization | Responsible for module | Type of teaching, group size, if applicable |
|---|---|---|
| Structural civil engineering | Prof. Dr.-Ing. Martin Klaus | Lecture and exercise |
| Can also be credited to study program: - | | Language of instruction: German |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Bachelor's degree with a major in structural engineering |

| Study/examination achievements/ examination types | If applicable, weighting of the study/examination achievements |
|---|---|
| Student research paper with colloquium<br>- | |

**Module objectives/desired learning outcomes:**

Design and calculation of plane surface structures and surface foundations

Students are able to calculate structural shells in building construction with and without the use of data processing. They are familiar with the types of foundations generally used in building construction and can also design and calculate complex shallow foundations. They are able to perform the required cross-section verifications with and without the use of data processing.

**Contents:**

- Overview of roof support structures
- Repetition and intensification of the calculation of area load-bearing structures without the use of data processing (line-bearing slabs; flat slabs; flat foundations; use of semi-prefabricated parts)
- More detailed verification of slab deformations (state II; time-dependent deformations)
- Elastically bedded surface foundations
- Calculation of surface supporting structures using the finite element method with commercial software used in actual practice
- Preparation of reinforcement drawings for surface supporting structures

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. M. Klaus | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Prestressed concrete construction 2** | **MBV 08** | | 01.03.2021 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Structural civil engineering | Responsible for module: Prof. Dr.-Ing. Martin Klaus | Type of teaching, group size, if applicable: Lecture and exercise | | |
| Can also be credited to study program: - | | Language of instruction: German | | |
| Requirements according to examination regulations | | Recommended prerequisites: Bachelor's degree with a major in structural engineering | | |
| Study/examination achievements/ examination types: Written examination (K2) - | | If applicable, weighting of the study/examination achievements | | |

**Module objectives/desired learning outcomes:**

Design and calculation of any prestressed structures in solid construction

Students are familiar with the different types of prestressing in concrete construction and are familiar with the terminology used in prestressed concrete construction. They are able to design, calculate and construct statically determinate and indeterminate prestressed structures. They understand the more complex relationships in prestressed concrete construction compared to reinforced concrete structures. They are also familiar with the special features of subsequently supplemented cross sections.

**Contents:**

- Historical development, prestressing process, tendon components
- Internal force determination of statically determinate and indeterminate systems
- Time and location-dependent clamping force losses
- Structural design of prestressed concrete components
- Design of tendon layout and preliminary dimensioning
- Verification of prestressed concrete components in the various limit states
- Special features and calculation of subsequently supplemented cross sections
- Software application for the calculation of prestressed concrete components using commercial software

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. M. Klaus | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Technical mechanics 4, static 4, structural engineering 4** | **MBV 10** | | 31.05.2021 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Michael Hansen | Type of teaching, group size, if applicable: Lecture with integrated exercises | | |
| Can also be credited to study program: Bachelor of Civil Engineering | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | BB 1-4, BB 2-4, BB 3-4 |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Written examination (K2)<br>- | |

**Module objectives/desired learning outcomes:**

Students gain advanced knowledge and skills for the determination and evaluation of the force distribution in complex structures. They are able to assess the influence of deformation behavior and non-elastic material properties on the load-bearing behavior of plane beam structures. In addition, they can determine and evaluate the distribution of forces in spatial load-bearing structures.

If suitable, this module can also be used as a specialization module in the Bachelor's degree program in civil engineering. In this case, however, credit cannot be given in a consecutive Master's program.

**Contents:**

- Kinematics
- Determination of the support reactions and internal forces of statically indeterminate plane systems using the deformation variable method (angle of rotation method) according to I. and II. theory. Order

- Introduction to nonlinear beam statics
- Load-bearing process
- Calculation of supporting and internal forces in spatial beam structures

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr.-Ing. habil. Michael Hansen | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 30 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 30 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Composite construction** | **MBV-13** | | 01.09.2018 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Structural civil engineering | Responsible for module: Prof. Dr.-Ing. Stefanie Steppeler | Type of teaching, group size, if applicable: Lecture with integrated exercises | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types:** Written examination (K2) - | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

Students
- know the most important material properties of structural steel, reinforcing steel, concrete and composites,
- are able to apply the European safety concept in relation to composite-specific safety factors and the basic European design standards in composite construction,
- are proficient in verifying the structural safety of simple composite beams, columns and slabs in accordance with standards,
- learn the basic fire design procedures for steel and composite steel construction.

**Contents:**

- Introduction to composite construction
- Material properties of structural steel, reinforcing steel, concrete and composites
- Basic principles of the design of simple composite structures (beams, columns, slabs)
- Introduction to fire safety
- Overview of the design procedures in case of fire
- Basic principles of design in case of fire

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Assistant lecturer | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 60 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Advanced project in water engineering** | **MBV 31** | | 01.09.2018 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: Prof. Dr.-Ing. Günther Bahre | Type of teaching, group size, if applicable: Project work with supervision in groups | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Good knowledge of CAD |
| Study/examination achievements/ examination types: Project work with colloquium<br>- | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

Students learn to work independently on an engineering problem from the field of water management (hydrology, water management, hydraulic engineering, urban water management, environmental engineering) under conditions identical to those in actual practice.
They develop independent, if necessary unconventional solutions, and describe their technical, ecological and economic effects in terms of quality and quantity.
Depending on the task, they enhance their skills in working on and solving interdisciplinary problems.
It is possible to prepare drawings of the solutions in an appropriate and professional manner.

**Contents:**

The tasks vary according to demand, but they should be based on current problems in the respective field.
The following project topics are given only as examples:

- Hydrology
- Water management
- Water engineering
- Laboratory/semi-industrial/large-scale tests for the elimination of substances or groups of substances from (waste) water
- Design of special process engineering units for wastewater treatment, partial flow treatment, etc.
- Planning of modifications in the process chain for sludge treatment
- Planning of a biogas plant
- Design of an I&C concept for a process plant, including the preparation of the functional specification and the P&I flow diagrams

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. G. Bahre and/or | 4 LVS | Course attendance time | | Home study | |
| Prof. Dr. A. Stödter | - | Lecture | 15 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 45 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

Project-accompanying supervision

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Process engineering in urban water management** | **MBV 32** | | 01.09.2018 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: Prof. Dr.-Ing. Günther Bahre | Type of teaching, group size, if applicable: Lecture with exercises | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types:** Student research paper with colloquium<br>- | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

Students are able to use basic microbiological and biochemical knowledge as an application prerequisite of material conversion processes to be described in terms of both quality and quantity. System analysis of ideal and real reactors can be performed and evaluated.
Students have a basic understanding of the simulation of wastewater treatment processes.
They are able to independently determine the parameters for the model description of processes.

**Contents:**

- Microbiological substance conversions (systematics of microorganisms, enzyme-catalyzed reactions, properties and classification of enzymes, biochemical conversions of hydrocarbons, biochemical conversions of inorganic substances, reaction kinetics of microbiological systems, batch systems, flow-through systems, energy conversion, enthalpy).
- System analysis (flow behavior of theoretical systems, flow in a totally mixed reactor, flow in a plug reactor, flow in a cascade system, flow in systems with recirculation, flow behavior in real systems, measurements of flow behavior, interpretation of measurement results (dead spaces, short-circuit flows), application examples
- Introduction to the simulation of biochemical processes (methods for the formulation of biochemical models, methods for the determination of model parameters, presentation of the ASM
- Independent set up and performance of laboratory tests, e.g. adsorption, gas exchange, precipitation/flocculation, reactions 1 Order, determination of residence time distributions, etc.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. G. Bahre | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 50 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 10 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

Supervision of lab work

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Multifunctional hydraulic engineering facilities** | **MBV 33** | | 01.09.2018 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: Prof. Dr.-Ing. Axel Stödter | Type of teaching, group size, if applicable: Excursion w. presentations for knowledge transfer | | |
| Can also be credited to study program: - | | Language of instruction: German and English | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Hydraulics, water management, hydraulic engineering from Bachelor's program |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Seminar paper<br>- | |

**Module objectives/desired learning outcomes:**

Advanced knowledge in planning and operation of weir and dam construction, dam and dike construction, and inland transportation hydraulic engineering, taking into account competing uses

Specific knowledge in energy economics and ecology Specific knowledge in steel hydraulic engineering

In addition, participation in a field trip to a hydraulic engineering facility with multiple functions is mandatory. A good working knowledge of English may also be required.

**Contents:**

- Backwater control
- Requirements for multifunctional hydraulic engineering plants and their plant components
- Design and operating modes of hydropower plants
- Planning guidelines, design principles and dimensioning approaches for dams
- Conversion, renovation and further development of existing facilities
- Hydraulic steel structures (closures, seals, special structures) and steel structures in and on the waterfront
- Practical examples/excursion

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. A. Stödter | 2 LVS | Course attendance time | | Home study | |
| Prof. Dr. S. Steppeler | 2 LVS | Lecture | 10 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 25 h | | |
| | - | Other | 25 h | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Sustainable water resources management** | **MBV 34** | | 01.09.2018 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: Prof. Dr.Ing. Axel Stödter | Type of teaching, group size, if applicable: Lecture, seminar, computer exercises | | |
| Can also be credited to study program: - | | Language of instruction: German and English | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Hydraulics, water management, hydraulic engineering from Bachelor's program |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Oral examination<br>- | |

**Module objectives/desired learning outcomes:**

Seen globally, water as a resource is not balanced between anthropogenic influences and its own regenerative power. As a result, it is essential to manage it in a sustainable manner, both ecologically and economically, throughout the world. For the water sector, this can be described by the term "Integrated Water Resources Management" (IWRM).

Students gain insight into the theory and methodology of water management, acquire basic knowledge of hydrologic planning tools, and the design of hydraulic engineering facilities for storage and irrigation and drainage. They also learn about innovative approaches to "sustainable, ecological management". Lectures and, in some cases, computer-aided calculation methods are used. A good working knowledge of English may also be required.

**Contents:**

- Surface and groundwater availability
- Systems theory and methodology for water management and sustainable planning
- Simulation methods: Precipitation-runoff modeling, storage models
- Concrete approaches in water resources management
- Irrigation, drainage/rewetting and extensification
- Practical examples

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. A. Stödter | 4 LVS | Course attendance time | | Home study | |
| Assistant lecturer, if applicable | - | Lecture | 30 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 30 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Water quality management** | **MBV 35** | | 01.09.2018 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: Prof. Dr.-Ing. Günther Bahre | Type of teaching, group size, if applicable: Lecture with exercises | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Student research paper with colloquium<br>- | |

**Module objectives/desired learning outcomes:**

Students understand the classification system of the European Water Framework Directive including the daughter directives; as well as the implementation into national law.
They are able to assess the water quality of surface waters according to chemical, biological and structural quality criteria in terms of quality and quantity.
They are also able to evaluate the impacts of stormwater and combined sewer discharges in terms of materials and hydraulics.
They are able to plan and dimension stormwater treatment measures. Students have a basic understanding of how to conduct a water quality simulation.

**Contents:**

- Water quality (historical development, legal basis, relevant substance groups, quality classification, biological water quality, saprobic index, chemical water quality, acidity index, water structural quality)
- Emission-oriented assessment of combined and storm water discharges into water bodies (introduction of BWK bulletin no. 3, determination of the permissible discharge quantity, proof of oxygen concentration, proof of ammonia toxicity)
- Treatment of stormwater (overview of systems, stormwater overflow basins (A 128), stormwater retention areas (A 117), further treatment of stormwater, mechanical treatment, retention soil filters
- Assessment and elimination of micropollutants
- Water quality of standing waters
- Introduction to water quality modeling

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. G. Bahre | 3 LVS | Course attendance time | | Home study | |
| Prof. Dr. K. Petersen | 1 LVS | Lecture | 50 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 10 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Plant engineering in urban water management** | **MBV 36** | | 01.09.2018 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: Prof. Dr.-Ing. Günther Bahre | Type of teaching, group size, if applicable: Lecture | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types:** Oral examination<br>- | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

- Students are able to collaborate with other engineering disciplines (mechanical engineering, electrical engineering, process engineering).
- They have detailed knowledge of the basics, prerequisites and areas of application of elements of technical equipment.
- They are familiar with recent process developments in the field of wastewater and sludge treatment and can recognize the necessities as well as the limits of use.

**Contents:**

- Drawing representation of process plants (including P&I flow diagrams)
- Systems for equipment marking, performance specification, requirements specification
- Elements of machine-technical equipment (pipelines, fittings, pumps, compressors, digester equipment, gas tanks, gas utilization, etc.).
- Elements of the EMSR technical equipment
- Protection of process plants against lightning strikes and power surges
- Special and newer wastewater treatment processes (e.g. biofiltration, membrane processes, adsorption, advanced oxidation processes, etc.)
- Basic principles of industrial wastewater treatment, characterization of wastewater and assessment of degradability
- Special processes for industrial wastewater treatment, areas of application, limits of use

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. G. Bahre | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 55 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 5 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

Excursion and tour of a process plant

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Mobility management** | **MBV 37** | | 04.08.2018 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: N.N. | Type of teaching, group size, if applicable: Lecture, exercise | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Completion of MBV 38 Mobility impact |
| **Study/examination achievements/ examination types**<br>Student research paper with colloquium<br>- | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

- Knowledge and understanding of the system interrelationships between management strategies, marketing strategies and mobility characteristics
- Ability to set up strategies in a mobility context in a working group as a key competence (group management)
- Ability to engage in technical discussion, evaluation of strategies, and decision making to determine a defined strategy in a mobility context as a key competency
- Ability to independently derive mobility strategies taking into account the integration of project-related, interdisciplinary factors as a key competence of interdisciplinary and cooperative action

**Contents:**

- Management strategies
- Marketing strategies
- Mobility effects
- Participation procedures
- Sustainability
- Mobility consulting

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Hon.-Prof. Dr. D. Seebo | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 50 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 10 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Mobility impact** | **MBV 38** | | 04.08.2018 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: N.N. | Type of teaching, group size, if applicable: Lecture, exercise | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Participation in module MBV-37 Mobility management |
| Study/examination achievements/ examination types: Student research paper with colloquium - | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

- Knowledge of behavioral psychology in the context of mobility behavior
- Knowledge of the differentiated determination of mobility origin and methodology of mobility impact
- Knowledge, development and application of qualitative and quantitative research methods
- Ability to select, apply, and evaluate a task-specific research method
- Ability to independently derive and develop complex mobility plans
- Ability to design traffic development projects taking into account the integration of project-related, interdisciplinary factors as a key competence of interdisciplinary and cooperative action

**Contents:**

- Traffic behavior
- Environmental impact
- Traffic-spanning measures
- Traffic calming
- Traffic reduction
- Impact analyses
- Success checks

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Hon.-Prof. Dr. D. Seebo | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 50 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 10 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Local public transportation** | **MBV 39** | | 01.09.2018 |

| Study semester | Offered in | Credit points | Semester week hours |
|---|---|---|---|
| 9th semester | WS | 6 CP | 4 SWS |

| Allocation to study specialization | Responsible for module | Type of teaching, group size, if applicable |
|---|---|---|
| Water and traffic engineering | N.N. | Lecture |
| Can also be credited to study program | | Language of instruction |
| - | | German |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |

| Study/examination achievements/ examination types | If applicable, weighting of the study/examination achievements |
|---|---|
| Written examination (K2)<br>- | |

**Module objectives/desired learning outcomes:**

- Knowledge of the basic principles of organization and financing of local public transport
- Knowledge and understanding of system interrelationships in local public transport
- Ability to understand practical contexts
- Ability to independently develop and implement public transport services in urban and rural areas

**Contents:**

- Legal basis and organization of public transport
- Financing
- Local public transportation facilities
- Network planning
- Differentiated operating modes
- Mobility development, multimodality
- Tariff cooperations / transport associations
- Marketing strategies
- Promotion of public transport / free public transport

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Dipl.-Ing. A. Markwart, M.Sc. | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 60 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|---|
| Master's Degree in Civil Engineering | | **Road traffic engineering** | **MBV 40** | | 04.08.2018 |
| Study semester | Offered in | | Credit points | | Semester week hours |
| 8th semester | SS | | 6 CP | | 4 SWS |
| Allocation to study specialization | | Responsible for module | Type of teaching, group size, if applicable | | |
| Water and traffic engineering | | N.N. | Seminar teaching | | |
| Can also be credited to study program | | | Language of instruction | | |
| - | | | German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Student research paper with colloquium<br>- | |

**Module objectives/desired learning outcomes:**

- In-depth knowledge of traffic signal control of traffic flows and evaluation of traffic quality
- In-depth knowledge of the construction of microscopic simulation models
- Ability to build a complex simulation model in VISSIM
- Ability to independently develop traffic dependent signal controls
- Ability to develop and evaluate solutions for transportation planning issues using complex tools

**Contents:**

Introduction to signal controls, control procedures, and traffic flow quality design and evaluation
Using the VISSIM simulation software: Basic principles, editing of routes, signalized and unsignalized intersections and roundabouts
Building your own simulation model
Evaluation and assessment of traffic quality in the simulation model; development of traffic-dependent signal controls and application in the simulation model

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Hon.-Prof. Dr. D. Seebo | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Urban streetscape planning** | **MBV 41** | | 04.08.2018 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: N.N. | Type of teaching, group size, if applicable: Seminar teaching | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Participation in module MBV-42 Municipal traffic concepts |
| Study/examination achievements/ examination types: Student research paper with colloquium - | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

Students acquire
- in-depth knowledge of methods and process of urban streetscape design,
- the ability to independently create a design for real street space with appropriate consideration of all usage requirements and local constraints,
- the ability to evaluate different planning alternatives,
- social competence through cooperation with external institutions as well as through group work.

**Contents:**

- Survey of a community transportation network
- Representation of urban structures
- Calculation of the traffic load
- Target definitions for integrated transportation development
- Deficiency analysis
- Independent development of a traffic concept

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Hon.-Prof. Dr. D. Seebo | 2 LVS | Course attendance time | | Home study | |
| Assistant lecturer | 2 LVS | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Municipal traffic concepts** | **MBV 42** | | 04.08.2018 |

| Study semester | Offered in | Credit points | Semester week hours |
|---|---|---|---|
| 8th semester | SS | 6 CP | 4 SWS |

| Allocation to study specialization | Responsible for module | Type of teaching, group size, if applicable |
|---|---|---|
| Water and traffic engineering | N.N. | Seminar teaching |
| Can also be credited to study program: - | | Language of instruction: German |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Basic knowledge in the design of rural and urban roads |

| Study/examination achievements/ examination types | If applicable, weighting of the study/examination achievements |
|---|---|
| Student research paper with colloquium<br>- | |

**Module objectives/desired learning outcomes:**

Students acquire
- in-depth knowledge of the development and application of qualitative and quantitative analytical methods,
- knowledge and understanding of the individual procedures used in traffic planning processes,
- the ability to independently develop cross-system transportation concepts for a real-world planning area,
- social competence through cooperation with external institutions as well as through group work.

**Contents:**

- Survey of a community transportation network
- Representation of urban structures
- Calculation of the traffic load
- Target definitions for integrated transportation development
- Deficiency analysis
- Independent development of a traffic concept

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Hon.-Prof. Dr. D. Seebo | 2 LVS | Course attendance time | | Home study | |
| Assistant lecturer | 2 LVS | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Design and maintenance of railroad facilities** | **MBV 43** | | 01.02.2019 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: N.N. | Type of teaching, group size, if applicable: Lecture with integrated exercises | | |
| Can also be credited to study program: - | | Language of instruction: German | | |
| Requirements according to examination regulations | | Recommended prerequisites: BBV 69 Railroad construction | | |
| Study/examination achievements/ examination types: Student research paper with colloquium - | | If applicable, weighting of the study/examination achievements | | |

**Module objectives/desired learning outcomes:**

Students
- are able to design and draw a junction station based on a timetable, including signaling,
- are capable of performing vehicle dynamics tests,
- are able to draw up a BETRA (construction and operating instructions for construction work on the track),
- know the track construction machines suitable for track maintenance and new track construction,
- know the basic principles of shunting technology,
- are able to lead planning meetings and successfully apply negotiation techniques.

**Contents:**

- Calculation of the required number of tracks from a timetable specification
- Calculation of track and effective lengths
- Travel time calculations and timetable designs
- Railroad facilities and railway loading gauges
- Requirements for the superstructure and line layout
- Use of track-laying machines
- Set up of construction and operating instructions (BETRA)
- Shunting systems and technology
- Signal box technology
- Negotiation techniques in contract talks and supplementary negotiations

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Hon.-Prof. Friedrich Pech | 2 LVS | Course attendance time | | Home study | |
| Assistant lecturer | 2 LVS | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Railway engineering** | **MBV 44** | | 22.08.2019 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Water and traffic engineering | Responsible for module: N.N. | Type of teaching, group size, if applicable: Lecture with integrated exercises | | |
| Can also be credited to study program: - | | Language of instruction: German | | |
| Requirements according to examination regulations | Recommended prerequisites: Successful participation in BBV 69 and MBV 39 | | | |
| Study/examination achievements/ examination types: Student research paper with colloquium - | If applicable, weighting of the study/examination achievements | | | |

**Module objectives/desired learning outcomes:**

Students
- know the most important basic terms from the various specialist trades of rail infrastructure and rail operations and can reproduce and explain them,
- possess basic knowledge of rail transport guidelines and safety concepts,
- understand the rail transport system with its special features and interconnections,
- are able to apply the basic technical rules of planning for construction measures and to use the learned basics of building law in the implementation of the measures,
- recognize the issues – construction and operation – and can thus assess and evaluate the operational impact of construction measures of different sizes.

**Contents:**

- Railroad operations and traffic facilities
- Control and safety technology in rail traffic
- Railroad superstructure – Projects and investments – Maintenance – Track-laying machines
- Consolidation of knowledge through excursions to actual locations
- Railway tie production at the Leonhard Moll concrete railway tie plant
- Functional principle of the MegaHub Lehrte fast transshipment facility for combined traffic
- Driving service and network dispatching at the Hannover Operations Center
- Elastomeric bearing technology in the superstructure
- Specialist planning of structural engineering for rail transport systems
- Railroad bridge inspections
- Railroad stations as interfaces between rail traffic and the city
- Sequence of events during the commissioning of rail transport facilities
- Driving and construction while maintaining rail traffic
- Application examples for the awarding of contracts and contract regulations for construction services in rail transport as well as basic principles of construction contracts for infrastructure projects
- Experience gained from an international railroad project

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Hon.-Prof. Friedrich Pech | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 50 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 10 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Building climatology** | **MBV 61** | | 29.03.2019 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Hans-Peter Leimer | Type of teaching, group size, if applicable: Lecture | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types:** Project work without colloquium - | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

Students are made able to evaluate the holistic interrelationships of construction with respect to the impact on energy and environmental issues.

- Insights into the influences of temperature and humidity on building structures
- Knowledge about the energetic behavior of buildings
- Verification according to the Energy Saving Act (EnEG) or the Building Energy Act (GEG)
- Ability to work in a team, professional discussion, presentation

**Contents:**

- The fundamentals of building climatology, heat and moisture protection and energy-saving construction are covered in depth.
- Using selected examples, the effects of building materials and building climatic boundary conditions on the building enclosure and indoor climate are presented for different buildings.
- The investigations are carried out on the basis of calculations or simulation calculations on the fundamentals according to BIM.
- Projects are carried out in individual or group work, in cooperation with other disciplines.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. P. Leimer | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Building energy design** | **MBV 62** | | 29.03.2019 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Hans-Peter Leimer | Type of teaching, group size, if applicable: Lecture | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types**<br>Project work without colloquium<br>- | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

Students are made able to evaluate the holistic interrelationships of construction with respect to the impact on energy and environmental issues.
This includes, among other things,
• knowledge of the interaction and effects of building structures and building physics on the indoor climate as well as the energetic and indoor climatic behavior of buildings.
• the evaluation and development of energy and climate concepts of buildings
• the ability to work in a team, professional discussion, presentation

**Contents:**

The fundamentals of building climatology, thermal and moisture protection, and energy conservation are covered in depth, and a close look is taken at the effects on the energy and building climatic performance of buildings.
• Selected examples are used to illustrate the effects of building materials and building climatic boundary conditions on the building enclosure and indoor climate.
• In the following, different formations of the building enclosure are developed and their effects on energy consumption and indoor climate are determined.
• The investigations are carried out on the basis of calculations or numerical simulation calculations according to BIM.
The results are used for further work in the Building Energy Design module to develop energy distribution and energy generation concepts in buildings.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. P. Leimer | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Energy Design Building services** | **MBV 63** | | 29.03.2019 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Hans-Peter Leimer | Type of teaching, group size, if applicable: Lecture | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Project work without colloquium<br>- | |

**Module objectives/desired learning outcomes:**

Students are made able to understand and evaluate the holistic interrelationships of construction with respect to the impact on energy and environmental issues.
Acquisition of in-depth knowledge for the assessment of the necessities of modern technical building equipment in harmony with architecture
Apply and implement in-depth knowledge, taking into account, among other things, the requirements in Sustainable Construction and the Sustainable Construction Assessment
To do so, introductory and detailed lectures and practical exercises with computer support are offered on the basis of BIM.

**Contents:**

Energy generation and energy conversion concepts, e.g. wind energy and combined heat and power
Energy distribution concepts, e.g. smart grids, BUS systems, building installation
Building installation systems for all trades of technical building equipment incl. evaluation of electrical consumers and lighting
• Evaluation and development of energy generation and distribution concepts for buildings
• The investigations are carried out on the basis of calculations or numerical simulation calculations according to BIM.
• Coordination with the module Building Energy Design (development of energy and climate concepts for buildings)

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Assistant lecturer | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Measurement technology in building physics** | **MBV 65** | | 29.03.2019 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Hans-Peter Leimer | Type of teaching, group size, if applicable: Lecture/lab | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Project work without colloquium<br>- | |

**Module objectives/desired learning outcomes:**

The aim is to make students familiar with a wide variety of measurement methods in building physics and to transfer the characteristic data measured in the laboratory to building practice.

- Understanding of the interaction and influences of structural engineering parameters
- Knowledge of a wide variety of calculation methods and simulation calculations
- Knowledge of the many different testing procedures
- Knowledge of a wide range of building physics measurements
- Interpretation of measurement data and findings

**Contents:**

A wide variety of measurement and test methods for determining building physics parameters for heat, moisture and sound insulation, room acoustics and emissions are presented and practiced using measurements in the laboratory. The following form the basis for application:

- the valid test standards for recording characteristic values of building materials and building components
- the various measurement procedures and measurement methods for different areas of application
- the evaluation of measurement findings, also on the basis of a wide variety of statistical methods
- comparative performance of numerical calculations for validation and evaluation

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. P. Leimer | 2 LVS | Course attendance time | | Home study | |
| Assistant lecturer | 2 LVS | Lecture | 30 | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 30 | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Concrete technology I** | **MBV 77** | | 02.07.2020 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 6 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Iris Marquardt | Type of teaching, group size, if applicable: Lecture, exercise, practical lab training | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Basic principles of concrete technology from BB |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Written examination (K2)<br>Project work without colloquium | |

**Module objectives/desired learning outcomes:**

Sound concrete technology knowledge and skills in accordance with the specifications and the syllabus for the extended concrete technology training of the Concrete Training Advisory Board of the German Concrete and Construction Technology Association (Deutscher Beton- und Bautechnik-Verein e. V.) for the acquisition of the theoretical E-certificate

The aim of the training is to enable the Master's graduates to work as senior concrete engineers in companies after passing the two modules of Concrete Technology I and Concrete Technology II. After graduation, proof of one year of practical concrete technology work is required. With the proof of practical activity, an application for the issuance of the E-certificate can be submitted.

If you are aiming to obtain an E-certificate, please note:
The duration of the exam is (different from above) 210 min.
For the theoretical E-certificate, 70% of the achievable total score (corresponds to grade 3.3) is required in the 1st exam attempt.
Attendance is compulsory for the module.

**Contents:**

- Concrete as a building material
- Raw materials (cement, aggregates, concrete admixtures, concrete additive mixtures, water)
- Purpose of a permanent concrete testing station
- Task and position of the senior concrete technologist in the company
- European standards and regulations concept, construction supervision regulations
- Requirements for concrete components
- Concrete according to exposure classes
- Fresh concrete
- Hardened concrete
- Design of concrete mixtures
- Production and delivery

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr.-Ing. Iris Marquardt | 6 LVS | Course attendance time | | Home study | |
| | - | Lecture | 80 h | Course accompanying and exam preparation | 90 h |
| | - | Exercise | 10 h | | |
| | - | Other | | | |
| **Total classroom time** | **6 LVS** | **Total workload** | | | **180 h** |

Optional extra

Application for E-certificate possible under the above conditions

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Concrete technology II** | **MBV 78** | | 02.07.2020 |
| Study semester: 10th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 6 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Iris Marquardt | Type of teaching, group size, if applicable: Lecture, exercise, practical lab training | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Basic principles of concrete technology from BB |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Written examinatio n (K2), seminar paper | |

**Module objectives/desired learning outcomes:**

Sound concrete technology knowledge and skills in accordance with the specifications and the syllabus for the extended concrete technology training of the Concrete Training Advisory Board of the German Concrete and Construction Technology Association (Deutscher Beton- und Bautechnik-Verein e. V.) for the acquisition of the theoretical E-certificate

The aim of the training is to enable the Master's graduates to work as senior concrete engineers in companies after passing the two modules of Concrete Technology I and Concrete Technology II. After graduation, proof of one year of practical concrete technology work is required. With the proof of practical activity, an application for the issuance of the E-certificate can be submitted.

If you are aiming to obtain an E-certificate, please note:
The duration of the exam is (different from above) 210 min.
For the theoretical E-certificate, 70% of the achievable total score (corresponds to grade 3.3) is required in the 1st exam attempt.
Attendance is compulsory for the module.

**Contents:**

- Construction execution
- Seams
- Concretes for specific applications (including high-strength concrete, self-compacting concrete, concrete for massive structural elements, concrete for traffic areas, etc.), lightweight concrete, heavy concrete, grout
- Exposed concrete
- Prefabrication of components
- Cement screed, mortar
- Quality assurance, conformity and conformity control
- Durability of concrete building elements

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr.-Ing. Iris Marquardt | 6 LVS | Course attendance time | | Home study | |
| | - | Lecture | 80 h | Course accompanying and exam preparation | 90 h |
| | - | Exercise | 10 h | | |
| | - | Other | | | |
| **Total classroom time** | **6 LVS** | **Total workload** | | | **180 h** |

Optional extra

Application for E-certificate possible under the above conditions

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Tunnel, shaft and gallery construction** | **MBV 89** | | 15.03.2021 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. G. Maybaum | Type of teaching, group size, if applicable: Seminar | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Geotechnics 2 |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Student research paper with colloquium<br>- | |

**Module objectives/desired learning outcomes:**

Students learn to understand complex tasks of basic and special civil engineering in their engineering broadness and their interconnection with other disciplines.

They examine the computational proofs and discuss the modeling ideas behind them. As far as possible, they also independently carry out the calculation of actions and resistances.

They are taught to independently identify, analyze, and master problems by expanding their methodological skills.

They broaden their engineering science base.

**Contents:**

Geological, soil mechanical, earth static and process aspects are discussed for several, selected tunnel, shaft and gallery construction projects.

Within the framework of seminars, students develop approaches and solutions and compare them with the construction projects that have been carried out.

Discussion topics also include construction management issues and environmental and economic issues.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. G. Maybaum | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 60 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Digital planning and building** | **MBV-90** | | 11.03.2020 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: Building operations, construction management | Responsible for module: Prof. Dr. M. Hanusrichter | Type of teaching, group size, if applicable: Lecture | | |
| Can also be credited to study program: - | | Language of instruction: German | | |
| Requirements according to examination regulations | | Recommended prerequisites | | |
| Study/examination achievements/ examination types: Project work with colloquium - | | If applicable, weighting of the study/examination achievements | | |

**Module objectives/desired learning outcomes:**

Knowledge-based part: This course is designed to provide students with fundamental knowledge on digitization in the construction industry. The main focus is directed towards the application of the BIM method (Building Information Modeling). A close look is taken at all essential processes that are relevant in the context of project execution (design, approval, award, construction, operation). In addition, students gain insight into technologies such as virtual reality (VR), augmented reality (AR), and additive manufacturing (3D printing).

Application-based part: Through the independent application of interdisciplinary BIM software, students acquire competencies in the areas of modeling, coordination as well as attribution. In seminar work, students develop their own models under supervision, carry out appropriate collision checks, and add schedules and processes as well as quantities and costs to these models (3D | 4D | 5D).

With a suitable number of participants, the students deal with the latest developments in connection with the digitalization of the construction industry in the preparation and delivery of presentations.

**Contents:**

By linking the knowledge-based and the application-oriented parts, the following contents are taught with emphasis on:

- Definitions of terms and relevant standards and guidelines
- Opportunities and risks arising from the introduction and application of the BIM method
- Forms of application of BIM, object-oriented model structure (technical and partial models, exchange formats, etc.)
- BIM strategy in the company; training, implementation and communication
- Project preparation and execution: BIM objectives, client information requirements, BIM execution plan
- BIM tools: Hardware and software, Common Data Environment (CDE), information exchange
- Project execution structure and roles of stakeholders (BIM manager, BIM coordinator, etc.)
- Digital workflows (e.g. in approval processes)
- Interface problems and system breaks (e.g. during the transition between two project phases)
- Legal aspects, remuneration and future prospects

With a suitable number of participants (and subject to availability): In the form of guest lectures, representatives from the construction industry provide insights into current digital construction practice that cannot be conveyed through the teaching structure at a university.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. M. Hanusrichter | 2 LVS | Course attendance time | | Home study | |
| B. Jaroszewski, M.Sc. (lecturer) | 2 LVS | Lecture | 30 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 30 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Land surveying** | **MBV 91** | | 01.09.2018 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Axel Stödter | Type of teaching, group size, if applicable: Seminar | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Student research paper without colloquium<br>- | |

**Module objectives/desired learning outcomes:**

Students gain in-depth knowledge of surveying in order to be able to perform qualified site and elevation surveys of terrain, as well as structures.

Group work is designed to practice efficient task distribution of complex surveying tasks including evaluation and visualization.

Students internalize the importance of surveying for any planning and construction task.

**Contents:**

- Engineering leveling
- Tachymetry
- Free deployment
- Terrain survey
- Building measurement and documentation
- Construction staking
- Visualization / cartography
- Participation in a symposium or trade fair (if scheduling allows) to present innovative surveying methods

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. A. Stödter | 2 LVS | Course attendance time | | Home study | |
| Dipl.-Ing. S. Wethkamp | 2 LVS | Lecture | 15 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 45 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Construction management, AVA** | **MBV 92** | | 25.01.2019 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Mario Hanusrichter | Type of teaching, group size, if applicable: Lecture | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |

| Study/examination achievements/ examination types | If applicable, weighting of the study/examination achievements |
|---|---|
| Written examination (K2)<br>- | |

**Module objectives/desired learning outcomes:**

Tendering, awarding and invoicing (AVA) of planning and construction services:
The performance specification is the link between architecture/planning/construction on the one hand and construction on the other. With this in mind, students gain knowledge of how to create clear and exhaustive bidding documents. In addition, teaching also covers the basic principles of how contracts are awarded (national and Europe-wide) and the regulations of the legal protection of public procurement. Students are taught basic accounting skills.

Construction law II (public construction law):
Students gain knowledge of public building law (urban land use planning, building code law) as well as the assessment of the approval of building projects. In addition, students are taught the basic principles for applying for building permits with the required building documents.

**Contents:**

Tendering, awarding and invoicing (AVA) of planning and construction services:
- Ways of transferring planning results into the performance specification
- Components and structures of tender documents
- European and German public contract law
- Forms and process of contract awarding procedures
- Contracting authority, secondary offers
- Rules for the evaluation of tenders
- Online tenders, internet auction, legal protection and review procedures
- Billing of services, auditability of billing documents

Construction law II (public construction law):
- Execution of the building permit procedure, building neighbor law
- Urban land use planning according to BauGB, BauNVO and PlanVZ; land use and urban land use plans
- Clearance areas, fire protection regulations, traffic safety
- Building projects that do not require a permit and those that do; application and building documentation ordinance

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. M. Hanusrichter | 2 LVS | Course attendance time | | Home study | |
| Assistant lecturer | 2 LVS | Lecture | 60 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Research in civil engineering** | **MBV 93** | | 29.03.2019 |
| Study semester: 9th semester / Offered in: WS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Hans-Peter Leimer | Type of teaching, group size, if applicable: Lecture | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types**<br>Student research paper without colloquium<br>- | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

Students learn
- about the research content of the faculty of the university,
- how to carry out/cooperate in research projects within the scope of own scientific contributions,
- how to evaluate research projects,
- to collaborate on research projects.

**Contents:**

The basis of the module is formed by completed, current or planned research projects of the university, which are to be worked on in depth, supplementary or preparatory by the student under research aspects within the scope of self-study.
Research projects are presented, discussed and developed further
- .
- The influences of the constructive and structural-physical formations on buildings, rooms and its components are discussed and evaluated on the bases of architecture, civil engineering, restorative requirements.
- Project work on the one hand theoretically, as well as supplementing practically in the existing university laboratories for building physics, building materials, restoration, etc.
- Students work on complex tasks and solutions by applying model and simulation calculations.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. P. Leimer | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 60 | Course accompanying and exam preparation | 120 h |
| | - | Exercise | | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Geotechnics 3, Process engineering** | **MBV 94** | | 27.07.2021 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: Prof. Dr.-Ing. Georg Maybaum | Type of teaching, group size, if applicable: Seminar | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Geotechnics 2 |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Student research paper with colloquium<br>- | |

**Module objectives/desired learning outcomes:**

Students
- learn to understand complex tasks of basic and special civil engineering in their engineering broadness and their interconnection with other disciplines.

They are taught to independently identify, analyze, and master problems by expanding their methodological skills.

**Contents:**

Primarily, the procedural aspects are discussed for several selected projects in foundation and special civil engineering.

Within the framework of seminars, students develop approaches and solutions and compare them with the construction projects that have been carried out.

The discussion topics include soil mechanics, soil statics, construction management and design, as well as aspects of environmental protection and economic efficiency.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Prof. Dr. G. Maybaum | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 60 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **R&D in civil and wood engineering** | **MBV 96** | | 01.02.2019 |
| Study semester: 8th semester / Offered in: SS | | Credit points: 6 CP | | Semester week hours: 4 SWS |
| Allocation to study specialization: All | Responsible for module: N.N. | Type of teaching, group size, if applicable: Lecture with (lab) exercises | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | |
| **Study/examination achievements/ examination types:** Student research paper with colloquium - | If applicable, weighting of the study/examination achievements |

**Module objectives/desired learning outcomes:**

Students are able to recognize and classify the possibilities, necessities and opportunities of research and development work in civil and wood engineering at universities.
They recognize the need to identify the in-kind and financial resources required to carry out the R&D activity and learn the ways to acquire them.
Through their own R&D work on a precisely defined thematic issue, students are enabled to independently arrive at valid research results using scientific methods and procedures. Students will then be able to discuss the results appropriately in a professionally competent environment, compare them with the work of others, and make informed evaluations.

**Contents:**

Overview of relevant and current research topics in civil and wood engineering Overview of public and private research funding
Guidance on the structure and wording of research proposals
Identification of a research topic (taking into account the tight time frame), definition of specific questions, design and set-up of the experimental facility, description of the measurement techniques to be used and the analytical procedures
Experimental studies are conducted with the results recorded and processed, and presented appropriately.
Preparation of a research report
The work will be carried out alternately and depending on capacities in the following laboratories (and as field investigations, if necessary):
Building physics, building materials science, geotechnics, wood technology, processing technology, urban water management, hydraulic engineering as well as – assuming availability – BIM and road construction.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| NN (entire teaching staff, changing, depending on | - | Course attendance time | | Home study | |
| current research topic) | - | Lecture | 15 h | Course accompanying and exam preparation | 120 h |
| total | 4 LVS | Exercise | | | |
| | - | Other | 45 h | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Management techniques** | **MBV 97** | | 01.09.2018 |

| Study semester | Offered in | Credit points | Semester week hours |
|---|---|---|---|
| 9th semester | WS | 6 CP | 4 SWS |

| Allocation to study specialization | Responsible for module | Type of teaching, group size, if applicable |
|---|---|---|
| All | N.N. | Lecture with exercises |
| Can also be credited to study program | | Language of instruction |
| - | | German |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| | Basic principles of cement and concrete technology from BB2-2 |
| Study/examination achievements/ examination types | If applicable, weighting of the study/examination achievements |
| Seminar paper 1<br>Seminar paper 2 | |

**Module objectives/desired learning outcomes:**

Students
- have the skills to conduct negotiations and discussions, especially in the construction industry,
- recognize and can judge whether negotiating partners or opponents want to manipulate,
- can distinguish between and assess the various leadership styles and apply them successfully to specific situations,
- have the knowledge necessary to recognize and respond appropriately to adversary tactics and unsound methods.

**Contents:**

- Negotiation techniques with applications in role plays Video recordings for external and self-analysis
- Defense against opponent tactics
- Basic principles of decision-making
- Prerequisites for successful leadership and cooperation
- Leadership styles and authority
- Fluency, idioms and presentations in English
- Self and peer analysis using filmed role plays (landing in the Sonoran Desert, mail basket exercise, etc.)
- Financial mathematical basis for decision-making

Attendance is compulsory for presentations/speeches.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| Assistant lecturer | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 45 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 15 h | | |
| | - | Other | | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**

is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Special project** | **MBV 98** | | 01.02.2019 |
| Study semester: 8th or 9th semester / Offered in: SS or WS | | Credit points: 6 CP | | Semester week hours: n/a |
| Allocation to study specialization: - | Responsible for module: N.N. | Type of teaching, group size, if applicable: Lecture and parts in seminar form | | |
| Can also be credited to study program: - | | Language of instruction: German, English, if applicable | | |
| Requirements according to examination regulations | | Recommended prerequisites | | |
| Study/examination achievements/ examination types: Project work with colloquium - | | If applicable, weighting of the study/examination achievements | | |

**Module objectives/desired learning outcomes:**

Within the framework of a topic that varies from semester to semester, the students are expected to obtain and work through the relevant working bases largely independently, can outline possible variants and solutions for a concrete task and select, evaluate and apply target-oriented procedures and methods for processing and solving the problem.

Students practice and master the structural design and formulation of a project report.

**Contents:**

Projects with different main focuses from the entire field of civil engineering, e.g. from structural engineering, hydraulic engineering, traffic engineering, construction operation/management, building materials science, building physics, geotechnics; the topics and the work should be as interdisciplinary as possible. Depending on the topic, also multidisciplinary work with students from other degree programs.

Special notes:
The module MBV 98 'Special Project' can only be chosen once in the Master's program and is not assigned to any specialization. The module is not offered regularly, but only after special advance notice. There is no obligation for this module to be offered in any particular semester.
The semester-specific module examination performance relates to the material covered in the current semester. The first (and second, if applicable) retake exam will be on the topic area of the current semester and may deviate significantly to completely from the topic area of the first (or second) attempt.

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| varying, in total max. | 4 LVS | Course attendance time | | Home study | |
| | - | Lecture | 10 h | Course accompanying and exam preparation | 120 h |
| | - | Exercise | 10 h | | |
| | - | Other | 40 h | | |
| **Total classroom time** | **4 LVS** | **Total workload** | | | **180 h** |

Optional extra

**Literature**
is listed in Stud.IP

| Allocation to course of study | Module name | Course code | Internal | Last updated |
|---|---|---|---|---|
| Master's Degree in Civil Engineering | **Master's thesis** | **MBV 99** | | 01.12.2019 |
| Study semester: 10th semester / Offered in WS: + SS | | Credit points: 30 CP | | Semester week hours: n/a |
| Allocation to study specialization: All | Responsible for module: N.N. | Type of teaching, group size, if applicable: n/a | | |
| Can also be credited to study program: - | | Language of instruction: German | | |

| Requirements according to examination regulations | Recommended prerequisites |
|---|---|
| 54 CP from semesters 8 to 9 | |
| **Study/examination achievements/ examination types** | **If applicable, weighting of the study/examination achievements** |
| Final thesis with colloquium<br>- | |

**Module objectives/desired learning outcomes:**

- Students have the ability to grasp and present the state of the art in a given subject area.
- They develop and demonstrate independent decision-making skills.
- They demonstrate acquired competence in the application of scientific procedures and methods.
- They present their total expertise acquired in a given subject area.

**Contents:**

For example:
Conducting comprehensive literature research with classification and evaluation, and/or
Carrying out practical investigations, test procedures or similar with evaluation, discussion and the student's own assessments and conclusions
and/or
Performing technical calculations with factual/technical appropriate presentation, and/or
Developing detailed drafts from a given subject area in the field of civil engineering

| **Course attendance time** (in mandatory hours - LVS) | | **Workload** (in hours) | | | |
|---|---|---|---|---|---|
| First examiner | 0.3 LVS | Course attendance time | | Home study | |
| Second examiner | 0.1 LVS | Lecture | | Course accompanying and exam preparation | 742 h |
| | - | Exercise | | | |
| | - | Other | 8 | | |
| **Total classroom time** | **0.4 LVS** | **Total workload** | | | **750 h** |

Optional extra

**Literature**
is listed in Stud.IP

March 2022

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