



Module Manual

Bachelor of Science (B.Sc.)

Civil- and Environmental Engineering

Cohort: Winter Term 2020

Updated: 30th April 2020

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Program description

Content

Program structure

Core qualification

Module M0687: Chemistry

Courses

Title	Typ	Hrs/wk	CP
Chemistry I+II (L0460)	Lecture	4	4
Chemistry I+II (L0475)	Recitation (large)	Section 2	2
Module Responsible	Dr. Dorothea Rechtenbach		
Admission Requirements	None		
Recommended Previous Knowledge	none		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p><i>Knowledge</i></p> <p>The students are able to name and to describe basic principles and applications of general chemistry (structure of matter, periodic table, chemical bonds), physical chemistry (aggregate states, separating processes, thermodynamics, kinetics), inorganic chemistry (acid/base, pH-value, salts, solubility, redox, metals) and organic chemistry (aliphatic hydrocarbons, functional groups, carbonyl compounds, aromates, reaction mechanisms, natural products, synthetic polymers). Furthermore students are able to explain basic chemical terms.</p> <p><i>Skills</i></p> <p>After successful completion of this module students are able to describe substance groups and chemical compounds. On this basis, they are capable of explaining, choosing and applying specific methods and various reaction mechanisms.</p> <p>Personal Competence</p> <p><i>Social Competence</i></p> <p>Students are able to take part in discussions on chemical issues and problems as a member of an interdisciplinary team. They can contribute to those discussion by their own statements.</p> <p><i>Autonomy</i></p> <p>After successful completion of this module students are able to solve chemical problems independently by defending proposed approaches with arguments. They can also document their approaches.</p>		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		
Credit points	6		
Course achievement	None		
Examination	Written exam		
Examination duration and	120 min		

scale	
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Core qualification: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0460: Chemistry I+II	
Typ	Lecture
Hrs/wk	4
CP	4
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56
Lecturer	Dr. Christoph Wutz
Language	DE
Cycle	WiSe
Content	<p>Chemistry I:</p> <ul style="list-style-type: none"> - Structure of matter - Periodic table - Electronegativity - Chemical bonds - Solid compounds and solutions - Chemistry of water - Chemical reactions and equilibria - Acid-base reactions - Redox reactions <p>Chemistry II:</p> <ul style="list-style-type: none"> - Simple compounds of carbon, aliphatic hydrocarbons, aromatic hydrocarbons, - Alcohols, phenols, ether, aldehydes, ketones, carbonic acids, ester, amines, amino acids, fats, sugars - Reaction mechanisms, radical reactions, nucleophilic substitution, elimination reactions, addition reaction - Practical applications and examples
Literature	<ul style="list-style-type: none"> - Blumenthal, Linke, Vieth: Chemie - Grundwissen für Ingenieure - Kickelbick: Chemie für Ingenieure (Pearson) - Mortimer: Chemie. Basiswissen der Chemie. - Brown, LeMay, Bursten: Chemie. Studieren kompakt. - Schmuck: Basisbuch Organische Chemie (Pearson)

Course L0475: Chemistry I+II	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Dorothea Rechtenbach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0889: Mechanics I (Statics)

Courses

Title	Typ	Hrs/wk	CP
Mechanics I (Statics) (L1001)	Lecture	2	3
Mechanics I (Statics) (L1002)	Recitation (small)	Section 2	2
Mechanics I (Statics) (L1003)	Recitation (large)	Section 1	1
Module Responsible	Prof. Robert Seifried		
Admission Requirements	None		
Recommended Previous Knowledge	Solid school knowledge in mathematics and physics.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p>The students can</p> <ul style="list-style-type: none"> describe the axiomatic procedure used in mechanical contexts; explain important steps in model design; present technical knowledge in stereostatics. 		
<i>Knowledge</i>			
<i>Skills</i>	<p>The students can</p> <ul style="list-style-type: none"> explain the important elements of mathematical / mechanical analysis and model formation, and apply it to the context of their own problems; apply basic statical methods to engineering problems; estimate the reach and boundaries of statical methods and extend them to be applicable to wider problem sets. 		
Personal Competence			
<i>Social Competence</i>	The students can work in groups and support each other to overcome difficulties.		
<i>Autonomy</i>	Students are capable of determining their own strengths and weaknesses and to organize their time and learning based on those.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70		
Credit points	6		
Course achievement	None		
Examination	Written exam		
Examination duration and scale	90 min		
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Core qualification: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Data Science: Specialisation Mechanics: Compulsory Digital Mechanical Engineering: Core qualification: Compulsory Logistics and Mobility: Core qualification: Compulsory Mechanical Engineering: Core qualification: Compulsory Mechatronics: Core qualification: Compulsory Orientierungsstudium: Core qualification: Elective Compulsory		

Course L1001: Mechanics I (Statics)

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Robert Seifried
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Tasks in Mechanics • Modelling and model elements • Vector calculus for forces and torques • Forces and equilibrium in space • Constraints and reactions, characterization of constraint systems • Planar and spatial truss structures • Internal forces and moments for beams and frames • Center of mass, volumn, area and line • Computation of center of mass by intergals, joint bodies • Friction (sliding and sticking) • Friction of ropes
Literature	<p>K. Magnus, H.H. Müller-Slany: Grundlagen der Technischen Mechanik. 7. Auflage, Teubner (2009). D. Gross, W. Hauger, J. Schröder, W. Wall: Technische Mechanik 1. 11. Auflage, Springer (2011).</p>

Course L1002: Mechanics I (Statics)

Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Robert Seifried
Language	DE
Cycle	WiSe
Content	<p>Forces and equilibrium Constraints and reactions Frames Center of mass Friction Internal forces and moments for beams</p>
Literature	<p>K. Magnus, H.H. Müller-Slany: Grundlagen der Technischen Mechanik. 7. Auflage, Teubner (2009). D. Gross, W. Hauger, J. Schröder, W. Wall: Technische Mechanik 1. 11. Auflage, Springer (2011).</p>

Course L1003: Mechanics I (Statics)	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Robert Seifried
Language	DE
Cycle	WiSe
Content	Forces and equilibrium Constraints and reactions Frames Center of mass Friction Internal forces and moments for beams
Literature	K. Magnus, H.H. Müller-Slany: Grundlagen der Technischen Mechanik. 7. Auflage, Teubner (2009). D. Gross, W. Hauger, J. Schröder, W. Wall: Technische Mechanik 1. 11. Auflage, Springer (2011).

Module M0850: Mathematics I

Courses

Title	Typ	Hrs/wk	CP
Analysis I (L1010)	Lecture	2	2
Analysis I (L1012)	Recitation (small)	Section 1	1
Analysis I (L1013)	Recitation (large)	Section 1	1
Linear Algebra I (L0912)	Lecture	2	2
Linear Algebra I (L0913)	Recitation (small)	Section 1	1
Linear Algebra I (L0914)	Recitation (large)	Section 1	1

Module Responsible	Prof. Anusch Taraz
Admission Requirements	None
Recommended Previous Knowledge	School mathematics
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
<i>Knowledge</i>	<ul style="list-style-type: none"> • Students can name the basic concepts in analysis and linear algebra. They are able to explain them using appropriate examples. • Students can discuss logical connections between these concepts. They are capable of illustrating these connections with the help of examples. • They know proof strategies and can reproduce them.
<i>Skills</i>	<ul style="list-style-type: none"> • Students can model problems in analysis and linear algebra with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods. • Students are able to discover and verify further logical connections between the concepts studied in the course. • For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results.
Personal Competence	
<i>Social Competence</i>	<ul style="list-style-type: none"> • Students are able to work together in teams. They are capable to use mathematics as a common language. • In doing so, they can communicate new concepts according to the needs of their cooperating partners. Moreover, they can design examples to check and deepen the understanding of their peers.
<i>Autonomy</i>	<ul style="list-style-type: none"> • Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in solving them. • Students have developed sufficient persistence to be able to work for longer

	periods in a goal-oriented manner on hard problems.
Workload in Hours	Independent Study Time 128, Study Time in Lecture 112
Credit points	8
Course achievement	None
Examination	Written exam
Examination duration and scale	60 min (Analysis I) + 60 min (Linear Algebra I)
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Core qualification: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Bioprocess Engineering: Core qualification: Compulsory Digital Mechanical Engineering: Core qualification: Compulsory Electrical Engineering: Core qualification: Compulsory Energy and Environmental Engineering: Core qualification: Compulsory Computational Science and Engineering: Core qualification: Compulsory Logistics and Mobility: Core qualification: Compulsory Mechanical Engineering: Core qualification: Compulsory Mechatronics: Core qualification: Compulsory Orientierungsstudium: Core qualification: Elective Compulsory Naval Architecture: Core qualification: Compulsory Process Engineering: Core qualification: Compulsory

Course L1010: Analysis I	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	Foundations of differential and integrational calculus of one variable <ul style="list-style-type: none"> • statements, sets and functions • natural and real numbers • convergence of sequences and series • continuous and differentiable functions • mean value theorems • Taylor series • calculus • error analysis • fixpoint iteration
Literature	<ul style="list-style-type: none"> • http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

Course L1012: Analysis I	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1013: Analysis I	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0912: Linear Algebra I	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Anusch Taraz, Prof. Marko Lindner
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • vectors: intuition, rules, inner and cross product, lines and planes • systems of linear equations: Gauß elimination, matrix product, inverse matrices, transformations, block matrices, determinants • orthogonal projection in \mathbb{R}^n, Gram-Schmidt-Orthonormalization
Literature	<ul style="list-style-type: none"> • T. Arens u.a. : Mathematik, Spektrum Akademischer Verlag, Heidelberg 2009 • W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 • W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 • G. Strang: Lineare Algebra, Springer-Verlag, 2003 • G. und S. Teschl: Mathematik für Informatiker, Band 1, Springer-Verlag, 2013

Course L0913: Linear Algebra I	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Anusch Taraz, Prof. Marko Lindner
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • vectors: intuition, rules, inner and cross product, lines and planes • general vector spaces: subspaces, Euclidean vector spaces • systems of linear equations: Gauß-elimination, matrix product, inverse matrices, transformations, LR-decomposition, block matrices, determinants
Literature	<ul style="list-style-type: none"> • T. Arens u.a. : Mathematik, Spektrum Akademischer Verlag, Heidelberg 2009 • W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 • W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994

Course L0914: Linear Algebra I	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Christian Seifert
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0577: Non-technical Courses for Bachelors

Module Responsible	Dagmar Richter
Admission Requirements	None
Recommended Previous Knowledge	None
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p>The Non-technical Academic Programms (NTA)</p> <p>imparts skills that, in view of the TUHH’s training profile, professional engineering studies require but are not able to cover fully. Self-reliance, self-management, collaboration and professional and personnel management competences. The department implements these training objectives in its teaching architecture, in its teaching and learning arrangements, in teaching areas and by means of teaching offerings in which students can qualify by opting for specific competences and a competence level at the Bachelor’s or Master’s level. The teaching offerings are pooled in two different catalogues for nontechnical complementary courses.</p> <p>The Learning Architecture</p> <p>consists of a cross-disciplinarily study offering. The centrally designed teaching offering ensures that courses in the nontechnical academic programms follow the specific profiling of TUHH degree courses.</p> <p>The learning architecture demands and trains independent educational planning as regards the individual development of competences. It also provides orientation knowledge in the form of “profiles”</p> <p>The subjects that can be studied in parallel throughout the student’s entire study program - if need be, it can be studied in one to two semesters. In view of the adaptation problems that individuals commonly face in their first semesters after making the transition from school to university and in order to encourage individually planned semesters abroad, there is no obligation to study these subjects in one or two specific semesters during the course of studies.</p> <p>Teaching and Learning Arrangements</p> <p>provide for students, separated into B.Sc. and M.Sc., to learn with and from each other across semesters. The challenge of dealing with interdisciplinarity and a variety of stages of learning in courses are part of the learning architecture and are deliberately encouraged in specific courses.</p> <p>Fields of Teaching</p> <p>are based on research findings from the academic disciplines cultural studies, social studies, arts, historical studies, migration studies, communication studies and sustainability research, and from engineering didactics. In addition, from the winter semester 2014/15 students on all Bachelor’s courses will have the opportunity to learn about business management and start-ups in a goal-oriented way.</p> <p>The fields of teaching are augmented by soft skills offers and a foreign language offer. Here, the focus is on encouraging goal-oriented communication skills, e.g. the skills required by outgoing engineers in international and intercultural situations.</p> <p>The Competence Level</p> <p>of the courses offered in this area is different as regards the basic training objective</p>

Knowledge

	<p>in the Bachelor's and Master's fields. These differences are reflected in the practical examples used, in content topics that refer to different professional application contexts, and in the higher scientific and theoretical level of abstraction in the B.Sc.</p> <p>This is also reflected in the different quality of soft skills, which relate to the different team positions and different group leadership functions of Bachelor's and Master's graduates in their future working life.</p> <p>Specialized Competence (Knowledge)</p> <p>Students can</p> <ul style="list-style-type: none"> • locate selected specialized areas with the relevant non-technical mother discipline, • outline basic theories, categories, terminology, models, concepts or artistic techniques in the disciplines represented in the learning area, • different specialist disciplines relate to their own discipline and differentiate it as well as make connections, • sketch the basic outlines of how scientific disciplines, paradigms, models, instruments, methods and forms of representation in the specialized sciences are subject to individual and socio-cultural interpretation and historicity, • Can communicate in a foreign language in a manner appropriate to the subject. <p>Professional Competence (Skills)</p> <p>In selected sub-areas students can</p> <ul style="list-style-type: none"> • apply basic methods of the said scientific disciplines, • question a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specialist discipline, • to handle simple questions in aforementioned scientific disciplines in a successful manner, • justify their decisions on forms of organization and application in practical questions in contexts that go beyond the technical relationship to the subject. <p>Personal Competence</p> <p>Personal Competences (Social Skills)</p> <p>Students will be able</p> <ul style="list-style-type: none"> • to learn to collaborate in different manner, • to present and analyze problems in the abovementioned fields in a partner or group situation in a manner appropriate to the addressees, • to express themselves competently, in a culturally appropriate and gender-sensitive manner in the language of the country (as far as this study-focus would be chosen), • to explain nontechnical items to auditorium with technical background knowledge. <p>Personal Competences (Self-reliance)</p> <p>Students are able in selected areas</p> <ul style="list-style-type: none"> • to reflect on their own profession and professionalism in the context of real-life fields of application • to organize themselves and their own learning processes • to reflect and decide questions in front of a broad education background • to communicate a nontechnical item in a competent way in written form or verbally • to organize themselves as an entrepreneurial subject country (as far as this study-focus would be chosen)
Workload in Hours	Depends on choice of courses

Credit points	6
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Courses

Information regarding lectures and courses can be found in the corresponding module handbook published separately.

Module M0580: Principles of Building Materials and Building Physics

Courses

Title	Typ	Hrs/wk	CP
Building Physics (L0217)	Lecture	2	2
Building Physics (L0219)	Recitation (large)	Section 1	1
Building Physics (L0247)	Recitation (small)	Section 1	1
Principles of Building Materials (L0215)	Lecture	2	2

Module Responsible	Prof. Frank Schmidt-Döhl
Admission Requirements	None
Recommended Previous Knowledge	Knowledge of physics, chemistry and mathematics from school
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
<i>Knowledge</i>	The students are able to identify fundamental effects of action to materials and structures, to explain different types of mechanical behaviour, to describe the structure of building materials and the correlations between structure and other properties, to show methods of joining and of corrosion processes and to describe the most important regularities and properties of building materials and structures and their measurement in the field of protection against moisture, coldness, fire and noise.
<i>Skills</i>	The students are able to work with the most important standardized methods and regularities in the field of moisture protection, the German regulation for energy saving, fire protection and noise protection in the case of a small building.
Personal Competence	
<i>Social Competence</i>	The students are able to support each other to learn the very extensive specialist knowledge.
<i>Autonomy</i>	The students are able to make the timing and the operation steps to learn the specialist knowledge of a very extensive field.
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	2 h written exam
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory Orientierungsstudium: Core qualification: Elective Compulsory Technomathematics: Specialisation III. Engineering Science: Elective Compulsory

Course L0217: Building Physics	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	Heat transport, thermal bridges, balances of energy consumption, German regulation for energy saving, heat protection in summer, moisture transport, condensation moisture, protection against mold, fire protection, noise protection
Literature	Fischer, H.-M. ; Freymuth, H.; Häupl, P.; Homann, M.; Jenisch, R.; Richter, E.; Stohrer, M.: Lehrbuch der Bauphysik. Vieweg und Teubner Verlag, Wiesbaden, ISBN 978-3-519-55014-3

Course L0219: Building Physics	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0247: Building Physics	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0215: Principles of Building Materials	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	WiSe
Content	<p>Structure of building materials Effects of action Fundamentals of mechanical behaviour</p> <p>Material testing</p> <p>Principles of metals</p> <p>Joining methods</p>
Literature	<p>Wendehorst, R.: Baustoffkunde. ISBN 3-8351-0132-3</p> <p>Scholz, W.: Baustoffkenntnis. ISBN 3-8041-4197-8</p>

Module M0590: Building Materials and Building Chemistry				
Courses				
Title		Typ	Hrs/wk	CP
Building Materials and Building Chemistry (L0248)		Lecture	4	4
Building Materials and Building Chemistry (L0249)		Recitation (small)	Section 1	2
Module Responsible	Prof. Frank Schmidt-Döhl			
Admission Requirements	None			
Recommended Previous Knowledge	Module Principles of Building Materials and Building Physics			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
<i>Knowledge</i>	The students are able to explain the most important components, the manufacture, the structure, the most important characteristics of the mechanical behaviour and the corrosion behaviour, the material testing and the fields of utilization of all relevant building materials.			
<i>Skills</i>	The students are able to assess the usability of building materials for different applications and to select building materials according to their specific advantages and disadvantages. The students are able to prepare the mixture of a normal type concrete and to consider the mixture in respect to the actual rules and the connections between the characteristic concrete parameters. They are able to select suitable materials and mixtures to avoid damage processes.			
Personal Competence				
<i>Social Competence</i>	The students are able to support each other to learn the very extensive specialist knowledge in learning groups and to carry out exercises in small groups in the lab.			
<i>Autonomy</i>	The students are able to make the timing and the operation steps to learn the specialist knowledge of a very extensive field.			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points	6			
Course achievement	Compulsory	Bonus	Form	Description
	No	10 %	Presentation	
Examination	Written exam			
Examination duration and scale	2 h written exam			
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory Orientierungsstudium: Core qualification: Elective Compulsory			

Course L0248: Building Materials and Building Chemistry	
Typ	Lecture
Hrs/wk	4
CP	4
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56
Lecturer	Prof. Frank Schmidt-Döhl
Language	DE
Cycle	SoSe
Content	Cementing materials, aggregates, admixtures and other components in mortar and concrete, concrete, durability of cement bonded materials, repair of concrete structures, steel, cast iron, non-ferrous metals, metal corrosion, timber, plastics, natural stone, synthetic stones, mortar, masonry, glass, bitumen
Literature	Wendehorst, R.: Baustoffkunde. ISBN 3-8351-0132-3 Scholz, W.: Baustoffkenntnis. ISBN 3-8041-4197-8 Henning, O.; Knöfel, D.: Baustoffchemie. ISBN 3-345-00799-1 Knoblauch, H.; Schneider, U.: Bauchemie. ISBN 3-8041-5174-4

Course L0249: Building Materials and Building Chemistry	
Typ	Recitation Section (small)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Frank Schmidt-Döhl, André Rössler
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0696: Mechanics II: Mechanics of Materials

Courses

Title	Typ	Hrs/wk	CP	
Mechanics II (L0493)	Lecture	2	2	
Mechanics II (L0494)	Recitation (small)	Section 2	2	
Mechanics II (L1691)	Recitation (large)	Section 2	2	
Module Responsible	Prof. Christian Cyron			
Admission Requirements	None			
Recommended Previous Knowledge	Mechanics I			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence	<p><i>Knowledge</i> The students name the fundamental concepts and laws of statics such as stresses, strains, Hooke's linear law.</p> <p>The students apply the mathematical/mechanical analysis and modeling.</p> <p><i>Skills</i> The students apply the fundamental methods of elasto statics to simply engineering problems.</p> <p>The students estimate the validity and limitations of the introduced methods.</p>			
Personal Competence				
<i>Social Competence</i>				-
<i>Autonomy</i>				-
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Core qualification: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Data Science: Specialisation Mechanics: Compulsory Digital Mechanical Engineering: Core qualification: Compulsory Logistics and Mobility: Core qualification: Compulsory Mechanical Engineering: Core qualification: Compulsory Mechatronics: Core qualification: Compulsory Orientierungsstudium: Core qualification: Elective Compulsory Naval Architecture: Core qualification: Compulsory			

Course L0493: Mechanics II	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Christian Cyron
Language	DE
Cycle	SoSe
Content	stresses and strains Hooke's law tension and compression torsion bending stability buckling energy methods
Literature	<ul style="list-style-type: none"> • Gross, D., Hauger, W., Schröder, J., Wall, W.A.: Technische Mechanik 1, Springer • Gross, D., Hauger, W., Schröder, J., Wall, W.A.: Technische Mechanik 2 Elastostatik, Springer

Course L0494: Mechanics II	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Christian Cyron
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1691: Mechanics II	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Christian Cyron, Dr. Konrad Schneider
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0660: Construction Industry and Construction Management

Courses

Title	Typ	Hrs/wk	CP
Construction Management (L0396)	Lecture	2	2
Construction Management (L0397)	Recitation (large)	Section 1	2
Law of Building Contracts (L0408)	Lecture	1	1
Environmental Law (L0346)	Lecture	1	1

Module Responsible	Prof. Jürgen Grabe
Admission Requirements	None
Recommended Previous Knowledge	none
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p>After successful completion of the module, students are able to</p> <ul style="list-style-type: none"> • understand basic knowledge of construction management, • choose appropriate methods of construction project management to solve problems, • capture basic structures and antagonisms of European environmental legislation, • locate and apply relevant environmental regulations • implement any environmental regulation to the realisation of an construction project and to capture the significance for the civil engineer • recognize basic structures of general civil and construction law as well as standards for construction works • capture the content of contracts which are important for building design and execution.
<i>Knowledge</i>	
<i>Skills</i>	
Personal Competence	
<i>Social Competence</i>	
<i>Autonomy</i>	
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	100 minutes
Assignment for the Following Curricula	Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory

Course L0396: Construction Management	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Project development • Project management • Announcement • Order acquisition • Project execution • Project supervision
Literature	<ul style="list-style-type: none"> • Vorlesungsskript, s. www.tuhh.de/gbt • Baugeräteliste BGL • Honorarordnung für Architekten und Ingenieure HOAI • Verdingungsordnung im Bauwesen VOB mit Kommentaren

Course L0397: Construction Management	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0408: Law of Building Contracts	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Schmeel
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Detecting the legal foundations and connections of construction law • Awareness of legal "Control points" in the construction contract and the construction process • Construction contract law according to the BGB and VOB • public procurement according to national and EU laws • Engineers law
Literature	<ul style="list-style-type: none"> • Axel Maser, Baurecht nach BGB und VOB/B Grundlagenwissen für Architekten und Ingenieure, Id Verlag 1., Auflage 2005, 28,00 € • Schmeel ATB Baurecht, Auflage 2002, 34,80 € • Werner / Pastor, Der Bauprozess 11. Auflage 2005, 149,00 €

Course L0346: Environmental Law	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Friederike Mechel
Language	DE
Cycle	SoSe
Content	<p>The lecture focusses on:</p> <ul style="list-style-type: none"> • Structure of Environmental Legislation in Europe and Germany • Important international, European and German laws/legal regulations (Water Framework Directive, IED, etc.) • Interactions between Environmental Laws and Technical Standards
Literature	<ul style="list-style-type: none"> • Erbguth, Wilfried; Schlacke, Sabine, Umweltrecht, 6. Auflage 2016 • Gesetzessammlung Umweltrecht, 26. Auflage 2016 (Beck Texte im dtv)

Module M0851: Mathematics II

Courses

Title	Typ	Hrs/wk	CP
Analysis II (L1025)	Lecture	2	2
Analysis II (L1026)	Recitation (large)	Section 1	1
Analysis II (L1027)	Recitation (small)	Section 1	1
Linear Algebra II (L0915)	Lecture	2	2
Linear Algebra II (L0916)	Recitation (small)	Section 1	1
Linear Algebra II (L0917)	Recitation (large)	Section 1	1

Module Responsible	Prof. Anusch Taraz
Admission Requirements	None
Recommended Previous Knowledge	Mathematics I
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
<i>Knowledge</i>	<ul style="list-style-type: none"> • Students can name further concepts in analysis and linear algebra. They are able to explain them using appropriate examples. • Students can discuss logical connections between these concepts. They are capable of illustrating these connections with the help of examples. • They know proof strategies and can reproduce them.
<i>Skills</i>	<ul style="list-style-type: none"> • Students can model problems in analysis and linear algebra with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods. • Students are able to discover and verify further logical connections between the concepts studied in the course. • For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results.
Personal Competence	
<i>Social Competence</i>	<ul style="list-style-type: none"> • Students are able to work together in teams. They are capable to use mathematics as a common language. • In doing so, they can communicate new concepts according to the needs of their cooperating partners. Moreover, they can design examples to check and deepen the understanding of their peers.
<i>Autonomy</i>	<ul style="list-style-type: none"> • Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in solving them. • Students have developed sufficient persistence to be able to work for longer

	periods in a goal-oriented manner on hard problems.
Workload in Hours	Independent Study Time 128, Study Time in Lecture 112
Credit points	8
Course achievement	None
Examination	Written exam
Examination duration and scale	60 min (Analysis II) + 60 min (Linear Algebra II)
Assignment for the Following Curricula	<p>General Engineering Science (German program, 7 semester): Core qualification: Compulsory</p> <p>Civil- and Environmental Engineering: Core qualification: Compulsory</p> <p>Bioprocess Engineering: Core qualification: Compulsory</p> <p>Digital Mechanical Engineering: Core qualification: Compulsory</p> <p>Electrical Engineering: Core qualification: Compulsory</p> <p>Energy and Environmental Engineering: Core qualification: Compulsory</p> <p>Computational Science and Engineering: Core qualification: Compulsory</p> <p>Logistics and Mobility: Core qualification: Compulsory</p> <p>Mechanical Engineering: Core qualification: Compulsory</p> <p>Mechatronics: Core qualification: Compulsory</p> <p>Orientierungsstudium: Core qualification: Elective Compulsory</p> <p>Naval Architecture: Core qualification: Compulsory</p> <p>Process Engineering: Core qualification: Compulsory</p>

Course L1025: Analysis II	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • power series and elementary functions • interpolation • integration (proper integrals, fundamental theorem, integration rules, improper integrals, parameter dependent integrals) • applications of integration (volume and surface of bodies of revolution, lines and arc length, line integrals) • numerical quadrature • periodic functions
Literature	<ul style="list-style-type: none"> • http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

Course L1026: Analysis II	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1027: Analysis II	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0915: Linear Algebra II	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Anusch Taraz, Prof. Marko Lindner
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • general vector spaces: subspaces, Euclidean vector spaces • linear mappings: basis transformation, orthogonal projection, orthogonal matrices, householder matrices • linear regression: normal equations, linear discrete approximation • eigenvalues: diagonalising matrices, normal matrices, symmetric and Hermite matrices • system of linear differential equations • matrix factorizations: LR-decomposition, QR-decomposition, Schur decomposition, Jordan normal form, singular value decomposition
Literature	<ul style="list-style-type: none"> • T. Arens u.a. : Mathematik, Spektrum Akademischer Verlag, Heidelberg 2009 • W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 • W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 • G. Strang: Lineare Algebra, Springer-Verlag, 2003 • G. und S. Teschl: Mathematik für Informatiker, Band 1, Springer-Verlag, 2013

Course L0916: Linear Algebra II	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Anusch Taraz, Prof. Marko Lindner
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • linear mappings: basis transformation, orthogonal projection, orthogonal matrices, householder matrices • linear regression: QR-decomposition, normal equations, linear discrete approximation • eigenvalues: diagonalising matrices, normal matrices, symmetric and Hermite matrices, Jordan normal form, singular value decomposition • system of linear differential equations
Literature	<ul style="list-style-type: none"> • W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994 • W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994

Course L0917: Linear Algebra II	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Anusch Taraz, Prof. Marko Lindner, Dr. Christian Seifert
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M1627: Water and Environment

Courses

Title	Typ	Hrs/wk	CP
Project on Water, Environment, Traffic (L2462)	Project-/problem-based Learning	2	3
Water in the Environment (L2461)	Lecture	2	3
Module Responsible	Prof. Mathias Ernst		
Admission Requirements	None		
Recommended Previous Knowledge	Basic knowledge of chemistry		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p><i>Knowledge</i> Students can define generic material interactions between the environmental media. They can demonstrate their knowledge about natural as well as anthropogenic materials. They are capable of explaining the natural condition of waters and other environmental media.</p> <p><i>Skills</i> Students are able to research environment-specific aspects of civil engineering independent. They can present their findings using accredited academic media (e.g. posters) and can give a short summary including scientific references.</p> <p>Personal Competence</p> <p><i>Social Competence</i> Students can fulfil a complex environment-related assignment in the field of civil engineering by working in a team.</p> <p><i>Autonomy</i></p>		
<i>Knowledge</i>			
<i>Skills</i>			
Personal Competence			
<i>Social Competence</i>	Students can fulfil a complex environment-related assignment in the field of civil engineering by working in a team.		
<i>Autonomy</i>			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Subject theoretical and practical work		
Examination duration and scale	Written-theoretical part and project work		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Core qualification: Compulsory		

Course L2462: Project on Water, Environment, Traffic	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dozenten des SD B
Language	DE
Cycle	SoSe
Content	Lecturers of Civil Engineering provide duties on environmentally relevant fields of civil engineering for small student groups (max. 4 students).
Literature	aufgabenspezifisch / according to corresponding tasks

Course L2461: Water in the Environment	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Mathias Ernst, Dozenten des SD B
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Basics of global/regional Water Cycle • quality of water • natural/anthropogenic water ingredients • Basics water science • water legislation (EU/D)
Literature	<p>Schwoerbel, J. 2005: Einführung in die Limnologie. Heidelberg: Elsevier</p> <p>Grohmann, A. u. a. 2011: Wasser. Berlin: de Gruyter</p> <p>Kluth, W. & Schmeddinck, U. 2013: Umweltrecht: Ein Lehrbuch. Wiesbaden: Springer</p>

Module M0728: Hydromechanics and Hydrology

Courses

Title	Typ	Hrs/wk	CP
Hydrology (L0909)	Lecture	1	1
Hydrology (L0956)	Project-/problem-based Learning	1	1
Hydromechanics (L0615)	Lecture	2	2
Hydromechanics (L0616)	Project-/problem-based Learning	1	2

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	Mathematics I, II and III Mechanics I und II
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p><i>Knowledge</i></p> <p>The students are able to define the basic terms of hydromechanics, hydrology groundwater hydrology and water management. They are able to derive the basic formulations of i) hydrostatics, ii) kinematics of flows and iii) conservation laws and to describe and quantify the relevant processes of the hydrological water cycle. Besides, the students can describe the main aspects of rainfall-run-off-modelling and of established reservoir / storage models as well as the concepts of the determination of a unit-hydrograph.</p> <p><i>Skills</i></p> <p>The students are able to apply the fundamental formulations of hydromechanics to basic practical problems. Furthermore, they are able to run, explain and document basic hydraulic experiments.</p> <p>Besides, they are able to apply basic hydrological approaches and methods to simple hydrological problems. The students have the capability to exemplarily apply simple reservoir/storage models and a unit-hydrograph to given problems.</p> <p>In addition, the basic concepts of field-measurements of hydrological and hydrodynamic values can be described and the students are able to perform, analyze and assess respective measurements.</p> <p style="text-align: center;">Personal Competence</p> <p><i>Social Competence</i></p> <p>The students are able to work in groups in a goal-orientated, structured manner. They can explain their results sustainably in plenary sessions by use of peer learning approaches. Furthermore, they are able to prepare and present technical presentations for given topics in groups.</p> <p><i>Autonomy</i></p> <p>Students are capable of organising their individual work flow to contribute to the conduct of experiments and to present discipline-specific knowledge. They can provide each other with feedback and suggestions on their results. They are capable of reflecting their study techniques and learning strategy on an individual basis.</p>
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	None

Examination	Written exam
Examination duration and scale	120 minutes
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

Course L0909: Hydrology	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	<p>Introduction to basics of hydrology and groundwater hydrology:</p> <ul style="list-style-type: none"> • Hydrological cycle • Data acquisition in hydrology • Data analyses and statistical assessment • Statistics of extremes • Regionalization methods for hydrological values • rainfall-run-off modelling on the basis of a unit hydrograph concept
Literature	<p>Maniak, U. (2017). Hydrologie und Wasserwirtschaft: Eine Einführung für Ingenieure. Springer Vieweg.</p> <p>Skript "Hydrologie und Gewässerkunde"</p>

Course L0956: Hydrology	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	<p>Introduction to basics of Hydrology:</p> <ul style="list-style-type: none"> • Hydrological cycle • Data acquisition • Data analyses and statistical assessment • Statistics of extremes • Regionalization methods for hydrological values <p>Rainfall-run-off modelling on the basis of a unit hydrograph concepts</p>
Literature	<p>Maniak, Hydrologie und Wasserwirtschaft, Eine Einführung für Ingenieure, Springer</p> <p>Skript Hydrologie und Gewässerkunde</p>

Course L0615: Hydromechanics	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	<p>Fundamentals of Hydromechanics</p> <ul style="list-style-type: none"> • Characteristics of fluids • Hydrostatics • Kinematics of flows, laminar and turbulent flows • Conservation laws <ul style="list-style-type: none"> ◦ Conservation of mass ◦ Conservation of Energy ◦ Momentum Equation • Application of conservation laws to flow conditions
Literature	<p>Skript zur Vorlesung Hydromechanik/Hydraulik, Kapitel 1-2</p> <p>E-Learning Werkzeug: Hydromechanik und hydraulik (Link): (http://www.tu-harburg.de/ ... hydraulik_tool/index.html)</p> <p>Truckenbrodt, E.: Lehrbuch der angewandten Fluidmechanik, Springer Verlag, Berlin, 1998.</p> <p>Truckenbrodt, E.: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide / Fluidmechanik, Springer Verlag, Berlin, 1996.</p>

Course L0616: Hydromechanics	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0740: Structural Analysis I				
Courses				
Title		Typ	Hrs/wk	CP
Structural Analysis I (L0666)		Lecture	2	3
Structural Analysis I (L0667)		Recitation (large)	Section 2	3
Module Responsible	Prof. Uwe Starossek			
Admission Requirements	None			
Recommended Previous Knowledge	Mechanics I, Mathematics I			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
<i>Knowledge</i>	After successfully completing this module, students can express the basic aspects of linear frame analysis of statically determinate systems.			
<i>Skills</i>	After successful completion of this module, the students are able to distinguish between statically determinate and indeterminate structures. They are able to analyze state variables and to construct influence lines of statically determinate plane and spatial frame and truss structures.			
Personal Competence	Students can			
<i>Social Competence</i>	<ul style="list-style-type: none"> • participate in subject-specific and interdisciplinary discussions, • defend their own work results in front of others • promote the scientific development of colleagues • Furthermore, they can give and accept professional constructive criticism 			
<i>Autonomy</i>	The students are able work in-term homework assignments. Due to the in-term feedback, they are enabled to self-assess their learning progress during the lecture period, already.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Course achievement	Compulsory	Bonus	Form	Description
	No	10 %	Written elaboration	Hausübungen mit Testat, betreut durch Studentische Tutoren (Tutorium)
Examination	Written exam			
Examination duration and scale	90 Minuten			
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory Technomathematics: Specialisation III. Engineering Science: Elective Compulsory			

Course L0666: Structural Analysis I	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	WiSe
Content	<p>Statically determinate structural systems</p> <ul style="list-style-type: none"> • basics: statically determinacy, equilibrium, method of sections • forces: determination of support reactions and internal forces • influence lines of forces • displacements: calculation of discrete displacements and rotations, calculation of deflection curves • principle of virtual displacements and virtual forces • work-energy theorem • differential equation of beam
Literature	Krätzig, W.B., Harte, R., Meskouris, K., Wittek, U.: Tragwerke 1 - Theorie und Berechnungsmethoden statisch bestimmter Stabtragwerke. 4. Aufl., Springer, Berlin, 1999.

Course L0667: Structural Analysis I	
Typ	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0853: Mathematics III

Courses

Title	Typ	Hrs/wk	CP
Analysis III (L1028)	Lecture	2	2
Analysis III (L1029)	Recitation (small)	Section 1	1
Analysis III (L1030)	Recitation (large)	Section 1	1
Differential Equations 1 (Ordinary Differential Equations) (L1031)	Lecture	2	2
Differential Equations 1 (Ordinary Differential Equations) (L1032)	Recitation (small)	Section 1	1
Differential Equations 1 (Ordinary Differential Equations) (L1033)	Recitation (large)	Section 1	1

Module Responsible	Prof. Anusch Taraz
Admission Requirements	None
Recommended Previous Knowledge	Mathematics I + II
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
<i>Knowledge</i>	<ul style="list-style-type: none"> • Students can name the basic concepts in the area of analysis and differential equations. They are able to explain them using appropriate examples. • Students can discuss logical connections between these concepts. They are capable of illustrating these connections with the help of examples. • They know proof strategies and can reproduce them.
<i>Skills</i>	<ul style="list-style-type: none"> • Students can model problems in the area of analysis and differential equations with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods. • Students are able to discover and verify further logical connections between the concepts studied in the course. • For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results.
Personal Competence	
<i>Social Competence</i>	<ul style="list-style-type: none"> • Students are able to work together in teams. They are capable to use mathematics as a common language. • In doing so, they can communicate new concepts according to the needs of their cooperating partners. Moreover, they can design examples to check and deepen the understanding of their peers.
<i>Autonomy</i>	<ul style="list-style-type: none"> • Students are capable of checking their understanding of complex concepts on their own. They can specify open questions precisely and know where to get help in solving them. • Students have developed sufficient persistence to be able to work for longer

	periods in a goal-oriented manner on hard problems.
Workload in Hours	Independent Study Time 128, Study Time in Lecture 112
Credit points	8
Course achievement	None
Examination	Written exam
Examination duration and scale	60 min (Analysis III) + 60 min (Differential Equations 1)
Assignment for the Following Curricula	<p>General Engineering Science (German program, 7 semester): Core qualification: Compulsory</p> <p>Civil- and Environmental Engineering: Core qualification: Compulsory</p> <p>Bioprocess Engineering: Core qualification: Compulsory</p> <p>Computer Science: Core qualification: Compulsory</p> <p>Data Science: Core qualification: Compulsory</p> <p>Digital Mechanical Engineering: Core qualification: Compulsory</p> <p>Electrical Engineering: Core qualification: Compulsory</p> <p>Energy and Environmental Engineering: Core qualification: Compulsory</p> <p>Engineering Science: Core qualification: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Core qualification: Compulsory</p> <p>Computational Science and Engineering: Core qualification: Compulsory</p> <p>Mechanical Engineering: Core qualification: Compulsory</p> <p>Mechatronics: Core qualification: Compulsory</p> <p>Naval Architecture: Core qualification: Compulsory</p> <p>Process Engineering: Core qualification: Compulsory</p>

Course L1028: Analysis III	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	<p>Main features of differential and integrational calculus of several variables</p> <ul style="list-style-type: none"> • Differential calculus for several variables • Mean value theorems and Taylor's theorem • Maximum and minimum values • Implicit functions • Minimization under equality constraints • Newton's method for multiple variables • Double integrals over general regions • Line and surface integrals • Theorems of Gauß and Stokes
Literature	<ul style="list-style-type: none"> • http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

Course L1029: Analysis III	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1030: Analysis III	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1031: Differential Equations 1 (Ordinary Differential Equations)	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	<p>Main features of the theory and numerical treatment of ordinary differential equations</p> <ul style="list-style-type: none"> • Introduction and elementary methods • Existence and uniqueness of initial value problems • Linear differential equations • Stability and qualitative behaviour of the solution • Boundary value problems and basic concepts of calculus of variations • Eigenvalue problems • Numerical methods for the integration of initial and boundary value problems • Classification of partial differential equations
Literature	<ul style="list-style-type: none"> • http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

Course L1032: Differential Equations 1 (Ordinary Differential Equations)	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L1033: Differential Equations 1 (Ordinary Differential Equations)	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dozenten des Fachbereiches Mathematik der UHH
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0706: Geotechnics I				
Courses				
Title		Typ	Hrs/wk	CP
Soil Mechanics (L0550)		Lecture	2	2
Soil Mechanics (L0551)		Recitation (large)	Section 2	2
Soil Mechanics (L1493)		Recitation (small)	Section 2	2
Module Responsible	Prof. Jürgen Grabe			
Admission Requirements	None			
Recommended Previous Knowledge	Modules : <ul style="list-style-type: none"> • Mechanics I-II 			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence	The students know the basics of soil mechanics as the structure and characteristics of soil, stress distribution due to weight, water or structures, consolidation and settlement calculations, as well as failure of the soil due to ground- or slope failure. After the successful completion of the module the students should be able to describe the mechanical properties and to evaluate them with the help of geotechnical standard tests. They can calculate stresses and deformation in the soils due to weight or influence of structures. They are able to prove the usability (settlements) for shallow foundations.			
<i>Knowledge</i>				
<i>Skills</i>				
Personal Competence				
<i>Social Competence</i>				
<i>Autonomy</i>				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Course achievement	Compulsory	Bonus	Form	Description
	No	20 %	Attestation	
Examination	Written exam			
Examination duration and scale	60 minutes			
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory Technomathematics: Specialisation III. Engineering Science: Elective Compulsory			

Course L0550: Soil Mechanics	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	<ul style="list-style-type: none"> • Structure of the soil • Ground surveying • Composition and properties of the soil • Groundwater • One-dimensional compression • Spreading of stresses • Settlement calculation • Consolidation • Shear strength • Earth pressure • Slope failure • Ground failure • Suspension based earth trenches
Literature	<ul style="list-style-type: none"> • Vorlesungsumdruck, s. ww.tu-harburg.de/gbt • Grabe, J. (2004): Bodenmechanik und Grundbau • Gudehus, G. (1981): Bodenmechanik • Kolymbas, D. (1998): Geotechnik - Bodenmechanik und Grundbau • Grundbau-Taschenbuch, Teil 1, aktuelle Auflage

Course L0551: Soil Mechanics	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1493: Soil Mechanics	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0579: Structural Design

Courses

Title	Typ	Hrs/wk	CP
Basics in Structural Design (L0209)	Project-/problem-based Learning	2	4
Basics of Structural Design (L0205)	Lecture	2	1
Basics in Structural Design (L0208)	Recitation (large)	Section 1	1
Module Responsible	Thomas Kölzer		
Admission Requirements	None		
Recommended Previous Knowledge	Contents of module "Principles of Building Materials and Building Physics"		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p>After attending the "Building Construction" module students are able</p> <ul style="list-style-type: none"> to define the basics of building regulations law to explain load effects and associated concepts to describe overriding conventions of the construction industry to specify typical building components to distinguish between different possibilities of load bearing behaviour and risks due to lack of stability to explain the main objectives of fire control. <p>After the successful completion of the "Building Construction" module, students will be able</p> <ul style="list-style-type: none"> to apply industry-specific drawing conventions carry out preliminary dimensioning of basic building components develop stability and foundation concepts use BIM software and to design and construct standard cross-sections due to structural aspects. 		
<i>Knowledge</i>			
<i>Skills</i>			
Personal Competence	<p>After attending the course students are able</p> <ul style="list-style-type: none"> to work in a team and to present the results of the team work to use the feedback from other students to improve the own results to give a feedback to other students in a constructive manner <p>After attending the course students are able</p> <ul style="list-style-type: none"> to control and improve their knowledge with the help of weekly presentations (lecture room) and tests (STUD.IP) to divide the main task in different parts, to deduce the needed knowledge and to schedule the different work steps 		
<i>Social Competence</i>			
<i>Autonomy</i>			
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70		
Credit points	6		
Course	None		

achievement	
Examination	Subject theoretical and practical work
Examination duration and scale	Desing, Construction and preliminary design in a written form
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory

Course L0209: Basics in Structural Design	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Thomas Kölzer
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Constructing a small individuell building in groups of 4 persons • Analysing the informations and the contents of development plans and building regulation laws • Design of building components and approving of the functionality (sealing, facades, roofs) • Design and approve of the functionality of the component interconnections • Proofing and assessing of moisture behaviour, energy consumption, acoustic protection and fire control • Assessing the building stability • Basics of building services • Each week the results of different work steps are presented in oral and written form
Literature	<p>Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung</p> <p>Neumann, Dietrich (Hestermann, Ulf.; Rongen, Ludwig.; Weinbrenner, Ulrich) Frick/Knöll Baukonstruktionslehre 1 / [Internet-Ressource] ISBN: 978-3-8351-9121-1 Wiesbaden : B.G. Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2006</p> <p>Frick[Begr.], Otto (Knöll[Begr.], Karl.; Neumann, Dietrich.; Hestermann, Ulf.; Rongen, Ludwig.) Baukonstruktionslehre 2 / [Internet-Ressource] ISBN: 978-3-8348-9486-1 Wiesbaden : Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008</p> <p>Dierks, Klaus (Wormuth, Rüdiger.) Baukonstruktion : [Einführung, Grundlagen, Gründungen, technische Ausrüstung, Wände, Geschosdecken, Treppen, Dächer, Fenster, Türen, Konstruktionsatlas] ISBN: 3804150454 (Gb.) ISBN: 978-3-8041-5045-4 Neuwied : Werner, 2007</p> <p>Schneider, Klaus-Jürgen (Goris, Alfons.; Berner, Klaus) Bautabellen für Ingenieure : mit Berechnungshinweisen und Beispielen ; [auf CD-ROM: Stabwerksprogramm IQ 100 B, Tools für den konstr. Ingenieurbau, Fachinformationen, Normentexte] ISBN: 3804152287 Neuwied : Werner, 2006</p>

Wendehorst, Reinhard (Wetzell, Otto W.,; Baumgartner, Herwig,; Deutsches Institut für Normung)

Wendehorst Bautechnische Zahlentafeln

ISBN: 978-3-8351-0055-8 ISBN: 3835100556

Stuttgart [u.a.] : Teubner Berlin [u.a.] : Beuth, 2007

Neufert, Ernst (Kister, Johannes)

Bauentwurfslehre : Grundlagen, Normen, Vorschriften über Anlage, Bau, Gestaltung, Raumbedarf, Raumbeziehungen, Maße für Gebäude, Räume, Einrichtungen, Geräte mit dem Menschen als Maß und Ziel ; Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernenden

ISBN: 978-3-8348-0732-8 (GB.)

Wiesbaden : Vieweg + Teubner, 2009

Course L0205: Basics of Structural Design	
Typ	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Thomas Kölzer
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Basics of building regulation laws • Foundation of buildings • Sealing of basements • facades • Ceilings • Roofs • Windows, doors and post-and-beam constructions • Staircases • Basics of structural engineering design • Structural fire prevention • Optional tests on STUD.IP
Literature	<p>Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung</p> <p>Schneider Bautabellen (Hrsg. A. Albert) 23., überarbeitete Aufl. ISBN 978-3-8462-0880-9 Reguvis Fachmedien GmbH, 2018</p> <p>Neumann, Dietrich (Hestermann, U.; Rongen, L.; Weinbrenner, U.) Frick/Knöll Baukonstruktionslehre 1 / [Internet-Ressource] ISBN: 978-3-8351-9121-1 Wiesbaden: Vieweg+Teubner Verlag, 2006</p> <p>Frick, Otto (Knöll, K.; Neumann, D.; Hestermann, U.; Rongen, L.) Baukonstruktionslehre 2 / [Internet-Ressource] ISBN: 978-3-8348-9486-1 Wiesbaden: Vieweg+Teubner Verlag, 2008</p> <p>Dierks, Klaus (Wormuth, R.) Baukonstruktion ISBN: 978-3-8041-5045-4 Neuwied : Werner, 2007</p> <p>Neufert, Ernst (Kister, J.) Bauentwurfslehre (42. Aufl.) ISBN: 978-3-8348-0732-8 Wiesbaden : Vieweg + Teubner, 2018</p> <p>Wendehorst, Reinhard (Wetzell, O. W.,; Baumgartner, H.,) Wendehorst Bautechnische Zahlentafeln ISBN: 978-3-8351-0055-8 Stuttgart/Berlin: Teubner/Beuth, 2018</p>

Course L0208: Basics in Structural Design	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14

Lecturer	Thomas Kölzer
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Constructing a small individuell building in groups of 4 persons • Analysing the informations and the contents of development plans and building regulation laws • Design of building components and approving of the functionality (sealing, facades, roofs) • Design and approve of the functionality of the component interconnections • Proofing and assessing of moisture behaviour, energy consumption, acoustic protection and fire control • Assessing the building stability • Basics of building services • Each week the results of different work steps are presented in oral and written form
Literature	<p>Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung</p> <p>Neumann, Dietrich (Hestermann, Ulf.; Rongen, Ludwig.; Weinbrenner, Ulrich) Frick/Knöll Baukonstruktionslehre 1 / [Internet-Ressource] ISBN: 978-3-8351-9121-1 Wiesbaden : B.G. Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2006</p> <p>Frick[Begr.], Otto (Knöll[Begr.], Karl.; Neumann, Dietrich.; Hestermann, Ulf.; Rongen, Ludwig.) Baukonstruktionslehre 2 / [Internet-Ressource] ISBN: 978-3-8348-9486-1 Wiesbaden : Vieweg+Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2008</p> <p>Dierks, Klaus (Wormuth, Rüdiger.) Baukonstruktion : [Einführung, Grundlagen, Gründungen, technische Ausrüstung, Wände, Geschossdecken, Treppen, Dächer, Fenster, Türen, Konstruktionsatlas] ISBN: 3804150454 (Gb.) ISBN: 978-3-8041-5045-4 Neuwied : Werner, 2007</p> <p>Schneider, Klaus-Jürgen (Goris, Alfons.; Berner, Klaus) Bautabellen für Ingenieure : mit Berechnungshinweisen und Beispielen ; [auf CD-ROM: Stabwerksprogramm IQ 100 B, Tools für den konstr. Ingenieurbau, Fachinformationen, Normentexte] ISBN: 3804152287 Neuwied : Werner, 2006</p> <p>Wendehorst, Reinhard (Wetzell, Otto W.;; Baumgartner, Herwig.; Deutsches Institut für Normung) Wendehorst Bautechnische Zahlentafeln ISBN: 978-3-8351-0055-8 ISBN: 3835100556 Stuttgart [u.a.] : Teubner Berlin [u.a.] : Beuth, 2007</p> <p>Neufert, Ernst (Kister, Johannes) Bauentwurfslehre : Grundlagen, Normen, Vorschriften über Anlage, Bau, Gestaltung, Raumbedarf, Raumbeziehungen, Maße für Gebäude, Räume, Einrichtungen, Geräte mit dem Menschen als Maß und Ziel ; Handbuch für den Baufachmann, Bauherrn, Lehrenden und Lernenden ISBN: 978-3-8348-0732-8 (GB.) Wiesbaden : Vieweg + Teubner, 2009</p>

Module M0613: Reinforced Concrete Structures I

Courses

Title	Typ	Hrs/wk	CP			
Project Seminar Concrete I (L0896)	Seminar	1	1			
Reinforced Concrete Design I (L0303)	Lecture	2	3			
Reinforced Concrete Design I (L0305)	Recitation (large)	Section 2	2			
Module Responsible	Prof. Günter Rombach					
Admission Requirements	None					
Recommended Previous Knowledge	Basic knowledge in structural analysis and building materials. Modules: Structural Analysis I, Mechanics I+II					
Educational Objectives	After taking part successfully, students have reached the following learning results					
Professional Competence	<p><i>Knowledge</i></p> <p>The students can outline the history of concrete construction and explain the basics of structural engineering, including usual load combinations and safety concepts. They are able to draft and dimension simple structures, as well as to evaluate and discuss the behaviour of the materials and of structural members.</p> <p><i>Skills</i></p> <p>The students are able to apply basic procedures of the conception and dimensioning to practical cases. They are capable to draft simple concrete structures and to design them for bending and bending with axial force, and to plan their detailing and execution. Moreover, they can make design and construction sketches and draw up technical descriptions.</p> <p>Personal Competence</p> <p><i>Social Competence</i></p> <p><i>Autonomy</i></p> <p>The students are able to carry out simple tasks in the conception and dimensioning of structures and to critically reflect the results.</p>					
Workload in Hours				Independent Study Time 110, Study Time in Lecture 70		
Credit points				6		
Course achievement				Compulsory	Bonus	Form
	Yes	None	Exercices			
Examination	Written exam					
Examination duration and scale	120 minutes					
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory					

Course L0896: Project Seminar Concrete I	
Typ	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Björn Schütte
Language	DE
Cycle	SoSe
Content	In the course of the project seminar, a simple structure is drafted and dimensioned.
Literature	Download der Unterlagen zur Vorlesung über Stud.IP!

Course L0303: Reinforced Concrete Design I	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
Content	<p>The following subjects/contents are treated:</p> <ul style="list-style-type: none"> • history of concrete construction • building materials: mechanical and physical-chemical properties of concrete, steel, GFRP, CFRP • Introduction in safety concepts, ultimate limit states and safety coefficients • actions on structures • design of linear concrete members with arbitrary cross section for tension and bending with/without axial force • design of slender columns
Literature	<p>Download der Unterlagen zur Vorlesung über Stud.IP!</p> <ul style="list-style-type: none"> • Zilch K., Zehetmaier G.: Bemessung im konstruktiven Betonbau. Springer Verlag, 2010 • König G., Tue N.: Grundlagen des Stahlbetonbaus, 3. Auflage, Teubner-Verlag, 2008 • Deutscher Beton- und Bautechnikverein E.V.: Beispiele zur Bemessung von Betontragwerken nach Eurocode 2. Band 1: Hochbau, Bauverlag GmbH, Wiesbaden 2011 • Fingerlos F., Hegger J., Zilch K.: Eurocode 2 für Deutschland. Berlin 2016 • Dahms K.-H.: Rohbauzeichnungen, Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997 • Grasser E., Thielen G.: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken. Deutscher Ausschuss für Stahlbeton, Heft 240, Verlag Ernst & Sohn, Berlin 1978

Course L0305: Reinforced Concrete Design I	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0744: Structural Analysis II

Courses

Title	Typ	Hrs/wk	CP
Structural Analysis II (L0673)	Lecture	2	3
Structural Analysis II (L0674)	Recitation (large)	Section 2	3
Module Responsible	Prof. Uwe Starossek		
Admission Requirements	None		
Recommended Previous Knowledge	<ul style="list-style-type: none"> • Mechanics I/II • Mathematics I/II • Differential Equations I • Structural Analysis I 		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p>After successful completion of this module, students can express the basic aspects of linear frame analysis of statically indeterminate systems.</p>		
<i>Knowledge</i>			
<i>Skills</i>	<p>After successful completion of this module, the students are able to analyze state variables and to construct influence lines of statically indeterminate plane and spatial frame and truss structures.</p>		
Personal Competence	<p>Students can</p> <ul style="list-style-type: none"> • participate in subject-specific and interdisciplinary discussions, • defend their own work results in front of others • promote the scientific development of colleagues • Furthermore, they can give and accept professional constructive criticism 		
<i>Social Competence</i>			
<i>Autonomy</i>	<p>The students are able to work in-term homework assignments. Due to the in-term feedback, they are enabled to self-assess their learning progress during the lecture period, already.</p>		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
	Compulsor	Bonus	Description

Course achievement	No	10 %	Written elaboration	Hausübungen mit Testat, betreut durch Studentische Tutoren (Tutorium)
Examination	Written exam			
Examination duration and scale	90 Minuten			
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory			

Course L0673: Structural Analysis II	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Linear structural analysis: statically indeterminate systems • force method • slope-deflection method for sway and non-sway frames • general displacement method and finite element method
Literature	Krätzig, W. B.; Harte, R.; Meskouris, K.; Wittek, U.: Tragwerke 2 - Theorie und Berechnungsmethoden statisch unbestimmter Stabtragwerke, 4. Auflage, Berlin, 2004

Course L0674: Structural Analysis II	
Typ	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Uwe Starossek
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0686: Sanitary Engineering I

Courses

Title	Typ	Hrs/wk	CP
Wastewater Disposal (L0276)	Lecture	2	2
Wastewater Disposal (L0278)	Recitation (large)	Section 1	1
Drinking Water Supply (L0306)	Lecture	2	1
Drinking Water Supply (L0308)	Recitation (large)	Section 1	2

Module Responsible	Prof. Ralf Otterpohl
Admission Requirements	None
Recommended Previous Knowledge	<ul style="list-style-type: none"> • Basic knowledge on Chemistry and Biology • Hydraulics of pipe systems and open channels • Basic knowledge on water management: water quantity and water quality • Basic knowledge on Environmental Legislation: Federal Water Act
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
<i>Knowledge</i>	The students can exemplify their expert knowledge on urban water infrastructures. They can present the derivation and detailed explanation of important standards for the design of drinking water supply and wastewater disposal systems in Germany and they are capable of reproducing the relevant empirical assumptions and scientific simplifications. The students are able to present and discuss sanitary engineering processes and the technologies used for drinking and wastewater treatment. They can also assess existing problems in the field of sanitary engineering by considering legal, risk and safety aspects. Furthermore, they know how to draft the features and effectiveness of important technologies of the future such as high- and low-pressure membrane filtration systems and techniques for the removal of trace pollutants.
<i>Skills</i>	The students are able to apply the relevant standards and guidelines for the design and operation of urban water infrastructures independently. Their expertise comprises expert skills to design drinking water supply and urban drainage systems as well as the associated treatment facilities. Besides the acquisition of technical skills the students are able to address and solve biochemical problems in the field of drinking water and wastewater treatment. The students are also able to develop ideas of their own to improve the existing water related infrastructures, systems and concepts.
Personal Competence	
<i>Social Competence</i>	Social skills are not targeted in this module.
<i>Autonomy</i>	Students are able to form concepts on their own to optimize urban water infrastructure processes. Therefore they can acquire appropriate knowledge when being given some clues or information with regard to the approach to problems (preparation and follow-up of the exercises).

Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	120 min
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Elective Compulsory

Course L0276: Wastewater Disposal	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	DE
Cycle	SoSe
Content	<p>This lecture focusses on urban drainage and wastewater treatment.</p> <p>Urban Drainage</p> <ul style="list-style-type: none"> • Design of urban drainage systems (combined and separate sewer systems) • Special structures • Rainwater management <p>Wastewater treatment</p> <ul style="list-style-type: none"> • Mechanical treatment (Screens, Grit chamber, Preliminary Sedimentation, Secondary Settlement Tanks, Membrane Filtration) • Biological Treatment (aerobic, anaerobic, anoxic) • Special Wastewater Treatment Processes (Ozonation, Adsorption)
Literature	<p>Die hier aufgeführte Literatur ist in der Bibliothek der TUHH verfügbar.</p> <p>The literature listed below is available in the library of the TUHH.</p> <ul style="list-style-type: none"> • Taschenbuch der Stadtentwässerung : mit 10 Tafeln und 67 Tabellen, Imhoff, K., & . (2009). (31., verbesserte Aufl.). München: Oldenbourg Industrieverl. • Abwasser : Technik und Kontrolle. Neitzel, Volkmar, and. . Weinheim [u.a.]: Wiley-VCH, 1998. • Kommunale Kläranlagen : Bemessung, Erweiterung, Optimierung, Betrieb und Kosten, (2009). Günthert, F. Wolfgang: (3., völlig neu bearb. Aufl.). Renningen: expert-Verl. • Water and wastewater technology Hammer, M. J. 1., & . (2012). (7. ed., internat. ed.). Boston [u.a.]: Pearson Education International. • Water and wastewater engineering : design principles and practice: Davis, M. L. 1. (2011). . New York, NY: McGraw-Hill. • Biological wastewater treatment: (2011). C. P. Leslie Grady, Jr. (3. ed.). London, Boca Raton, Fla. [u.a.]: IWA Publ.

Course L0278: Wastewater Disposal	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Ralf Otterpohl
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0306: Drinking Water Supply	
Typ	Lecture
Hrs/wk	2
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Klaus Johannsen, Prof. Mathias Ernst
Language	DE
Cycle	SoSe
Content	<p>The lecture on drinking water supply provides students with a basic understanding of the entire water supply system, encompassing water catchment, water treatment including pump systems, water storage, and the distribution system that carries water to the consumer.</p> <p>Initially, basics in hydraulics and pump systems are presented (system curve and pump curve). Students learn how the duty point of the pump is determined. Students learn about different water resources and will be able to design groundwater wells. Students learn how to determine water demand and derive planning values for designing the different elements of a water supply system (e.g. firefighting requirements). The functions of reservoirs, their design and arrangement in the water supply system are explained. Students will be able to design simple water distribution systems.</p> <p>A further part of the lecture deals with the processes involved in drinking water supply. This includes a presentation of the essential mechanisms and layout parameters for sedimentation, filtration, coagulation, membrane treatment, adsorption, water softening, gas exchange, ion exchange and disinfection. The basics of process treatment technology will be built on with parallel analysis of the impacts on chemical and physical water quality parameters.</p>
Literature	<p>Gujer, Willi (2007): Siedlungswasserwirtschaft. 3., bearb. Aufl., Springer-Verlag.</p> <p>Karger, R., Cord-Landwehr, K., Hoffmann, F. (2005): Wasserversorgung. 12., vollst. überarb. Aufl., Teubner Verlag</p> <p>Rautenberg, J. et al. (2014): Mutschmann/Stimmelmayer Taschenbuch der Wasserversorgung. 16. Aufl., Springer-Vieweg Verlag.</p> <p>DVGW Lehr- und Handbuch Wasserversorgung: Wasseraufbereitung - Grundlagen und Verfahren, m. CD-ROM: Band 6 (2003).</p>

Course L0308: Drinking Water Supply	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Dr. Klaus Johannsen, Prof. Mathias Ernst
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0611: Steel Structures I			
Courses			
Title	Typ	Hrs/wk	CP
Steel Structures I (L0299)	Lecture	2	3
Steel Structures I (L0300)	Recitation (large)	Section 2	3
Module Responsible	Prof. Marcus Rutner		
Admission Requirements	None		
Recommended Previous Knowledge	<ul style="list-style-type: none"> • Structural analysis I, Structural analysis II • Mechanics I, Mechanics II • Building Materials and Building Chemistry • Principles of Building Materials and Building Physics 		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p>After passing this module students are able to</p> <ul style="list-style-type: none"> • give a summary of the security concept • explain the principles of the design process • describe and illustrate the behaviour of members in tension, compression and bending <p>Students can rate and apply the material steel appropriately with respect to its properties and usage.</p> <p>They can use the security concept with respect to loads, forces and resistances.</p> <p>They can check the ultimate limit state and the serviceability of simple members in tension, compression and bending.</p>		
Personal Competence	<p>After participation of an optional course (building of a simple truss) they are able to organize themselves in groups. They will be successful in guided building a truss with bolted connections according to design drawings.</p>		
<i>Knowledge</i>			
<i>Skills</i>			
<i>Social Competence</i>			
<i>Autonomy</i>	--		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Written exam		
Examination duration and scale	120 minutes		
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory		

Course L0299: Steel Structures I	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Introduction to steel constructions • Materials • Design and security model • Tension rods • Beams (elastic and plastic design) • Column design • Bolted connections
Literature	<p>Petersen, C.: Stahlbau, 4. Auflage 2013, Springer-Vieweg Verlag</p> <p>Wagenknecht, G.: Stahlbau-Praxis nach Eurocode 3, Bauwerk-Verlag 2011</p> <ul style="list-style-type: none"> • Band 1 Tragwerksplanung, Grundlagen • Band 2 Verbindungen und Konstruktionen

Course L0300: Steel Structures I	
Typ	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M1635: Applications in Civil / Environmental Engineering

Courses

Title	Typ	Hrs/wk	CP
Applied Structural Dynamics (L0791)	Lecture	2	2
Soil Laboratory Course (L0499)	Practical Course	1	2
Building Information Modeling (L1903)	Lecture	1	1
Building Information Modeling (L1904)	Project-/problem-based Learning	2	2
Computational Analysis of Structures (L0370)	Lecture	2	3
Introduction in Statitics with R (L0286)	Lecture	1	1
Introduction in Statitics with R (L0776)	Recitation (large) Section	1	1
Principles of Geomatics (L0470)	Lecture	2	2
Principles of Geomatics (L0471)	Recitation (small) Section	2	2
Numeric and Matlab (L0125)	Practical Course	2	2
Practical Course in Drinking Water Chemistry (L1744)	Practical Course	1	2
Projects II (L1228)	Project Seminar	2	2
Special topics of Civil- and Environmental Engineering (L2411)		1	1
Special topics of Civil- and Environmental Engineering 2 LP (L2412)		2	2
Special topics of Civil- and Environmental Engineering 3LP (L2413)		3	3
Fire Protection and Prevention (L0472)	Lecture	2	2

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	none
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
<i>Knowledge</i>	The students are at home doing with typical applications of the study programme.
<i>Skills</i>	The students are able to use the methods that are provided during the lectures for practical questions. They are able to work in the learnt methods into new forms of application independently".
Personal Competence	
<i>Social Competence</i>	According to the course chosen students are able to perform tasks or to conduct a project in teams. If so, they can present, discuss and document results accordingly.
<i>Autonomy</i>	According to the course chosen individual students can plan and document tasks and work flow for themselves or for the team.
Workload in Hours	Depends on choice of courses
Credit points	9
Assignment for the Following	Civil- and Environmental Engineering: Core qualification: Compulsory

Curricula

Course L0791: Applied Structural Dynamics	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Mündliche Prüfung
Examination duration and scale	15 min
Lecturer	Dr. Kira Holtzendorff
Language	DE
Cycle	WiSe
Content	<p>The lecture gives an introduction into the classical structural dynamics, whereas the focus lies on the practical applications. The theoretical basics are worked out in order to apply them for typical issues in practice. For an effective vibration isolation due to vibration excitations by e.g. railway traffic, operating machines oder moving people, different structural measures are presented. The lecture is completed by performing examples of vibration measurements as well as interactive dynamic experiments in the laboratory.</p> <p>The following topics are covered:</p> <ul style="list-style-type: none"> Particular features in structural dynamics Basic terms of time-dependent excitations Free vibrations (natural frequencies) Induced vibrations Impact excitations of structures Methods of amplitude reduction (vibration isolation) Introduction to soil dynamics Vibration measurements and requirements for vibration protection Vibrations induced by people
Literature	<p>Helmut Kramer: Angewandte Baudynamik, Ernst & Sohn Verlag, 2. Auflage 2013</p> <p>Christian Petersen: Dynamik der Baukonstruktionen, Vieweg Verlag, 2. Auflage von 2000</p>

Course L0499: Soil Laboratory Course	
Typ	Practical Course
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	Die gesamte Arbeitszeit im Praktikum plus anschließender Bericht = 90 Stunden Arbeitszeit (Das Erstellen der Ausarbeitung = Bearbeitungszeitraum von 4 Wochen und ein Umfang von maximal 50 Seiten.)
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Field experiments • Short lecture on laboratory tests • soil analysis • laboratory test • soil clasification • Creating a ground and foundation report
Literature	<ul style="list-style-type: none"> • DIN-Taschenbuch 113, Erkundung und Untersuchung des Baugrundes

Course L1903: Building Information Modeling	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	siehe Modulhandbuch
Lecturer	Prof. Frank Schmidt-Döhl, Thomas Kölzer
Language	DE
Cycle	WiSe/SoSe
Content	<p>Basic knowledge of Building Information Modeling:</p> <ul style="list-style-type: none"> • Introduction to BIM (development, backgrounds, history, opportunities, risks, levels) • Current standards and guidelines (national and international standardisation, structures) • Applications of BIM (openBIM, closedBIM, littleBIM, data and interchange formats) • Object oriented modeling (requirements, structure, classification, parts catalogues) • BIM-Implementation (structures, cycles, professions, job profiles, execution plan) • BIM-Tools (software, hardware, application areas) • Execution examples (national and international construction projects) <p>Basic knowledge for the use of the software Allplan 2018:</p> <ul style="list-style-type: none"> • Basic settings (project administration, building structures, fileset structures, layers) • Construction fundamentals 2D (e. g. line, circle, spline, ellipse, parallel etc.) • Modifying of construction elements (e. g. copy, mirror, intersect, fillet etc.) • Dimensioning and text adding of designed elements and structural components • Generating of areas (hatchings, patterns, fills) • Construction fundamentals 3D (floor concept, floor manager, building structures) • Walls and columns (height definitions, parameters, attributes, format properties) • Slabs (height definitions, parameters, attributes, format properties) • Use of libraries (u. a. furnitures, surroundings etc.) • Opening Elements and SmartParts (doors and windows) • Stairs and ramps (stair wizard, IFC-Ramp) • Roof frame and roof covering (custom planes, parameters, attributes, format properties) • Attributes and characteristic values (allocations and modifications) • Export and Import of IFC-Data (basics, floor allocation, fileset selection) • Generating of sections and views (architectural sections and associative sections) • Generating of printable drawings (layouts, scales, page settings)
Literature	-

Course L1904: Building Information Modeling	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	siehe Modulhandbuch
Lecturer	Prof. Frank Schmidt-Döhl, Thomas Kölzer
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0370: Computational Analysis of Structures	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Examination Form	Klausur
Examination duration and scale	60 min
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • basics of the Finite Element Method, Spreadsheets • basics of software 'SOFISTIK' • modeling of an arbitrary cross-section • modeling of an arbitrary 2D truss structure incl. loads • Teddy: usage of global and local variables • design of a concrete section • modeling of a T-beam bridge by means of a grillage system • modeling and design of a rectangular slab • building models
Literature	<ul style="list-style-type: none"> • Vorlesungsunterlagen können im STUDiP heruntergeladen werden • Tutorials von SOFiSTIK • Rombach G.: Anwendung der Finite - Elemente - Methode im Betonbau. 2. Auflage. Verlag Ernst & Sohn, Berlin, 2007 • Rombach G.: Finite-Element Design of Concrete Structures. 2nd edition, ICE Publishing, London, 2011, ISBN 0 7277 32749 • Rombach G.: EDV-unterstützte Berechnungen im Stahlbetonbau. in: „Stahlbetonbau aktuell 2014“ (ed. Gorris A., Hegger J., Mark P.), Berlin 2014 (S. C1.-C.36)

Course L0286: Introduction in Statistics with R	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	60 min
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	WiSe
Content	<p>Introduction to R</p> <p>Graphics with R</p> <p>Descriptive Statistic (Boxplot, Percentiles, outliers)</p> <p>Propability (Combinatorics, relative frequency, dependand probability)</p> <p>random numbers and distibutions (confidence interval, uniform and discrete distributions, test-distributions (t-F-X²-distribuition))</p> <p>Correlation and Regression analysis (Confidence interval of calibration curves, linearity)</p> <p>Statistic test procedures (mean value-t-Test, Chi²-Test, F-Test)</p> <p>Analysis of variance (ANOVA, Bartlett-Test, Kruskal-Wallis Rank sum test)</p> <p>Introduction time series (tseries)</p> <p>Introduction cluster analysis (k-means)</p>
Literature	<p>Regionales Rechenzentrum für Niedersachsen</p> <p>Statistik mit R Grundlagen der Datenanalyse , 2013</p> <p>Einführung in die Statistik mit R, Andreas Handl, Skript Uni Bielefeld http://www.wiwi.uni-bielefeld.de/fileadmin/emeriti/frohn/handl_grundausbildung/statskript.pdf</p> <p>und die dazugehörige Aufgabensammlung http://www.wiwi.uni-bielefeld.de/fileadmin/emeriti/frohn/handl_grundausbildung/statauf.pdf</p> <p>Induktive Statistik [Elektronische Ressource] : eine Einführung mit R und SPSS / Helge... von Toutenburg, Helge 2008 http://dx.doi.org/10.1007/978-3-540-77510-2http://dx.doi.org/10.1007/978-3-540-77510-2</p> <p>R-Referenzcard: http://cran.r-project.org/doc/contrib/Short-refcard.pdfhttp://cran.r-project.org/doc/contrib/Short-refcard.pdf</p> <p>Grafiken und Statistik in R von Andreas Plank Nachschlage Skript mit Beispielen: http://www.geo.fu-berlin.de/geol/fachrichtungen/pal/mitarbeiter/plank/Formeln_in_R.pdfhttp://www.geo.fu-berlin.de/geol/fachrichtungen/pal/mitarbeiter/plank/Formeln_in_R.pdf</p>

Course L0776: Introduction in Statistics with R	
Typ	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	Klausur
Examination duration and scale	siehe Vorlesung
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L0470: Principles of Geomatics	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	schriftliche Ausarbeitungen zu allen fünf Übungen, ggf. Testklausur
Lecturer	Prof. Peter Andree
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Overview of geomatics in general • Units of measurements • Generating of topographical maps • Basic surveying instruments and handling • Geodetic surveying lines and verification of measurements • Methods of horizontal survey • Components of geodetic surveying instruments • Height determination • Setting out points • Topographical survey • Directions and angles • Determination of coordinates • Traversing • Basics on surveying and positioning with GNSS
Literature	<p>Andree, P.: Grundlagen der Geomatik (Skript)</p> <p>Resnik, B. / Bill, R.: Vermessungskunde für den Planungs- Bau- und Umweltbereich, Wichmann-verlag</p> <p>Witte, B. / Sparla, P.: Vermessungskunde und Grundlagen der Statistik für das Bauwesen, Wichmann-Verlag</p> <p>Gruber, F.J. / Joeckel, R.: Formelsammlung für das Vermessungswesen, Vieweg + Teubner-Verlag</p>

Course L0471: Principles of Geomatics	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Schriftliche Ausarbeitung
Examination duration and scale	.
Lecturer	Prof. Peter Andree
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0125: Numeric and Matlab	
Typ	Practical Course
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Fachtheoretisch-fachpraktische Arbeit
Examination duration and scale	5 Übungsaufgaben jeweils mit Testat am Ende
Lecturer	Prof. Siegfried Rump, Weitere Mitarbeiter
Language	DE
Cycle	SoSe
Content	<ol style="list-style-type: none"> 1. Programming in Matlab 2. Numerical methods for systems of nonlinear equations 3. Basics in computer arithmetic 4. Linear and nonlinear optimization 5. Condition of problems and algorithms 6. Verified numerical results with INTLAB
Literature	<p>Literatur (Software-Teil):</p> <ol style="list-style-type: none"> 1. Moler, C., Numerical Computing with MATLAB, SIAM, 2004 2. The Math Works, Inc. , MATLAB: The Language of Technical Computing, 2007 3. Rump, S. M., INTLAB: Interval Labority, http://www.ti3.tu-harburg.de 4. Highham, D. J.; Highham, N. J., MATLAB Guide, SIAM, 2005

Course L1744: Practical Course in Drinking Water Chemistry	
Typ	Practical Course
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Examination Form	Fachtheoretisch-fachpraktische Arbeit
Examination duration and scale	6 Versuchsprotokolle
Lecturer	Dr. Klaus Johannsen
Language	DE
Cycle	WiSe
Content	<p>!Max.12 students! The students learn basic experimental work in the laboratory. The experiments give an overview about the most important chemical analysis methods of drinking water. This includes sampling, photometric measurement, complexometric titration as well as acid/base titration. The experiments are strongly related to the processes in drinking water treatment and water distribution (e. g. removal of iron and manganese, softening and conditioning). Instrumental analytics is not subject of this practical course.</p> <ol style="list-style-type: none"> 1. Day: Introduction, safety instructions 2. Day: Electrical conductivity, saturation with respect to calcite, hardness 3. Day: Organic carbon, iron, acid and base neutralization capacity 4. Day: Writing protocols of experiments and presentations 5. Day: Evaluation of the protocols and presentations, final discussion
Literature	<p>Siehe Skript. See Script.</p>

Course L1228: Projects II	
Typ	Project Seminar
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Referat
Examination duration and scale	ca. zehnmütige Präsentation
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	Excursions to different construction and environmental projects.
Literature	keine

Course L2411: Special topics of Civil- and Environmental Engineering	
Typ	
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE/EN
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L2412: Special topics of Civil- and Environmental Engineering 2 LP	
Typ	
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE/EN
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L2413: Special topics of Civil- and Environmental Engineering 3LP	
Typ	
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Examination Form	laut FSPO
Examination duration and scale	wird zu Beginn der Lehrveranstaltung festgelegt
Lecturer	Dozenten des SD B
Language	DE/EN
Cycle	WiSe/SoSe
Content	The course occurs only if required. The content is defined at short notice.
Literature	Die Literatur wird kurzfristig festgelegt.

Course L0472: Fire Protection and Prevention	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Examination Form	Mündliche Prüfung
Examination duration and scale	20 min
Lecturer	Philipp Below
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Introduction • fire in residential and office buildings • town planning: location of residential, office and industry areas, location of fire stations • design of roads and water pipes • explosions
Literature	<ul style="list-style-type: none"> • Schneider U. : Ingenieurmethoden im baulichen Brandschutz. Expert Verlag, 2. Aufl., 2002

Module M0869: Hydraulic Engineering

Courses

Title	Typ	Hrs/wk	CP
Hydraulics (L0957)	Lecture	1	1
Hydraulics (L0958)	Project-/problem-based Learning	1	1
Hydraulic Engineering (L0959)	Lecture	2	2
Hydraulic Engineering (L0960)	Project-/problem-based Learning	1	2

Module Responsible	Prof. Peter Fröhle
Admission Requirements	None
Recommended Previous Knowledge	Hydraulic Engineering I
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
<i>Knowledge</i>	Students are able to define the basic terms of hydraulic engineering and hydraulics. They are able to explain the application of basic hydrodynamic formulations (conservation laws) to practical hydraulic engineering problems. Besides this, the students can illustrate important tasks of hydraulic engineering and give an overview over river engineering, flood protection, hydraulic power engineering and waterways engineering.
<i>Skills</i>	The students are able to apply hydraulic engineering methods and approaches to basic practical problems and design respective hydraulic engineering systems. Besides this, they are able to use and apply established approaches of hydraulics and determine water surfaces of channel flows, influences of constructions (weirs, etc.) on channel flows as well as flow conditions of pipe system. Furthermore, they are able to run, explain and document basic hydraulic experiments.
Personal Competence	
<i>Social Competence</i>	The students are able to deploy their gained knowledge in applied problems. Additionally, they will be able to work in team with engineers of other disciplines in a goal-orientated, structured manner. They can explain their results by use of peer learning approaches.
<i>Autonomy</i>	The students will be able to independently extend their knowledge and apply it to new problems. Furthermore, they are capable of organising their individual work flow to contribute to the conduct of experiments and to present discipline-specific knowledge.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Written exam
Examination duration and scale	The duration of the examination is 2 hours. The examination includes tasks with respect to the general understanding of the lecture contents and calculations tasks.
Assignment for the Following	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory

Curricula	General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Elective Compulsory
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Course L0957: Hydraulics	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe/SoSe
Content	<p>Flow of incompressible fluids in pipes and open channels</p> <ul style="list-style-type: none"> • Hydraulics of pipes • Pumps in hydraulic systems • Open channel flow • Regulative construction in open channel flow <ul style="list-style-type: none"> ◦ Weirs ◦ Sliding panels ◦ Cross-section reduction by constructions
Literature	<p>Zanke, Ulrich C. , Hydraulik für den Wasserbau Ursprünglich erschienen unter: Schröder/Zanke "Technische Hydraulik", Springer-Verlag, 2003</p> <p>Naudascher, E.: Hydraulik der Gerinne und Gerinnebauwerke, Springer, 1992</p>

Course L0958: Hydraulics	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Course L0959: Hydraulic Engineering	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe/SoSe
Content	<p>Fundamentals of hydraulic engineering</p> <ul style="list-style-type: none"> • Introduction and hydrological cycle • River engineering <ul style="list-style-type: none"> ◦ Regime theory of natural rivers ◦ Sediment transport ◦ Regulation of rivers ◦ Bank protection / protection of river bed ◦ Tidal rivers • Flood protection <ul style="list-style-type: none"> ◦ Dikes ◦ Flood contraol basins • Hydraulic power • Inland waterways engineering <ul style="list-style-type: none"> ◦ waterways ◦ Locks and ship lifts ◦ Fish passages • Nature-oriented hydraulic engineering
Literature	<p>Strobl, T. & Zunic, F: Wasserbau, Springer 2006</p> <p>Patt, H. & Gonsowski, P: Wasserbau, Springer 2011</p>

Course L0960: Hydraulic Engineering	
Typ	Project-/problem-based Learning
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Specialization Civil Engineering

Module M0755: Geotechnics II

Courses

Title	Typ	Hrs/wk	CP
Foundation Engineering (L0552)	Lecture	2	2
Foundation Engineering (L0553)	Recitation (large)	Section 2	2
Foundation Engineering (L1494)	Recitation (small)	Section 2	2

Module Responsible	Prof. Jürgen Grabe		
Admission Requirements	None		
Recommended Previous Knowledge	Modules: <ul style="list-style-type: none"> • Mechanics I-II • Geotechnics I 		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	The students know the basic principles and methods which are required to verificate the stability of geotechnical structures. After successful completion of the module the students are able to: <ul style="list-style-type: none"> • verificate the stability and usability of foundations, • know individual methods of ground improvement and apply them in their range of application, • design retaining walls. 		
<i>Knowledge</i>			
<i>Skills</i>			
Personal Competence			
<i>Social Competence</i>			
<i>Autonomy</i>			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		
Credit points	6		
Course achievement	Compulsor No	Bonus 20 %	Form Attestation
Examination	Written exam		
Examination duration and scale	60 minutes		
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment:		

	Elective Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Technomathematics: Specialisation III. Engineering Science: Elective Compulsory
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Course L0552: Foundation Engineering	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	<ul style="list-style-type: none"> • Shallow foundations • Pile foundations • Ground improvement • Retaining walls • Underpinning • Groundwater Conservation • Cut-off Walls
Literature	<ul style="list-style-type: none"> • Vorlesung/Übung s. www.tu-harburg.de/gbt • Grabe, J. (2004): Bodenmechanik und Grundbau • Kolymbas, D. (1998): Geotechnik - Bodenmechanik und Grundbau • Grundbau-Taschenbuch, neueste Auflage

Course L0553: Foundation Engineering	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1494: Foundation Engineering	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0618: Renewables and Energy Systems

Courses

Title	Typ	Hrs/wk	CP
Power Industry (L0316)	Lecture	1	1
Energy Systems and Energy Industry (L0315)	Lecture	2	2
Renewable Energy (L0313)	Lecture	2	2
Renewable Energy (L1434)	Recitation (small)	Section 1	1

Module Responsible	Prof. Martin Kaltschmitt
Admission Requirements	None
Recommended Previous Knowledge	none
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p><i>Knowledge</i></p> <p>With completion of this module, the students can provide an overview of characteristics of energy systems and their economic efficiency. They can explain the issues occurring in this context. Furthermore, they can explain details of power generation, power distribution and power trading with regard to subject-related contexts. The students can explain these aspects, which are applicable to many energy systems in general, especially for renewable energy systems and critically discuss them. Furthermore, the students can explain the environmental benefits from the use of such systems.</p> <p><i>Skills</i></p> <p>Students are able to apply methodologies for detailed determination of energy demand or energy production for various types of energy systems. Furthermore, they can evaluate energy systems technically, environmentally and economically and design them under certain given conditions. Therefore, they can choose the necessary subject-specific calculation rules, also for non-standardized solutions of a problem.</p> <p>The students are able to explain questions and possible approaches to its processing from the field of renewable energies orally and to put them into the right context.</p> <p>Personal Competence</p> <p><i>Social Competence</i></p> <p>The students are able to analyze suitable technical alternatives and to assess them with technical, economical and ecological criteria under sustainability aspects. This allows them to make an effective contribution to a more sustainable power supply.</p> <p><i>Autonomy</i></p> <p>Students can independently exploit sources, acquire the particular knowledge about the subject area and transform it to new questions.</p>
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam

Examination duration and scale	3 hours written exam
Assignment for the Following Curricula	<p>General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory</p> <p>General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory</p> <p>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Elective Compulsory</p> <p>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory</p> <p>Energy and Environmental Engineering: Core qualification: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Elective Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Elective Compulsory</p> <p>Process Engineering: Core qualification: Compulsory</p>

Course L0316: Power Industry	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Martin Kaltschmitt, Prof. Andreas Wiese
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Electrical energy in the energy system • Demand and use of electrical energy (households, industry, "new" buyers (including e-mobility)) • Electricity generation <ul style="list-style-type: none"> ◦ electricity generation technologies using fossil fuels and their characteristics ◦ combined heat and power technologies and their production characteristics ◦ electricity generation from renewable energy technologies and their characteristics • Power distribution <ul style="list-style-type: none"> ◦ "classic" distribution of electrical energy ◦ challenges of fluctuating electricity generation by distributed systems (electricity market, electricity stock exchange, emissions trading) • District heating industry • Legal and administrative aspects <ul style="list-style-type: none"> ◦ Energy Act ◦ support instruments for renewable energy ◦ CHP Act • Cost and efficiency calculation
Literature	Folien der Vorlesung

Course L0315: Energy Systems and Energy Industry	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Kaltschmitt
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Energy: development and significance • Fundamentals and basic concepts • Energy demand and future trends (heat, electricity, fuels) • Energy reserve and sources • Cost and efficiency calculation • Final and effective energy from petroleum, natural gas, coal, uranium and other • Legal, administrative and organizational aspects of energy systems • Energy systems as a permanent optimization task
Literature	<ul style="list-style-type: none"> • Kopien der Folien

Course L0313: Renewable Energy	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Kaltschmitt
Language	DE/EN
Cycle	SoSe
Content	<ul style="list-style-type: none"> • introduction • solar energy for heat and power generation • wind power for electricity generation • hydropower for electricity generation • ocean energy for electricity generation • geothermal energy for heat and electricity generation
Literature	<ul style="list-style-type: none"> • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007

Course L1434: Renewable Energy	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Martin Kaltschmitt
Language	DE/EN
Cycle	SoSe
Content	<p>Students work on different tasks in the field of renewable energies. They present their solutions in the exercise lesson and discuss it with other students and the lecturer.</p> <p>Possible tasks in the field of renewable energies are:</p> <ul style="list-style-type: none"> • Solar thermal heat • Concentrating solare power • Photovoltaic • Windenergie • Hydropower • Heat pump • Deep geothermal energy
Literature	<ul style="list-style-type: none"> • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007

Module M0983: Mobility Concepts

Courses

Title	Typ	Hrs/wk	CP
Mobility Research and Transportation Projects (L1181)	Project-/problem-based Learning	3	3
Mobility in Megacities and Developing Countries (L1182)	Seminar	3	3

Module Responsible	Dr. Philine Gaffron
Admission Requirements	None
Recommended Previous Knowledge	Module Transportation Planning and Traffic Engineering
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p>Students are able to:</p> <ul style="list-style-type: none"> name the different urban transport systems existing around the world. explain the transport challenges in Asian and African mega cities. recognise and relate interactions between transport systems on the one hand and ecological, socio-cultural and economic problem areas on the other. outline specific issues and problems in urban development and transport (in Germany and developing countries). explain the effects of external framework factors (like energy costs) on transport.
<i>Knowledge</i>	
Skills	<p>Students are able to:</p> <ul style="list-style-type: none"> analyse and evaluate given case studies. transfer learning results to other regions and cities. analyse specific issues and problems in urban development and transport (in developing countries). critically assess actors, planning objectives, planned measures and the implementation of transport projects in the light of the UN Millennium Development Goals develop and present sustainable (i.e. ecological, poverty oriented, gender balanced and economical) solutions for urban personal and goods transport
<i>Skills</i>	
Personal Competence	<p>Students are able to:</p> <ul style="list-style-type: none"> present and explain independently generated findings. constructively discuss potentially controversial topics in a group context.
<i>Social Competence</i>	
Autonomy	<p>Students are able to:</p> <ul style="list-style-type: none"> carry out independent literature research and analysis. independently author a written report on a given topic.
<i>Autonomy</i>	

Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		
Credit points	6		
Course achievement	Compulsory	Bonus	Form
	Yes	None	Participation in excursions
	Yes	None	Excercises
Examination	Written elaboration		
Examination duration and scale	All assignments in groups (2-4 students): written report, 2000 words (incl. 2 short presentations of 10 mins.); final presentation, 20 mins. plus discussion (incl. slides) and 1000 word report incl. peer review (individual).		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory		

Course L1181: Mobility Research and Transportation Projects	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Philine Gaffron
Language	DE
Cycle	SoSe
Content	<p>This course places its focus on transport and mobility in Germany. It deals with questions such as:</p> <ul style="list-style-type: none"> • Which external factors - like e.g. energy costs, availability of renewable and fossil fuels, environmental and climate protection objectives - influence current developments in the transport sector? • Which external effects in turn are caused by mobility choices and traffic? • How should these interactions be evaluated, how and by whom can they be influenced? • Which measures at the municipal level can contribute to a more sustainable transport system? <p>During the course, these questions will be illustrated and discussed with reference to different examples and current developments. Participants will also provide input on specific topics. Potential core subjects of the course could be:</p> <ul style="list-style-type: none"> • Environmental Justice : which population groups are disproportionately affected by transport emissions and who causes them? • Municipal cycle planning • Transport and Climate Protection: can, want, act - everything could be, nothing must be?
Literature	Die Literaturempfehlungen sind abhängig von den jeweiligen, wechselnden Themenschwerpunkten und werden rechtzeitig vor Beginn der Veranstaltung bekannt gegeben.

Course L1182: Mobility in Megacities and Developing Countries	
Typ	Seminar
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Jürgen Perschon, Christof Hertel
Language	DE
Cycle	SoSe
Content	<p>The course provides an overview over different transport projects in the metropolitan areas of developing countries. Considering different perspectives on urban growth, social justice, economic development, environmental and climate protection as well as the economic viability of public transport, the specific situation in the urban conglomerates of Asia, Latin America and Africa will be analysed and placed in a regional and global context. Specific public transport systems will be examined to establish, whether they are a suitable example for sustainable urban development.</p> <p>The following examples could be suitable case studies: Singapore (Metro), Lagos (BRT Light), Guangzhou, Bogota, Jakarta (Full BRT), Sao Paulo, Medellin (Cable Car Systems), Johannesburg (Minibus-Taxi).</p> <p>The course will be designed interactively with the students and will partly be in English as is the majority of the literature in this area (also: Skype online interviews with international experts in the transport sector).</p>
Literature	--

Module M1628: Sustainable Building

Courses

Title	Typ	Hrs/wk	CP
Circular flow economy and structural recycling (L2464)	Project-/problem-based Learning	3	3
Sustainable Building (L2463)	Seminar	3	3

Module Responsible	NN
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge of building materials, building chemistry, building construction and building project management
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p><i>Knowledge</i></p> <p>Students are able to reproduce essential features of sustainable construction and material cycles. They can also name the constructional and environmental properties of recyclates and describe the sampling and analysis process. They are able to give an overview of the history, definition and to provide strategic approaches to the sustainability discussion from a constructional and environmental perspective. Furthermore, they can explain relevant objectives, strategies and exemplary fields of research in the field of sustainable construction (e.g. environmental impacts of the production and use of building materials, life cycle assessment, energy and climate-optimised planning and construction, material principles of renewable raw materials). Students will be able to discuss the fundamental relationship between the origin and type of construction waste, quantities produced and methods for characterising them.</p> <p><i>Skills</i></p> <p>Students can relate relevant legal requirements to practical problems of environmentally sound design and construction and thus justify the application of specific limit values for individual areas of application. Students are able to assess risks that may arise from hazardous construction waste in a concise manner. They are able to critically examine innovative areas of application of sustainable construction on the basis of central engineering, economic and legal criteria. They can thereafter evaluate and propose approaches for alternative solutions exemplarily, e.g. for the processing and recycling of construction waste.</p> <p>Personal Competence</p> <p><i>Social Competence</i></p> <p>The students are able to work out their own solutions for specific problems of recycling building materials in small groups. For this purpose, they can organise themselves in a division of labour and can give themselves a work and project plan. Furthermore, they are able to appoint group members to coordinate the cooperation with other working groups of the module and to moderate the presentation of work results in the seminar.</p> <p><i>Autonomy</i></p> <p>Students can coordinate their individual work performance with the other members of the group and prepare for it efficiently by use of scientific media.</p>
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Subject theoretical and practical work
Examination	

duration and scale	Written-theoretical part and project work
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory

Course L2464: Circular flow economy and structural recycling	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	NN
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Types, origin, quantities of construction waste and building debris • Risks and characterisation of construction waste • Avoidance strategies and recycling options for construction waste and building debris • Criteria of sampling, analysis and opportunities for the use of treated building materials • political and legal requirements for the recycling of building materials
Literature	Friedrichsen, S. (2018). Nachhaltiges Planen, Bauen und Wohnen: Kriterien für Neubau und Bauen im Bestand. 2. Aufl. Berlin, Springer Müller et al. (2017). Nachhaltiges Bauen des Bundes: Grundlagen, Methoden, Werkzeuge (Schriftenreihe Zukunft Bauen, Band 08)

Course L2463: Sustainable Building	
Typ	Seminar
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	NN
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Building materials and resource management, significance for infrastructure and environmental projects • Material science of construction materials from renewable resources • Environmental impacts of production and use of building materials • Methods of assessing environmental impacts • Potentials of building materials for sustainable building • Energy- and climate-optimised planning and construction • Life cycle assessment (planning, execution, operation/use, deconstruction) • Aspects of building ecology with regard to refurbishment • Insight into certification systems and evaluation methods for ecological and sustainable buildings
Literature	<p>Friedrichsen, S. (2018). Nachhaltiges Planen, Bauen und Wohnen: Kriterien für Neubau und Bauen im Bestand. 2. Aufl. Berlin, Springer</p> <p>Müller et al. (2017): Nachhaltiges Bauen des Bundes: Grundlagen, Methoden, Werkzeuge (Schriftenreihe Zukunft Bauen, Band 08)</p>

Module M0631: Reinforced Concrete Structures II

Courses

Title	Typ	Hrs/wk	CP
Project Concrete Structures II (L0894)	Project Seminar	1	1
Concrete Structures II (L0348)	Lecture	2	3
Concrete Structures II (L0349)	Recitation (large)	Section 2	2

Module Responsible	Prof. Günter Rombach
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Admission Requirements	None
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Recommended Previous Knowledge	<ul style="list-style-type: none"> Knowledge of loads on structures and combination of actions Basics of safety format are required. Knowledge in design of beams and columns for ultimate limit state Modules: Reinforced Concrete Structures I, Structural Analysis I+II, Mechanics I+II
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Educational Objectives	After taking part successfully, students have reached the following learning results
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Professional Competence	<p>The students know the basic principles which are required for design of reinforced concrete structures. They know the various methods to estimate the member forces in simple one and two-way slabs.</p> <ul style="list-style-type: none"> The students can design reinforced concrete structure in the ultimate limit state (shear, bending, torsion) and in the serviceability limit state (crack and deflection control) including detailing (anchorage and links etc.). The students can estimate the member forces of simple slabs. The students know the content and the layout of a structural analysis
<i>Knowledge</i>	
<i>Skills</i>	
Personal Competence	Cooperation in a project work, where they design in a team a real concrete building and present the results at the end.
<i>Social Competence</i>	
<i>Autonomy</i>	

Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
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Credit points	6
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Course achievement	Compulsory	Bonus	Form	Description
	Yes	None	Excercises	

Examination	Written exam
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Examination duration and scale	120 minutes
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Assignment for the Following	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory
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Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Elective Compulsory
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Course L0894: Project Concrete Structures II	
Typ	Project Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Björn Schütte
Language	DE
Cycle	WiSe
Content	Design of a truss structure
Literature	Skript zur Lehrveranstaltung "Stahlbetonbau II"

Course L0348: Concrete Structures II	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Design of concrete members for shear, punching and torsion • Design for serviceability limit state (durability): crack- and deflection control • Detailing • Design of discontinuity regions (e.g. corbels, frame corner) • design of footings • Introduction in the design of slabs • Layout and content of a structural design
Literature	<ul style="list-style-type: none"> • Vorlesungsumdrucke zum downloaden im STUDiP • Zilch K., Zehetmaier G.: Bemessung im konstruktiven Betonbau. Springer Verlag, 2010 • König G., Tue N.: Grundlagen des Stahlbetonbaus. Teubner Verlag, Stuttgart 1998 • Deutscher Beton- und Bautechnikverein E.V.: Beispiele zur Bemessung von Betontragwerken nach Eurocode 2. Band 1: Hochbau, Bauverlag GmbH, Wiesbaden 2011 • Dahms K.-H.: Rohbauzeichnungen, Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997 • Grasser E., Thielen G.: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken. Deutscher Ausschuss für Stahlbeton, Heft 240, Verlag Ernst & Sohn, Berlin 1978 • DIN EN 1992-1-1:2011: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 1: Allgemeine Bemessungsregeln für den Hochbau.

Course L0349: Concrete Structures II	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0829: Foundations of Management

Courses

Title	Typ	Hrs/wk	CP
Management Tutorial (L0882)	Recitation (small)	Section 2	3
Introduction to Management (L0880)	Lecture	3	3

Module Responsible	Prof. Christoph Ihl
Admission Requirements	None
Recommended Previous Knowledge	Basic Knowledge of Mathematics and Business
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p>After taking this module, students know the important basics of many different areas in Business and Management, from Planning and Organisation to Marketing and Innovation, and also to Investment and Controlling. In particular they are able to</p> <ul style="list-style-type: none"> • explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions from the field of Management • explain the most important aspects of and goals in Management and name the most important aspects of entrepreneurial projects • describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and human resource management, information management, innovation management and marketing • explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and explain some basic methods from mathematical Finance • state basics from accounting and costing and selected controlling methods.
<i>Knowledge</i>	
<i>Skills</i>	<p>Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry out an Entrepreneurship project in a team. In particular, they are able to</p> <ul style="list-style-type: none"> • analyse Management goals and structure them appropriately • analyse organisational and staff structures of companies • apply methods for decision making under multiple objectives, under uncertainty and under risk • analyse production and procurement systems and Business information systems • analyse and apply basic methods of marketing • select and apply basic methods from mathematical finance to predefined problems • apply basic methods from accounting, costing and controlling to predefined problems
Personal Competence	<p>Students are able to</p> <ul style="list-style-type: none"> • work successfully in a team of students • to apply their knowledge from the lecture to an entrepreneurship project and

<p><i>Social Competence</i></p> <p><i>Autonomy</i></p>	<p>write a coherent report on the project</p> <ul style="list-style-type: none"> • to communicate appropriately and • to cooperate respectfully with their fellow students. <p>Students are able to</p> <ul style="list-style-type: none"> • work in a team and to organize the team themselves • to write a report on their project.
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
Credit points	6
Course achievement	None
Examination	Subject theoretical and practical work
Examination duration and scale	several written exams during the semester
Assignment for the Following Curricula	<p>General Engineering Science (German program, 7 semester): Core qualification: Compulsory</p> <p>Civil- and Environmental Engineering: Core qualification: Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory</p> <p>Bioprocess Engineering: Core qualification: Compulsory</p> <p>Computer Science: Core qualification: Compulsory</p> <p>Data Science: Core qualification: Compulsory</p> <p>Electrical Engineering: Core qualification: Compulsory</p> <p>Energy and Environmental Engineering: Core qualification: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Electrical Engineering: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Bioprocess Engineering: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Computer Science: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Biomechanics: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Aircraft Systems Engineering: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Materials in Engineering Sciences: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Mechatronics: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Product Development and Production: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Theoretical Mechanical Engineering: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Naval Architecture: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Biomedical Engineering: Compulsory</p> <p>Computational Science and Engineering: Core qualification: Compulsory</p> <p>Logistics and Mobility: Core qualification: Compulsory</p> <p>Mechanical Engineering: Core qualification: Compulsory</p>

	Mechatronics: Core qualification: Compulsory Orientierungsstudium: Core qualification: Elective Compulsory Naval Architecture: Core qualification: Compulsory Technomathematics: Core qualification: Compulsory Process Engineering: Core qualification: Compulsory
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Course L0882: Management Tutorial	
Typ	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Katharina Roedelius, Tobias Vlcek
Language	DE
Cycle	WiSe/SoSe
Content	<p>In the management tutorial, the contents of the lecture will be deepened by practical examples and the application of the discussed tools.</p> <p>If there is adequate demand, a problem-oriented tutorial will be offered in parallel, which students can choose alternatively. Here, students work in groups on self-selected projects that focus on the elaboration of an innovative business idea from the point of view of an established company or a startup. Again, the business knowledge from the lecture should come to practical use. The group projects are guided by a mentor.</p>
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.

Course L0880: Introduction to Management	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lühje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgang Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	<ul style="list-style-type: none"> • Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management • Important definitions from Management, • Developing Objectives for Business, and their relation to important Business functions • Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management, Marketing and Sales • Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management • Definitions as information, information systems, aspects of data security and strategic information systems • Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. • Relevance of marketing, B2B vs. B2C-Marketing • different techniques from the field of marketing (e.g. scenario technique), pricing strategies • important organizational structures • basics of human ressource management • Introduction to Business Planning and the steps of a planning process • Decision Analysis: Elements of decision problems and methods for solving decision problems • Selected Planning Tasks, e.g. Investment and Financial Decisions • Introduction to Accounting: Accounting, Balance-Sheets, Costing • Relevance of Controlling and selected Controlling methods • Important aspects of Entrepreneurship projects
Literature	<p>Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008</p> <p>Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003</p> <p>Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.</p> <p>Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.</p> <p>Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.</p> <p>Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.</p> <p>Weber, J., Schäffer, U. : Einführung in das Controlling, 12. Auflage, Stuttgart 2008.</p> <p>Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.</p>

Module M0887: Transportation Planning and Traffic Engineering

Courses

Title	Typ	Hrs/wk	CP
Transport Planning and Traffic Engineering (L0997)	Project-/problem-based Learning	4	6
Module Responsible	Prof. Carsten Gertz		
Admission Requirements	None		
Recommended Previous Knowledge	None		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
<i>Knowledge</i>	Students are able to <ul style="list-style-type: none"> • understand the facts, contexts and objectives of transport planning. • correctly apply definitions and concepts of transport planning. • reproduce basic concepts of transport modelling. • explain the fundamentals of traffic engineering and transport infrastructure construction. 		
<i>Skills</i>	Students are able to <ul style="list-style-type: none"> • analyse transport supply based on key metrics. • estimate transport demand using key metrics. • design transport networks, links and junctions. • calculate traffic signal plans. • assess transport concepts. 		
Personal Competence			
<i>Social Competence</i>	Students are able to <ul style="list-style-type: none"> • get together in groups and constructively discuss and analyse set problems. • in a group agree on solutions and document them. 		
<i>Autonomy</i>	Students are able to <ul style="list-style-type: none"> • produce reports on group work. • structure the tasks and timing for working out a set problem. 		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	Compulsor	Bonus	Form
	Yes	None	Group discussion
	No	5 %	Excercises
Examination	Subject theoretical and practical work		

Examination duration and scale	Project report in four work packages, in small groups, during the semester; mandatory interim presentation
Assignment for the Following Curricula	Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Logistics and Mobility: Core qualification: Compulsory

Course L0997: Transport Planning and Traffic Engineering	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz
Language	DE
Cycle	WiSe
Content	<p>The course provides an introductory overview over the fundamentals of urban and regional transport planning, including the sub-topic traffic engineering. The following subject areas are covered:</p> <ul style="list-style-type: none"> • objectives of transport planning, • key mobility metrics, • measuring and predicting demand, • designing and planning transport infrastructure, • fundamentals of traffic engineering and • an introduction to transport concepts and planning processes.
Literature	<p>Steierwald, Gerd; Kühne, Hans Dieter; Vogt, Walter (Hrsg.) (2005) Stadtverkehrsplanung: Grundlagen, Methoden, Ziele. Springer Verlag. Berlin.</p> <p>Bosserhoff, Dietmar (2000) Integration von Verkehrsplanung und räumlicher Planung. Schriftenreihe der Hessischen Straßen- und Verkehrsverwaltung, Heft 42. Hessisches Landesamt für Straßen- und Verkehrswesen. Wiesbaden.</p> <p>Lohse, Dieter; Schnabel, Werner (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung: Band 1; Straßenverkehrstechnik. Beuth Verlag. Berlin.</p> <p>Forschungsgesellschaft für Straßen- und Verkehrswesen (2007) Richtlinien für die Anlage von Stadtstraßen - RAST 06. FGSV-Verlag. Köln (FGSV, 200).</p>

Module M1631: Construction Informatics				
Courses				
Title	Typ	Hrs/wk	CP	
Construction Informatics (L2468)	Integrated Lecture	2	3	
Construction Informatics (L2469)	Recitation (small)	Section 2	3	
Module Responsible	NN			
Admission Requirements	None			
Recommended Previous Knowledge	Students can describe and analyze existing software programs in the discipline based on their essential characteristics. The students are able to reproduce the elementary basics and theoretical concepts of engineering informatics and to apply elementary solution algorithms to engineering problems. They are also able to define database principles and make simple queries to common database systems.			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence	The students are able to convert typical problems of civil engineering into structured programs, to apply spreadsheet programs to engineering problems and to evaluate the advantages and disadvantages of different digital illustrations of geometric models. In addition, the students are able to explain and create profiles and sections of technical drawings in accordance with standards and to design construction plans, 2D and 3D models in a CAD system.			
<i>Knowledge</i>				
<i>Skills</i>				
Personal Competence				
<i>Social Competence</i> <i>Autonomy</i>				
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and scale	Computer aided Application and written-theoretical part			
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory			

Course L2468: Construction Informatics	
Typ	Integrated Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Basic structures and special features of current and sustainable programming languages (like AC30 Python) • Data Formats • Creating, modifying and working process models of databases as a basis for Building Information Modeling (BIM) • Insight into the application of numerical methods (mesh-free, meshed, discrete element methods) for solving application-related engineering problems • pre- and post-processing • Discretization of time and place, accuracy, sensitivity • Exemplary application to civil engineering tasks
Literature	

Course L2469: Construction Informatics	
Typ	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0612: Steel Structures II

Courses

Title	Typ	Hrs/wk	CP
Steel Structures II (L0301)	Lecture	2	3
Steel Structures II (L0302)	Recitation (large)	Section 2	3
Module Responsible	Prof. Marcus Rutner		
Admission Requirements	None		
Recommended Previous Knowledge	Steel Structures I		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p>After successful completion students can</p> <ul style="list-style-type: none"> • describe and explain the behaviour of bolted and welded connections • design and check simple halls and buildings • calculate forces and stresses of simple structures (trusses, beams, frames) • illustrate and dimension the main details (framework, column base, load application points) 		
<i>Knowledge</i>			
<i>Skills</i>	Students are able to design simple structures and connections, describe the load distribution and recognize the possible modes of failure. They can apply structural imperfections, calculate according to 2nd order theory and verify their results.		
Personal Competence			
<i>Social Competence</i>	--		
<i>Autonomy</i>	--		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Written exam		
Examination duration and scale	120 minutes		
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory		

Course L0301: Steel Structures II	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Welded connections • Simple constructions <ul style="list-style-type: none"> ◦ Trusses ◦ Plate girders ◦ Frames ◦ Columns • Buildings with several storeys • Halls
Literature	Petersen, C.: Stahlbau, 4. Auflage 2013, Springer-Vieweg Verlag Wagenknecht, G.: Stahlbau-Praxis nach Eurocode 3, Bauwerk-Verlag 2011 <ul style="list-style-type: none"> • Band 1 Tragwerksplanung, Grundlagen • Band 2 Verbindungen und Konstruktionen

Course L0302: Steel Structures II	
Typ	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M1634: Structural Mechanics

Courses

Title	Typ	Hrs/wk	CP
Structural Mechanics (L2475)	Integrated Lecture	2	3
Module Responsible	Prof. Christian Cyron		
Admission Requirements	None		
Recommended Previous Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence <i>Knowledge</i> <i>Skills</i>			
Personal Competence <i>Social Competence</i> <i>Autonomy</i>			
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28		
Credit points	3		
Course achievement	None		
Examination	Written exam		
Examination duration and scale	90 min		
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory		

Course L2475: Structural Mechanics

Typ	Integrated Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christian Cyron
Language	DE
Cycle	SoSe
Content	
Literature	

Module M1633: Planning Law and Environmental Law/ Sustainable Urban Development

Courses

Title	Typ	Hrs/wk	CP
Sustainable Urban Development (L2474)	Lecture	2	3
Planning law and Environmental law (L2473)	Lecture	2	3
Module Responsible	Prof. Ralf Otterpohl		
Admission Requirements	None		
Recommended Previous Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence <i>Knowledge</i> <i>Skills</i>			
Personal Competence <i>Social Competence</i> <i>Autonomy</i>			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Subject theoretical and practical work		
Examination duration and scale	Written-theoretical part and report		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory		

Course L2474: Sustainable Urban Development

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Irene Peters
Language	DE
Cycle	SoSe
Content	
Literature	

Course L2473: Planning law and Environmental law	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Martin Wickel
Language	DE
Cycle	SoSe
Content	
Literature	

Module M1632: Applied Water Management

Courses

Title	Typ	Hrs/wk	CP
Groundwater Hydrology and -modelling (L2471)	Project-/problem-based Learning	2	2
Groundwater Hydrology and -modelling (L2470)	Lecture	2	2
Nature-oriented Hydraulic Engineering (L2472)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Peter Fröhle		
Admission Requirements	None		
Recommended Previous Knowledge	<ul style="list-style-type: none"> • Basic knowledge of analysis and differential equations • hydromechanical and hydraulic engineering principles 		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
<i>Knowledge</i>	Students are able to define the basic tasks and terms of nature-oriented hydraulic engineering und groundwater hydrology. They can describe the basics concepts, the basic approaches and methods of nature-oriented hydraulic engineering, groundwater hydrology and groundwater modelling and are able to apply these to practical problems.		
<i>Skills</i>	The students are able to apply the methods and approaches of nature-oriented hydraulic engineering and of groundwater hydrology to practical problems. They can demonstrate to transfer and apply these to simple hydraulic engineering systems. In addition, they are able to apply the approaches commonly used in groundwater hydrology. They can exemplarily explain and reason how to apply them as a basis for geo-hydrological questions. In addition, students can apply basic groundwater modelling methods to simple problems of groundwater movement and groundwater recharge.		
Personal Competence			
<i>Social Competence</i>	Students are able to help each other solving case studies. The students are able to deploy their gained knowledge in applied problems of the practical nature-based hydraulic engineering. Additionally, they will be able to demonstrate to work cooperatively in teams consisting of engineers from different subject areas.		
<i>Autonomy</i>	The students will be able to independently extend their knowledge and apply it to new problems.		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		
Credit points	6		
Course achievement	None		
Examination	Subject theoretical and practical work		
Examination duration and scale	Written-theoretical part and modelling		
Assignment for the Following	Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory		

Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory
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Course L2471: Groundwater Hydrology and -modelling	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L2470: Groundwater Hydrology and -modelling	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Hydrologic water balance • aquifertyps • groundwater velocities • Darcy law • groundwater contour lines • storage capacity • flow equation • pumping tests • method of Beyer • solute transport in groundwater • Basics and theoretical background of simulation methods for the analysis of water movement in vadose zone • groundwater recharge
Literature	<p>Todd, K. (2005): Groundwater Hydrology</p> <p>Fetter, C. W. (2001): Applied Hydrogeology</p> <p>Hölting, B. & Coldewey, W. (2005): Hydrogeologie</p> <p>Charbeneau, R. J. (2000): Groundwater Hydraulics and pollutant Transport</p>

Course L2472: Nature-oriented Hydraulic Engineering	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Regime-theory and application for the development of environmental guiding principles of rivers • Engineering-biological measures for the stabilization of rivers • design techniques for water engineering • hydraulic dimensioning of river bed and bank protection • design principles and design techniques for fish passages (fish ladder, ramps etc.)
Literature	

Module M0985: Introduction to Railways				
Courses				
Title	Typ	Hrs/wk	CP	
Introduction to Railways (L1184)	Lecture	2	4	
Introduction to Railways (L1185)	Recitation (large)	Section 1	2	
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
Recommended Previous Knowledge	none			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence	Students can...			
<i>Knowledge</i>	<ul style="list-style-type: none"> • give definitions for basic terms related to railways • explain specifics concerning the handling of goods on railways • explain the required infrastructure • describe the work at the track super structure 			
<i>Skills</i>	--			
Personal Competence	Students can...			
<i>Social Competence</i>	<ul style="list-style-type: none"> • work at tasks in groups and come to results together • discuss contents in groups, summarize them and present them in front of others • convey contents to other by processing them in writing 			
<i>Autonomy</i>	Students can work out and understand contents themselves during the lecture through literature research			
Workload in Hours	Independent Study Time 138, Study Time in Lecture 42			
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and scale	Written exam 60 minutes			
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory			

Course L1184: Introduction to Railways	
Typ	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Friedrich Pech
Language	DE
Cycle	SoSe
Content	--
Literature	Wird im Modul erarbeitet und hängt von den jeweilig benutzten Quellen der Studierenden ab; es werden während der Vorlesung Hinweise gegeben.

Course L1185: Introduction to Railways	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Friedrich Pech
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M1630: Sanitary Engineering II				
Courses				
Title	Typ	Hrs/wk	CP	
Management of Wastewater Infrastructure (L2467)	Seminar	2	3	
Drinking Water Treatment (L2466)	Seminar	2	3	
Module Responsible	Prof. Mathias Ernst			
Admission Requirements	None			
Recommended Previous Knowledge	Basic knowledge in the field of drinking water supply and waste water disposal.			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
<i>Knowledge</i>	The students can exemplify their expert knowledge on drinking water, waste water treatment and the associated infrastructure systems. They are capable of reproducing the relevant empirical assumptions and scientific simplifications in detail. The students can model some processes mathematically. They can also assess existing problems in the field of sanitary engineering, such as removal of nitrate, and place them in a socio-political context. Furthermore, they know how to draft the features and effectiveness of important technologies of the future such as high- and low-pressure membrane filtration systems and techniques.			
<i>Skills</i>	The students are able to apply the relevant standards and guidelines for the design and operation of urban water infrastructures independently. Their expertise comprises expert skills to design drinking water supply and urban drainage systems as well as the associated treatment facilities. Besides the acquirement of technical skills the students are able to address and solve biochemical problems in the field of drinking water and wastewater treatment. The students are also able to develop ideas of their own to improve the existing water related infrastructures, systems and concepts.			
Personal Competence				
<i>Social Competence</i>	The students are able to develop a specific topic in a team and to work out milestones according to a given plan.			
<i>Autonomy</i>	Students are in a position to work on a subject and to organize their work flow independently. They can also present on this subject.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and scale	Written-theoretical part and modelling			
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory			

Course L2467: Management of Wastewater Infrastructure	
Typ	Seminar
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	DE
Cycle	SoSe
Content	<p>The seminar ""Infrastructure Management Wastewater"" develops the understanding of infrastructure systems in relation to wastewater systems, but also addresses other infrastructure systems.</p> <p>Initially, an overview of the entire system is given, including water catchment areas, water distribution, the origin of wastewater in households and industry, stormwater runoff management, and the treatment and reuse of water (constituents). Thereby the design tools especially of digital modelling are understood by practical application. Energetic considerations as well as planning and restoration of pipeline systems are covered.</p> <p>For wastewater treatment, the basis developed in Sanitary Engineering I will be deepened and significantly expanded, especially the resource recovery of nutrients and water. Sanitary solutions for different socio-economic and climatic conditions are understood and calculated.</p>
Literature	<p>Gujer, W. (2007): Siedlungswasserwirtschaft, Springer, Berlin Heidelberg</p> <p>Metcalf and Eddy (2003): Wastewater Engineering : Treatment and Reuse, Boston, McGraw-Hill</p> <p>Henze, M. (1997): Wastewater Treatment : Biological and Chemical Processes, Berlin, Springer</p> <p>Stein D., Stein R. (2014): Instandhaltung von Kanalisationen, Verlag Prof. Dr.-Ing. Stein & Partner GmbH</p> <p>Wossog, G. (2016): Handbuch für den Rohrleitungsbau Band 1 und 2</p> <p>Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall (2009): Abwasserableitung : Bemessungsgrundlagen, Regenwasserbewirtschaftung, Fremdwasser, Netzsanierung, Grundstücksentwässerung, Weimar, Univ.-Verl.</p> <p>DWA Arbeitsblätter</p>

Course L2466: Drinking Water Treatment	
Typ	Seminar
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Mathias Ernst, Dr. Klaus Johannsen
Language	DE
Cycle	SoSe
Content	The seminar deepens and expands the knowledge of the processes of drinking water treatment. The seminar deals with ion exchange, oxidation, disinfection, gas exchange and hybrid treatment processes. Further topics include pH adjustment and energy efficiency in water supply. Within the scope of the course, the students work out a seminar performance (presentation, design, modelling) on the basis of a task.
Literature	Worch, E. (2019): Drinking Water Treatment, De Gruyter-Verlag Worch, E. (2015): Hydrochemistry, De Gruyter-Verlag Jekel, M., Czekalla, C. (2016): Wasseraufbereitung - Grundlagen und Verfahren (DVGW Lehr- und Handbuch Wasserversorgung, Band 6), DIV Deutscher Industrieverlag

Specialization Traffic and Mobility

Module M0983: Mobility Concepts

Courses

Title	Typ	Hrs/wk	CP
Mobility Research and Transportation Projects (L1181)	Project-/problem-based Learning	3	3
Mobility in Megacities and Developing Countries (L1182)	Seminar	3	3

Module Responsible	Dr. Philine Gaffron
Admission Requirements	None
Recommended Previous Knowledge	Module Transportation Planning and Traffic Engineering
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
<i>Knowledge</i>	<p>Students are able to:</p> <ul style="list-style-type: none"> • name the different urban transport systems existing around the world. • explain the transport challenges in Asian and African mega cities. • recognise and relate interactions between transport systems on the one hand and ecological, socio-cultural and economic problem areas on the other. • outline specific issues and problems in urban development and transport (in Germany and developing countries). • explain the effects of external framework factors (like energy costs) on transport.
<i>Skills</i>	<p>Students are able to:</p> <ul style="list-style-type: none"> • analyse and evaluate given case studies. • transfer learning results to other regions and cities. • analyse specific issues and problems in urban development and transport (in developing countries). • critically assess actors, planning objectives, planned measures and the implementation of transport projects in the light of the UN Millennium Development Goals • develop and present sustainable (i.e. ecological, poverty oriented, gender balanced and economical) solutions for urban personal and goods transport
Personal Competence	
<i>Social Competence</i>	<p>Students are able to:</p> <ul style="list-style-type: none"> • present and explain independently generated findings. • constructively discuss potentially controversial topics in a group context.
	<p>Students are able to:</p> <ul style="list-style-type: none"> • carry out independent literature research and analysis.

<i>Autonomy</i>	<ul style="list-style-type: none"> independently author a written report on a given topic. 		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		
Credit points	6		
Course achievement	Compulsory	Bonus	Form
	Yes	None	Participation in excursions
	Yes	None	Excercises
Examination	Written elaboration		
Examination duration and scale	All assignments in groups (2-4 students): written report, 2000 words (incl. 2 short presentations of 10 mins.); final presentation, 20 mins. plus discussion (incl. slides) and 1000 word report incl. peer review (individual).		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory		

Course L1181: Mobility Research and Transportation Projects

Typ	Project-/problem-based Learning
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Philine Gaffron
Language	DE
Cycle	SoSe
Content	<p>This course places its focus on transport and mobility in Germany. It deals with questions such as:</p> <ul style="list-style-type: none"> Which external factors - like e.g. energy costs, availability of renewable and fossil fuels, environmental and climate protection objectives - influence current developments in the transport sector? Which external effects in turn are caused by mobility choices and traffic? How should these interactions be evaluated, how and by whom can they be influenced? Which measures at the municipal level can contribute to a more sustainable transport system? <p>During the course, these questions will be illustrated and discussed with reference to different examples and current developments. Participants will also provide input on specific topics. Potential core subjects of the course could be:</p> <ul style="list-style-type: none"> Environmental Justice : which population groups are disproportionately affected by transport emissions and who causes them? Municipal cycle planning Transport and Climate Protection: can, want, act - everything could be, nothing must be?
Literature	Die Literaturempfehlungen sind abhängig von den jeweiligen, wechselnden Themenschwerpunkten und werden rechtzeitig vor Beginn der Veranstaltung bekannt gegeben.

Course L1182: Mobility in Megacities and Developing Countries	
Typ	Seminar
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Jürgen Perschon, Christof Hertel
Language	DE
Cycle	SoSe
Content	<p>The course provides an overview over different transport projects in the metropolitan areas of developing countries. Considering different perspectives on urban growth, social justice, economic development, environmental and climate protection as well as the economic viability of public transport, the specific situation in the urban conglomerates of Asia, Latin America and Africa will be analysed and placed in a regional and global context. Specific public transport systems will be examined to establish, whether they are a suitable example for sustainable urban development.</p> <p>The following examples could be suitable case studies: Singapore (Metro), Lagos (BRT Light), Guangzhou, Bogota, Jakarta (Full BRT), Sao Paulo, Medellin (Cable Car Systems), Johannesburg (Minibus-Taxi).</p> <p>The course will be designed interactively with the students and will partly be in English as is the majority of the literature in this area (also: Skype online interviews with international experts in the transport sector).</p>
Literature	--

Module M0755: Geotechnics II

Courses

Title	Typ	Hrs/wk	CP
Foundation Engineering (L0552)	Lecture	2	2
Foundation Engineering (L0553)	Recitation (large)	Section 2	2
Foundation Engineering (L1494)	Recitation (small)	Section 2	2
Module Responsible	Prof. Jürgen Grabe		
Admission Requirements	None		
Recommended Previous Knowledge	Modules: <ul style="list-style-type: none"> • Mechanics I-II • Geotechnics I 		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	The students know the basic principles and methods which are required to verificate the stability of geotechnical structures. After successful completion of the module the students are able to: <ul style="list-style-type: none"> • verificate the stability and usability of foundations, • know individual methods of ground improvement and apply them in their range of application, • design retaining walls. 		
<i>Knowledge</i>			
<i>Skills</i>			
Personal Competence			
<i>Social Competence</i>			
<i>Autonomy</i>			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		
Credit points	6		
Course achievement	Compulsory No	Bonus 20 %	Form Attestation
Examination	Written exam		
Examination duration and scale	60 minutes		
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Technomathematics: Specialisation III. Engineering Science: Elective Compulsory		

Course L0552: Foundation Engineering	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	<ul style="list-style-type: none"> • Shallow foundations • Pile foundations • Ground improvement • Retaining walls • Underpinning • Groundwater Conservation • Cut-off Walls
Literature	<ul style="list-style-type: none"> • Vorlesung/Übung s. www.tu-harburg.de/gbt • Grabe, J. (2004): Bodenmechanik und Grundbau • Kolymbas, D. (1998): Geotechnik - Bodenmechanik und Grundbau • Grundbau-Taschenbuch, neueste Auflage

Course L0553: Foundation Engineering	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1494: Foundation Engineering	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Module M1628: Sustainable Building

Courses

Title	Typ	Hrs/wk	CP
Circular flow economy and structural recycling (L2464)	Project-/problem-based Learning	3	3
Sustainable Building (L2463)	Seminar	3	3

Module Responsible	NN
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge of building materials, building chemistry, building construction and building project management
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p><i>Knowledge</i></p> <p>Students are able to reproduce essential features of sustainable construction and material cycles. They can also name the constructional and environmental properties of recyclates and describe the sampling and analysis process. They are able to give an overview of the history, definition and to provide strategic approaches to the sustainability discussion from a constructional and environmental perspective. Furthermore, they can explain relevant objectives, strategies and exemplary fields of research in the field of sustainable construction (e.g. environmental impacts of the production and use of building materials, life cycle assessment, energy and climate-optimised planning and construction, material principles of renewable raw materials). Students will be able to discuss the fundamental relationship between the origin and type of construction waste, quantities produced and methods for characterising them.</p> <p><i>Skills</i></p> <p>Students can relate relevant legal requirements to practical problems of environmentally sound design and construction and thus justify the application of specific limit values for individual areas of application. Students are able to assess risks that may arise from hazardous construction waste in a concise manner. They are able to critically examine innovative areas of application of sustainable construction on the basis of central engineering, economic and legal criteria. They can thereafter evaluate and propose approaches for alternative solutions exemplarily, e.g. for the processing and recycling of construction waste.</p> <p>Personal Competence</p> <p><i>Social Competence</i></p> <p>The students are able to work out their own solutions for specific problems of recycling building materials in small groups. For this purpose, they can organise themselves in a division of labour and can give themselves a work and project plan. Furthermore, they are able to appoint group members to coordinate the cooperation with other working groups of the module and to moderate the presentation of work results in the seminar.</p> <p><i>Autonomy</i></p> <p>Students can coordinate their individual work performance with the other members of the group and prepare for it efficiently by use of scientific media.</p>
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Subject theoretical and practical work
Examination	

duration and scale	Written-theoretical part and project work
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory

Course L2464: Circular flow economy and structural recycling	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	NN
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Types, origin, quantities of construction waste and building debris • Risks and characterisation of construction waste • Avoidance strategies and recycling options for construction waste and building debris • Criteria of sampling, analysis and opportunities for the use of treated building materials • political and legal requirements for the recycling of building materials
Literature	Friedrichsen, S. (2018). Nachhaltiges Planen, Bauen und Wohnen: Kriterien für Neubau und Bauen im Bestand. 2. Aufl. Berlin, Springer Müller et al. (2017). Nachhaltiges Bauen des Bundes: Grundlagen, Methoden, Werkzeuge (Schriftenreihe Zukunft Bauen, Band 08)

Course L2463: Sustainable Building	
Typ	Seminar
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	NN
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Building materials and resource management, significance for infrastructure and environmental projects • Material science of construction materials from renewable resources • Environmental impacts of production and use of building materials • Methods of assessing environmental impacts • Potentials of building materials for sustainable building • Energy- and climate-optimised planning and construction • Life cycle assessment (planning, execution, operation/use, deconstruction) • Aspects of building ecology with regard to refurbishment • Insight into certification systems and evaluation methods for ecological and sustainable buildings
Literature	<p>Friedrichsen, S. (2018). Nachhaltiges Planen, Bauen und Wohnen: Kriterien für Neubau und Bauen im Bestand. 2. Aufl. Berlin, Springer</p> <p>Müller et al. (2017): Nachhaltiges Bauen des Bundes: Grundlagen, Methoden, Werkzeuge (Schriftenreihe Zukunft Bauen, Band 08)</p>

Module M0618: Renewables and Energy Systems

Courses

Title	Typ	Hrs/wk	CP
Power Industry (L0316)	Lecture	1	1
Energy Systems and Energy Industry (L0315)	Lecture	2	2
Renewable Energy (L0313)	Lecture	2	2
Renewable Energy (L1434)	Recitation (small)	Section 1	1

Module Responsible	Prof. Martin Kaltschmitt
Admission Requirements	None
Recommended Previous Knowledge	none
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p><i>Knowledge</i></p> <p>With completion of this module, the students can provide an overview of characteristics of energy systems and their economic efficiency. They can explain the issues occurring in this context. Furthermore, they can explain details of power generation, power distribution and power trading with regard to subject-related contexts. The students can explain these aspects, which are applicable to many energy systems in general, especially for renewable energy systems and critically discuss them. Furthermore, the students can explain the environmental benefits from the use of such systems.</p> <p><i>Skills</i></p> <p>Students are able to apply methodologies for detailed determination of energy demand or energy production for various types of energy systems. Furthermore, they can evaluate energy systems technically, environmentally and economically and design them under certain given conditions. Therefore, they can choose the necessary subject-specific calculation rules, also for non-standardized solutions of a problem.</p> <p>The students are able to explain questions and possible approaches to its processing from the field of renewable energies orally and to put them into the right context.</p> <p>Personal Competence</p> <p><i>Social Competence</i></p> <p>The students are able to analyze suitable technical alternatives and to assess them with technical, economical and ecological criteria under sustainability aspects. This allows them to make an effective contribution to a more sustainable power supply.</p> <p><i>Autonomy</i></p> <p>Students can independently exploit sources, acquire the particular knowledge about the subject area and transform it to new questions.</p>
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam

Examination duration and scale	3 hours written exam
Assignment for the Following Curricula	<p>General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory</p> <p>General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory</p> <p>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Elective Compulsory</p> <p>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory</p> <p>Energy and Environmental Engineering: Core qualification: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Elective Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Elective Compulsory</p> <p>Process Engineering: Core qualification: Compulsory</p>

Course L0316: Power Industry	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Martin Kaltschmitt, Prof. Andreas Wiese
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Electrical energy in the energy system • Demand and use of electrical energy (households, industry, "new" buyers (including e-mobility)) • Electricity generation <ul style="list-style-type: none"> ◦ electricity generation technologies using fossil fuels and their characteristics ◦ combined heat and power technologies and their production characteristics ◦ electricity generation from renewable energy technologies and their characteristics • Power distribution <ul style="list-style-type: none"> ◦ "classic" distribution of electrical energy ◦ challenges of fluctuating electricity generation by distributed systems (electricity market, electricity stock exchange, emissions trading) • District heating industry • Legal and administrative aspects <ul style="list-style-type: none"> ◦ Energy Act ◦ support instruments for renewable energy ◦ CHP Act • Cost and efficiency calculation
Literature	Folien der Vorlesung

Course L0315: Energy Systems and Energy Industry	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Kaltschmitt
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Energy: development and significance • Fundamentals and basic concepts • Energy demand and future trends (heat, electricity, fuels) • Energy reserve and sources • Cost and efficiency calculation • Final and effective energy from petroleum, natural gas, coal, uranium and other • Legal, administrative and organizational aspects of energy systems • Energy systems as a permanent optimization task
Literature	<ul style="list-style-type: none"> • Kopien der Folien

Course L0313: Renewable Energy	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Kaltschmitt
Language	DE/EN
Cycle	SoSe
Content	<ul style="list-style-type: none"> • introduction • solar energy for heat and power generation • wind power for electricity generation • hydropower for electricity generation • ocean energy for electricity generation • geothermal energy for heat and electricity generation
Literature	<ul style="list-style-type: none"> • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007

Course L1434: Renewable Energy	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Martin Kaltschmitt
Language	DE/EN
Cycle	SoSe
Content	<p>Students work on different tasks in the field of renewable energies. They present their solutions in the exercise lesson and discuss it with other students and the lecturer.</p> <p>Possible tasks in the field of renewable energies are:</p> <ul style="list-style-type: none"> • Solar thermal heat • Concentrating solare power • Photovoltaic • Windenergie • Hydropower • Heat pump • Deep geothermal energy
Literature	<ul style="list-style-type: none"> • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007

Module M0887: Transportation Planning and Traffic Engineering

Courses

Title	Typ	Hrs/wk	CP
Transport Planning and Traffic Engineering (L0997)	Project-/problem-based Learning	4	6
Module Responsible	Prof. Carsten Gertz		
Admission Requirements	None		
Recommended Previous Knowledge	None		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
<i>Knowledge</i>	Students are able to <ul style="list-style-type: none"> understand the facts, contexts and objectives of transport planning. correctly apply definitions and concepts of transport planning. reproduce basic concepts of transport modelling. explain the fundamentals of traffic engineering and transport infrastructure construction. 		
<i>Skills</i>	Students are able to <ul style="list-style-type: none"> analyse transport supply based on key metrics. estimate transport demand using key metrics. design transport networks, links and junctions. calculate traffic signal plans. assess transport concepts. 		
Personal Competence			
<i>Social Competence</i>	Students are able to <ul style="list-style-type: none"> get together in groups and constructively discuss and analyse set problems. in a group agree on solutions and document them. 		
<i>Autonomy</i>	Students are able to <ul style="list-style-type: none"> produce reports on group work. structure the tasks and timing for working out a set problem. 		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	Compulsor	Bonus	Form
	Yes	None	Group discussion
	No	5 %	Excercises
Examination	Subject theoretical and practical work		

Examination duration and scale	Project report in four work packages, in small groups, during the semester; mandatory interim presentation
Assignment for the Following Curricula	Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Logistics and Mobility: Core qualification: Compulsory

Course L0997: Transport Planning and Traffic Engineering	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz
Language	DE
Cycle	WiSe
Content	<p>The course provides an introductory overview over the fundamentals of urban and regional transport planning, including the sub-topic traffic engineering. The following subject areas are covered:</p> <ul style="list-style-type: none"> • objectives of transport planning, • key mobility metrics, • measuring and predicting demand, • designing and planning transport infrastructure, • fundamentals of traffic engineering and • an introduction to transport concepts and planning processes.
Literature	<p>Steierwald, Gerd; Kühne, Hans Dieter; Vogt, Walter (Hrsg.) (2005) Stadtverkehrsplanung: Grundlagen, Methoden, Ziele. Springer Verlag. Berlin.</p> <p>Bosserhoff, Dietmar (2000) Integration von Verkehrsplanung und räumlicher Planung. Schriftenreihe der Hessischen Straßen- und Verkehrsverwaltung, Heft 42. Hessisches Landesamt für Straßen- und Verkehrswesen. Wiesbaden.</p> <p>Lohse, Dieter; Schnabel, Werner (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung: Band 1; Straßenverkehrstechnik. Beuth Verlag. Berlin.</p> <p>Forschungsgesellschaft für Straßen- und Verkehrswesen (2007) Richtlinien für die Anlage von Stadtstraßen - RAST 06. FGSV-Verlag. Köln (FGSV, 200).</p>

Module M0631: Reinforced Concrete Structures II

Courses

Title	Typ	Hrs/wk	CP
Project Concrete Structures II (L0894)	Project Seminar	1	1
Concrete Structures II (L0348)	Lecture	2	3
Concrete Structures II (L0349)	Recitation (large)	Section 2	2

Module Responsible	Prof. Günter Rombach
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Admission Requirements	None
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Recommended Previous Knowledge	<ul style="list-style-type: none"> • Knowledge of loads on structures and combination of actions • Basics of safety format are required. • Knowledge in design of beams and columns for ultimate limit state • Modules: Reinforced Concrete Structures I, Structural Analysis I+II, Mechanics I+II
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Educational Objectives	After taking part successfully, students have reached the following learning results
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Professional Competence	
<i>Knowledge</i>	The students know the basic principles which are required for design of reinforced concrete structures. They know the various methods to estimate the member forces in simple one and two-way slabs.
<i>Skills</i>	<ul style="list-style-type: none"> • The students can design reinforced concrete structure in the ultimate limit state (shear, bending, torsion) and in the serviceability limit state (crack and deflection control) including detailing (anchorage and links etc.). • The students can estimate the member forces of simple slabs. • The students know the content and the layout of a structural analysis
Personal Competence	
<i>Social Competence</i>	Cooperation in a project work, where they design in a team a real concrete building and present the results at the end.
<i>Autonomy</i>	

Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
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Credit points	6
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Course achievement	Compulsory	Bonus	Form	Description
	Yes	None	Excercises	

Examination	Written exam
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Examination duration and scale	120 minutes
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Assignment for the Following	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory
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Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Elective Compulsory
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Course L0894: Project Concrete Structures II	
Typ	Project Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Björn Schütte
Language	DE
Cycle	WiSe
Content	Design of a truss structure
Literature	Skript zur Lehrveranstaltung "Stahlbetonbau II"

Course L0348: Concrete Structures II	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Design of concrete members for shear, punching and torsion • Design for serviceability limit state (durability): crack- and deflection control • Detailing • Design of discontinuity regions (e.g. corbels, frame corner) • design of footings • Introduction in the design of slabs • Layout and content of a structural design
Literature	<ul style="list-style-type: none"> • Vorlesungsumdrucke zum downloaden im STUDiP • Zilch K., Zehetmaier G.: Bemessung im konstruktiven Betonbau. Springer Verlag, 2010 • König G., Tue N.: Grundlagen des Stahlbetonbaus. Teubner Verlag, Stuttgart 1998 • Deutscher Beton- und Bautechnikverein E.V.: Beispiele zur Bemessung von Betontragwerken nach Eurocode 2. Band 1: Hochbau, Bauverlag GmbH, Wiesbaden 2011 • Dahms K.-H.: Rohbauzeichnungen, Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997 • Grasser E., Thielen G.: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken. Deutscher Ausschuss für Stahlbeton, Heft 240, Verlag Ernst & Sohn, Berlin 1978 • DIN EN 1992-1-1:2011: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 1: Allgemeine Bemessungsregeln für den Hochbau.

Course L0349: Concrete Structures II	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M1631: Construction Informatics			
Courses			
Title	Typ	Hrs/wk	CP
Construction Informatics (L2468)	Integrated Lecture	2	3
Construction Informatics (L2469)	Recitation (small)	Section 2	3
Module Responsible	NN		
Admission Requirements	None		
Recommended Previous Knowledge	Students can describe and analyze existing software programs in the discipline based on their essential characteristics. The students are able to reproduce the elementary basics and theoretical concepts of engineering informatics and to apply elementary solution algorithms to engineering problems. They are also able to define database principles and make simple queries to common database systems.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	The students are able to convert typical problems of civil engineering into structured programs, to apply spreadsheet programs to engineering problems and to evaluate the advantages and disadvantages of different digital illustrations of geometric models. In addition, the students are able to explain and create profiles and sections of technical drawings in accordance with standards and to design construction plans, 2D and 3D models in a CAD system.		
<i>Knowledge</i>			
<i>Skills</i>			
Personal Competence			
<i>Social Competence</i> <i>Autonomy</i>			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Subject theoretical and practical work		
Examination duration and scale	Computer aided Application and written-theoretical part		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory		

Course L2468: Construction Informatics	
Typ	Integrated Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Basic structures and special features of current and sustainable programming languages (like AC30 Python) • Data Formats • Creating, modifying and working process models of databases as a basis for Building Information Modeling (BIM) • Insight into the application of numerical methods (mesh-free, meshed, discrete element methods) for solving application-related engineering problems • pre- and post-processing • Discretization of time and place, accuracy, sensitivity • Exemplary application to civil engineering tasks
Literature	

Course L2469: Construction Informatics	
Typ	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0829: Foundations of Management

Courses

Title	Typ	Hrs/wk	CP
Management Tutorial (L0882)	Recitation (small)	Section 2	3
Introduction to Management (L0880)	Lecture	3	3

Module Responsible	Prof. Christoph Ihl
Admission Requirements	None
Recommended Previous Knowledge	Basic Knowledge of Mathematics and Business
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p>After taking this module, students know the important basics of many different areas in Business and Management, from Planning and Organisation to Marketing and Innovation, and also to Investment and Controlling. In particular they are able to</p> <ul style="list-style-type: none"> • explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions from the field of Management • explain the most important aspects of and goals in Management and name the most important aspects of entrepreneurial projects • describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and human resource management, information management, innovation management and marketing • explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and explain some basic methods from mathematical Finance • state basics from accounting and costing and selected controlling methods.
<i>Knowledge</i>	
<i>Skills</i>	<p>Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry out an Entrepreneurship project in a team. In particular, they are able to</p> <ul style="list-style-type: none"> • analyse Management goals and structure them appropriately • analyse organisational and staff structures of companies • apply methods for decision making under multiple objectives, under uncertainty and under risk • analyse production and procurement systems and Business information systems • analyse and apply basic methods of marketing • select and apply basic methods from mathematical finance to predefined problems • apply basic methods from accounting, costing and controlling to predefined problems
Personal Competence	<p>Students are able to</p> <ul style="list-style-type: none"> • work successfully in a team of students • to apply their knowledge from the lecture to an entrepreneurship project and

	Mechatronics: Core qualification: Compulsory Orientierungsstudium: Core qualification: Elective Compulsory Naval Architecture: Core qualification: Compulsory Technomathematics: Core qualification: Compulsory Process Engineering: Core qualification: Compulsory
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Course L0882: Management Tutorial	
Typ	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Katharina Roedelius, Tobias Vlcek
Language	DE
Cycle	WiSe/SoSe
Content	<p>In the management tutorial, the contents of the lecture will be deepened by practical examples and the application of the discussed tools.</p> <p>If there is adequate demand, a problem-oriented tutorial will be offered in parallel, which students can choose alternatively. Here, students work in groups on self-selected projects that focus on the elaboration of an innovative business idea from the point of view of an established company or a startup. Again, the business knowledge from the lecture should come to practical use. The group projects are guided by a mentor.</p>
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.

Course L0880: Introduction to Management	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgang Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	<ul style="list-style-type: none"> • Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management • Important definitions from Management, • Developing Objectives for Business, and their relation to important Business functions • Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management, Marketing and Sales • Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management • Definitions as information, information systems, aspects of data security and strategic information systems • Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. • Relevance of marketing, B2B vs. B2C-Marketing • different techniques from the field of marketing (e.g. scenario technique), pricing strategies • important organizational structures • basics of human ressource management • Introduction to Business Planning and the steps of a planning process • Decision Analysis: Elements of decision problems and methods for solving decision problems • Selected Planning Tasks, e.g. Investment and Financial Decisions • Introduction to Accounting: Accounting, Balance-Sheets, Costing • Relevance of Controlling and selected Controlling methods • Important aspects of Entrepreneurship projects
Literature	<p>Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008</p> <p>Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003</p> <p>Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.</p> <p>Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.</p> <p>Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.</p> <p>Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.</p> <p>Weber, J., Schäffer, U. : Einführung in das Controlling, 12. Auflage, Stuttgart 2008.</p> <p>Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.</p>

Module M0985: Introduction to Railways				
Courses				
Title	Typ	Hrs/wk	CP	
Introduction to Railways (L1184)	Lecture	2	4	
Introduction to Railways (L1185)	Recitation (large)	Section 1	2	
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
Recommended Previous Knowledge	none			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence	Students can...			
<i>Knowledge</i>	<ul style="list-style-type: none"> • give definitions for basic terms related to railways • explain specifics concerning the handling of goods on railways • explain the required infrastructure • describe the work at the track super structure 			
<i>Skills</i>	--			
Personal Competence	Students can...			
<i>Social Competence</i>	<ul style="list-style-type: none"> • work at tasks in groups and come to results together • discuss contents in groups, summarize them and present them in front of others • convey contents to other by processing them in writing 			
<i>Autonomy</i>	Students can work out and understand contents themselves during the lecture through literature research			
Workload in Hours	Independent Study Time 138, Study Time in Lecture 42			
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and scale	Written exam 60 minutes			
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory			

Course L1184: Introduction to Railways	
Typ	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Friedrich Pech
Language	DE
Cycle	SoSe
Content	--
Literature	Wird im Modul erarbeitet und hängt von den jeweilig benutzten Quellen der Studierenden ab; es werden während der Vorlesung Hinweise gegeben.

Course L1185: Introduction to Railways	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Friedrich Pech
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M1629: Geoinformation Science				
Courses				
Title	Typ	Hrs/wk	CP	
Introduction to Geoinformation Science (L2465)	Project-/problem-based Learning	3	3	
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous Knowledge	Principles of analysis and linear algebra			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
<i>Knowledge</i>	The students are able to define the tasks and terms from the field of application of geo information systems. They can report the basics, the basic approaches and methods of geo information systems and are able to transfer these to practical questions.			
<i>Skills</i>	Students are able to apply the basic methods used in geo-information systems to practical problems. They are able to apply them to simple applications of geographic information systems and to transfer them to other problems. The students can process a simple GIS project and present their results.			
Personal Competence				
<i>Social Competence</i>	The students can work together groups cooperatively and productively.			
<i>Autonomy</i>	Students are able to organize their work flow to prepare themselves before presentations and discussion. They can acquire appropriate knowledge by making enquiries independently.			
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and scale	Computer aided GIS-Application and written-theoretical part			
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory			

Course L2465: Introduction to Geoinformation Science	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Yohannis Tadesse
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Theoretical basics of Geo-Information-Systems • Data models, geographical coordinates, geo-referencing, map-views • Data mining and -analyses of geo-data • Analysis techniques
Literature	

Module M0612: Steel Structures II

Courses

Title	Typ	Hrs/wk	CP
Steel Structures II (L0301)	Lecture	2	3
Steel Structures II (L0302)	Recitation (large)	Section 2	3
Module Responsible	Prof. Marcus Rutner		
Admission Requirements	None		
Recommended Previous Knowledge	Steel Structures I		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p>After successful completion students can</p> <ul style="list-style-type: none"> describe and explain the behaviour of bolted and welded connections design and check simple halls and buildings calculate forces and stresses of simple structures (trusses, beams, frames) illustrate and dimension the main details (framework, column base, load application points) 		
<i>Knowledge</i>			
<i>Skills</i>	Students are able to design simple structures and connections, describe the load distribution and recognize the possible modes of failure. They can apply structural imperfections, calculate according to 2nd order theory and verify their results.		
Personal Competence			
<i>Social Competence</i>	--		
<i>Autonomy</i>	--		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Written exam		
Examination duration and scale	120 minutes		
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory		

Course L0301: Steel Structures II	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Welded connections • Simple constructions <ul style="list-style-type: none"> ◦ Trusses ◦ Plate girders ◦ Frames ◦ Columns • Buildings with several storeys • Halls
Literature	Petersen, C.: Stahlbau, 4. Auflage 2013, Springer-Vieweg Verlag Wagenknecht, G.: Stahlbau-Praxis nach Eurocode 3, Bauwerk-Verlag 2011 <ul style="list-style-type: none"> • Band 1 Tragwerksplanung, Grundlagen • Band 2 Verbindungen und Konstruktionen

Course L0302: Steel Structures II	
Typ	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M1633: Planning Law and Environmental Law/ Sustainable Urban Development

Courses

Title	Typ	Hrs/wk	CP
Sustainable Urban Development (L2474)	Lecture	2	3
Planning law and Environmental law (L2473)	Lecture	2	3
Module Responsible	Prof. Ralf Otterpohl		
Admission Requirements	None		
Recommended Previous Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence <i>Knowledge</i> <i>Skills</i>			
Personal Competence <i>Social Competence</i> <i>Autonomy</i>			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Subject theoretical and practical work		
Examination duration and scale	Written-theoretical part and report		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory		

Course L2474: Sustainable Urban Development

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Irene Peters
Language	DE
Cycle	SoSe
Content	
Literature	

Course L2473: Planning law and Environmental law	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Martin Wickel
Language	DE
Cycle	SoSe
Content	
Literature	

Module M1630: Sanitary Engineering II

Courses

Title	Typ	Hrs/wk	CP
Management of Wastewater Infrastructure (L2467)	Seminar	2	3
Drinking Water Treatment (L2466)	Seminar	2	3
Module Responsible	Prof. Mathias Ernst		
Admission Requirements	None		
Recommended Previous Knowledge	Basic knowledge in the field of drinking water supply and waste water disposal.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p><i>Knowledge</i></p> <p>The students can exemplify their expert knowledge on drinking water, waste water treatment and the associated infrastructure systems. They are capable of reproducing the relevant empirical assumptions and scientific simplifications in detail. The students can model some processes mathematically. They can also assess existing problems in the field of sanitary engineering, such as removal of nitrate, and place them in a socio-political context. Furthermore, they know how to draft the features and effectiveness of important technologies of the future such as high- and low-pressure membrane filtration systems and techniques.</p> <p><i>Skills</i></p> <p>The students are able to apply the relevant standards and guidelines for the design and operation of urban water infrastructures independently. Their expertise comprises expert skills to design drinking water supply and urban drainage systems as well as the associated treatment facilities. Besides the acquirement of technical skills the students are able to address and solve biochemical problems in the field of drinking water and wastewater treatment. The students are also able to develop ideas of their own to improve the existing water related infrastructures, systems and concepts.</p> <p>Personal Competence</p> <p><i>Social Competence</i></p> <p>The students are able to develop a specific topic in a team and to work out milestones according to a given plan.</p> <p><i>Autonomy</i></p> <p>Students are in a position to work on a subject and to organize their work flow independently. They can also present on this subject.</p>		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Subject theoretical and practical work		
Examination duration and scale	Written-theoretical part and modelling		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory		

Course L2467: Management of Wastewater Infrastructure	
Typ	Seminar
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	DE
Cycle	SoSe
Content	<p>The seminar ""Infrastructure Management Wastewater"" develops the understanding of infrastructure systems in relation to wastewater systems, but also addresses other infrastructure systems.</p> <p>Initially, an overview of the entire system is given, including water catchment areas, water distribution, the origin of wastewater in households and industry, stormwater runoff management, and the treatment and reuse of water (constituents). Thereby the design tools especially of digital modelling are understood by practical application. Energetic considerations as well as planning and restoration of pipeline systems are covered.</p> <p>For wastewater treatment, the basis developed in Sanitary Engineering I will be deepened and significantly expanded, especially the resource recovery of nutrients and water. Sanitary solutions for different socio-economic and climatic conditions are understood and calculated.</p>
Literature	<p>Gujer, W. (2007): Siedlungswasserwirtschaft, Springer, Berlin Heidelberg</p> <p>Metcalf and Eddy (2003): Wastewater Engineering : Treatment and Reuse, Boston, McGraw-Hill</p> <p>Henze, M. (1997): Wastewater Treatment : Biological and Chemical Processes, Berlin, Springer</p> <p>Stein D., Stein R. (2014): Instandhaltung von Kanalisationen, Verlag Prof. Dr.-Ing. Stein & Partner GmbH</p> <p>Wossog, G. (2016): Handbuch für den Rohrleitungsbau Band 1 und 2</p> <p>Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall (2009): Abwasserableitung : Bemessungsgrundlagen, Regenwasserbewirtschaftung, Fremdwasser, Netzsanierung, Grundstücksentwässerung, Weimar, Univ.-Verl.</p> <p>DWA Arbeitsblätter</p>

Course L2466: Drinking Water Treatment	
Typ	Seminar
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Mathias Ernst, Dr. Klaus Johannsen
Language	DE
Cycle	SoSe
Content	The seminar deepens and expands the knowledge of the processes of drinking water treatment. The seminar deals with ion exchange, oxidation, disinfection, gas exchange and hybrid treatment processes. Further topics include pH adjustment and energy efficiency in water supply. Within the scope of the course, the students work out a seminar performance (presentation, design, modelling) on the basis of a task.
Literature	Worch, E. (2019): Drinking Water Treatment, De Gruyter-Verlag Worch, E. (2015): Hydrochemistry, De Gruyter-Verlag Jekel, M., Czekalla, C. (2016): Wasseraufbereitung - Grundlagen und Verfahren (DVGW Lehr- und Handbuch Wasserversorgung, Band 6), DIV Deutscher Industrieverlag

Module M1632: Applied Water Management

Courses

Title	Typ	Hrs/wk	CP
Groundwater Hydrology and -modelling (L2471)	Project-/problem-based Learning	2	2
Groundwater Hydrology and -modelling (L2470)	Lecture	2	2
Nature-oriented Hydraulic Engineering (L2472)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Peter Fröhle		
Admission Requirements	None		
Recommended Previous Knowledge	<ul style="list-style-type: none"> • Basic knowledge of analysis and differential equations • hydromechanical and hydraulic engineering principles 		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p><i>Knowledge</i></p> <p>Students are able to define the basic tasks and terms of nature-oriented hydraulic engineering und groundwater hydrology. They can describe the basics concepts, the basic approaches and methods of nature-oriented hydraulic engineering, groundwater hydrology and groundwater modelling and are able to apply these to practical problems.</p> <p><i>Skills</i></p> <p>The students are able to apply the methods and approaches of nature-oriented hydraulic engineering and of groundwater hydrology to practical problems. They can demonstrate to transfer and apply these to simple hydraulic engineering systems. In addition, they are able to apply the approaches commonly used in groundwater hydrology. They can exemplarily explain and reason how to apply them as a basis for geo-hydrological questions. In addition, students can apply basic groundwater modelling methods to simple problems of groundwater movement and groundwater recharge.</p>		
Personal Competence	<p><i>Social Competence</i></p> <p>Students are able to help each other solving case studies. The students are able to deploy their gained knowledge in applied problems of the practical nature-based hydraulic engineering. Additionally, they will be able to demonstrate to work cooperatively in teams consisting of engineers from different subject areas.</p> <p><i>Autonomy</i></p> <p>The students will be able to independently extend their knowledge and apply it to new problems.</p>		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		
Credit points	6		
Course achievement	None		
Examination	Subject theoretical and practical work		
Examination duration and scale	Written-theoretical part and modelling		
Assignment for the Following	Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory		

Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory
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Course L2471: Groundwater Hydrology and -modelling	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L2470: Groundwater Hydrology and -modelling	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Hydrologic water balance • aquifertyps • groundwater velocities • Darcy law • groundwater contour lines • storage capacity • flow equation • pumping tests • method of Beyer • solute transport in groundwater • Basics and theoretical background of simulation methods for the analysis of water movement in vadose zone • groundwater recharge
Literature	<p>Todd, K. (2005): Groundwater Hydrology</p> <p>Fetter, C. W. (2001): Applied Hydrogeology</p> <p>Hölting, B. & Coldewey, W. (2005): Hydrogeologie</p> <p>Charbeneau, R. J. (2000): Groundwater Hydraulics and pollutant Transport</p>

Course L2472: Nature-oriented Hydraulic Engineering	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Regime-theory and application for the development of environmental guiding principles of rivers • Engineering-biological measures for the stabilization of rivers • design techniques for water engineering • hydraulic dimensioning of river bed and bank protection • design principles and design techniques for fish passages (fish ladder, ramps etc.)
Literature	

Specialization Water and Environment

Module M1628: Sustainable Building

Courses

Title	Typ	Hrs/wk	CP
Circular flow economy and structural recycling (L2464)	Project-/problem-based Learning	3	3
Sustainable Building (L2463)	Seminar	3	3

Module Responsible	NN
Admission Requirements	None
Recommended Previous Knowledge	Basic knowledge of building materials, building chemistry, building construction and building project management
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p><i>Knowledge</i></p> <p>Students are able to reproduce essential features of sustainable construction and material cycles. They can also name the constructional and environmental properties of recyclates and describe the sampling and analysis process. They are able to give an overview of the history, definition and to provide strategic approaches to the sustainability discussion from a constructional and environmental perspective. Furthermore, they can explain relevant objectives, strategies and exemplary fields of research in the field of sustainable construction (e.g. environmental impacts of the production and use of building materials, life cycle assessment, energy and climate-optimised planning and construction, material principles of renewable raw materials). Students will be able to discuss the fundamental relationship between the origin and type of construction waste, quantities produced and methods for characterising them.</p> <p><i>Skills</i></p> <p>Students can relate relevant legal requirements to practical problems of environmentally sound design and construction and thus justify the application of specific limit values for individual areas of application. Students are able to assess risks that may arise from hazardous construction waste in a concise manner. They are able to critically examine innovative areas of application of sustainable construction on the basis of central engineering, economic and legal criteria. They can thereafter evaluate and propose approaches for alternative solutions exemplarily, e.g. for the processing and recycling of construction waste.</p> <p>Personal Competence</p> <p><i>Social Competence</i></p> <p>The students are able to work out their own solutions for specific problems of recycling building materials in small groups. For this purpose, they can organise themselves in a division of labour and can give themselves a work and project plan. Furthermore, they are able to appoint group members to coordinate the cooperation with other working groups of the module and to moderate the presentation of work results in the seminar.</p> <p><i>Autonomy</i></p> <p>Students can coordinate their individual work performance with the other members of the group and prepare for it efficiently by use of scientific media.</p>
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course	None

achievement	
Examination	Subject theoretical and practical work
Examination duration and scale	Written-theoretical part and project work
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory

Course L2464: Circular flow economy and structural recycling	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	NN
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Types, origin, quantities of construction waste and building debris • Risks and characterisation of construction waste • Avoidance strategies and recycling options for construction waste and building debris • Criteria of sampling, analysis and opportunities for the use of treated building materials • political and legal requirements for the recycling of building materials
Literature	<p>Friedrichsen, S. (2018). Nachhaltiges Planen, Bauen und Wohnen: Kriterien für Neubau und Bauen im Bestand. 2. Aufl. Berlin, Springer</p> <p>Müller et al. (2017). Nachhaltiges Bauen des Bundes: Grundlagen, Methoden, Werkzeuge (Schriftenreihe Zukunft Bauen, Band 08)</p>

Course L2463: Sustainable Building	
Typ	Seminar
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	NN
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Building materials and resource management, significance for infrastructure and environmental projects • Material science of construction materials from renewable resources • Environmental impacts of production and use of building materials • Methods of assessing environmental impacts • Potentials of building materials for sustainable building • Energy- and climate-optimised planning and construction • Life cycle assessment (planning, execution, operation/use, deconstruction) • Aspects of building ecology with regard to refurbishment • Insight into certification systems and evaluation methods for ecological and sustainable buildings
Literature	<p>Friedrichsen, S. (2018). Nachhaltiges Planen, Bauen und Wohnen: Kriterien für Neubau und Bauen im Bestand. 2. Aufl. Berlin, Springer</p> <p>Müller et al. (2017): Nachhaltiges Bauen des Bundes: Grundlagen, Methoden, Werkzeuge (Schriftenreihe Zukunft Bauen, Band 08)</p>

Module M0755: Geotechnics II

Courses

Title	Typ	Hrs/wk	CP
Foundation Engineering (L0552)	Lecture	2	2
Foundation Engineering (L0553)	Recitation (large)	Section 2	2
Foundation Engineering (L1494)	Recitation (small)	Section 2	2
Module Responsible	Prof. Jürgen Grabe		
Admission Requirements	None		
Recommended Previous Knowledge	Modules: <ul style="list-style-type: none"> • Mechanics I-II • Geotechnics I 		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	The students know the basic principles and methods which are required to verificate the stability of geotechnical structures. After successful completion of the module the students are able to: <ul style="list-style-type: none"> • verificate the stability and usability of foundations, • know individual methods of ground improvement and apply them in their range of application, • design retaining walls. 		
<i>Knowledge</i>			
<i>Skills</i>			
Personal Competence			
<i>Social Competence</i>			
<i>Autonomy</i>			
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		
Credit points	6		
Course achievement	Compulsory No	Bonus 20 %	Form Attestation
Examination	Written exam		
Examination duration and scale	60 minutes		
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Technomathematics: Specialisation III. Engineering Science: Elective Compulsory		

Course L0552: Foundation Engineering	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	<ul style="list-style-type: none"> • Shallow foundations • Pile foundations • Ground improvement • Retaining walls • Underpinning • Groundwater Conservation • Cut-off Walls
Literature	<ul style="list-style-type: none"> • Vorlesung/Übung s. www.tu-harburg.de/gbt • Grabe, J. (2004): Bodenmechanik und Grundbau • Kolymbas, D. (1998): Geotechnik - Bodenmechanik und Grundbau • Grundbau-Taschenbuch, neueste Auflage

Course L0553: Foundation Engineering	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1494: Foundation Engineering	
Typ	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0983: Mobility Concepts

Courses

Title	Typ	Hrs/wk	CP
Mobility Research and Transportation Projects (L1181)	Project-/problem-based Learning	3	3
Mobility in Megacities and Developing Countries (L1182)	Seminar	3	3

Module Responsible	Dr. Philine Gaffron
Admission Requirements	None
Recommended Previous Knowledge	Module Transportation Planning and Traffic Engineering
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
<i>Knowledge</i>	<p>Students are able to:</p> <ul style="list-style-type: none"> name the different urban transport systems existing around the world. explain the transport challenges in Asian and African mega cities. recognise and relate interactions between transport systems on the one hand and ecological, socio-cultural and economic problem areas on the other. outline specific issues and problems in urban development and transport (in Germany and developing countries). explain the effects of external framework factors (like energy costs) on transport.
<i>Skills</i>	<p>Students are able to:</p> <ul style="list-style-type: none"> analyse and evaluate given case studies. transfer learning results to other regions and cities. analyse specific issues and problems in urban development and transport (in developing countries). critically assess actors, planning objectives, planned measures and the implementation of transport projects in the light of the UN Millennium Development Goals develop and present sustainable (i.e. ecological, poverty oriented, gender balanced and economical) solutions for urban personal and goods transport
Personal Competence	
<i>Social Competence</i>	<p>Students are able to:</p> <ul style="list-style-type: none"> present and explain independently generated findings. constructively discuss potentially controversial topics in a group context.
<i>Autonomy</i>	<p>Students are able to:</p> <ul style="list-style-type: none"> carry out independent literature research and analysis. independently author a written report on a given topic.

Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		
Credit points	6		
Course achievement	Compulsory	Bonus	Form
	Yes	None	Participation in excursions
	Yes	None	Excercises
Examination	Written elaboration		
Examination duration and scale	All assignments in groups (2-4 students): written report, 2000 words (incl. 2 short presentations of 10 mins.); final presentation, 20 mins. plus discussion (incl. slides) and 1000 word report incl. peer review (individual).		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory		

Course L1181: Mobility Research and Transportation Projects	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Philine Gaffron
Language	DE
Cycle	SoSe
Content	<p>This course places its focus on transport and mobility in Germany. It deals with questions such as:</p> <ul style="list-style-type: none"> • Which external factors - like e.g. energy costs, availability of renewable and fossil fuels, environmental and climate protection objectives - influence current developments in the transport sector? • Which external effects in turn are caused by mobility choices and traffic? • How should these interactions be evaluated, how and by whom can they be influenced? • Which measures at the municipal level can contribute to a more sustainable transport system? <p>During the course, these questions will be illustrated and discussed with reference to different examples and current developments. Participants will also provide input on specific topics. Potential core subjects of the course could be:</p> <ul style="list-style-type: none"> • Environmental Justice : which population groups are disproportionately affected by transport emissions and who causes them? • Municipal cycle planning • Transport and Climate Protection: can, want, act - everything could be, nothing must be?
Literature	Die Literaturempfehlungen sind abhängig von den jeweiligen, wechselnden Themenschwerpunkten und werden rechtzeitig vor Beginn der Veranstaltung bekannt gegeben.

Course L1182: Mobility in Megacities and Developing Countries	
Typ	Seminar
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Jürgen Perschon, Christof Hertel
Language	DE
Cycle	SoSe
Content	<p>The course provides an overview over different transport projects in the metropolitan areas of developing countries. Considering different perspectives on urban growth, social justice, economic development, environmental and climate protection as well as the economic viability of public transport, the specific situation in the urban conglomerates of Asia, Latin America and Africa will be analysed and placed in a regional and global context. Specific public transport systems will be examined to establish, whether they are a suitable example for sustainable urban development.</p> <p>The following examples could be suitable case studies: Singapore (Metro), Lagos (BRT Light), Guangzhou, Bogota, Jakarta (Full BRT), Sao Paulo, Medellin (Cable Car Systems), Johannesburg (Minibus-Taxi).</p> <p>The course will be designed interactively with the students and will partly be in English as is the majority of the literature in this area (also: Skype online interviews with international experts in the transport sector).</p>
Literature	--

Module M0618: Renewables and Energy Systems

Courses

Title	Typ	Hrs/wk	CP
Power Industry (L0316)	Lecture	1	1
Energy Systems and Energy Industry (L0315)	Lecture	2	2
Renewable Energy (L0313)	Lecture	2	2
Renewable Energy (L1434)	Recitation (small)	Section 1	1

Module Responsible	Prof. Martin Kaltschmitt
Admission Requirements	None
Recommended Previous Knowledge	none
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	<p><i>Knowledge</i></p> <p>With completion of this module, the students can provide an overview of characteristics of energy systems and their economic efficiency. They can explain the issues occurring in this context. Furthermore, they can explain details of power generation, power distribution and power trading with regard to subject-related contexts. The students can explain these aspects, which are applicable to many energy systems in general, especially for renewable energy systems and critically discuss them. Furthermore, the students can explain the environmental benefits from the use of such systems.</p> <p><i>Skills</i></p> <p>Students are able to apply methodologies for detailed determination of energy demand or energy production for various types of energy systems. Furthermore, they can evaluate energy systems technically, environmentally and economically and design them under certain given conditions. Therefore, they can choose the necessary subject-specific calculation rules, also for non-standardized solutions of a problem.</p> <p>The students are able to explain questions and possible approaches to its processing from the field of renewable energies orally and to put them into the right context.</p> <p>Personal Competence</p> <p><i>Social Competence</i></p> <p>The students are able to analyze suitable technical alternatives and to assess them with technical, economical and ecological criteria under sustainability aspects. This allows them to make an effective contribution to a more sustainable power supply.</p> <p><i>Autonomy</i></p> <p>Students can independently exploit sources, acquire the particular knowledge about the subject area and transform it to new questions.</p>
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84
Credit points	6
Course achievement	None
Examination	Written exam

Examination duration and scale	3 hours written exam
Assignment for the Following Curricula	<p>General Engineering Science (German program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory</p> <p>General Engineering Science (German program, 7 semester): Specialisation Process Engineering: Compulsory</p> <p>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Elective Compulsory</p> <p>General Engineering Science (German program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory</p> <p>Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory</p> <p>Energy and Environmental Engineering: Core qualification: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Energy and Environmental Engineering: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Mechanical Engineering, Focus Energy Systems: Elective Compulsory</p> <p>General Engineering Science (English program, 7 semester): Specialisation Process Engineering: Elective Compulsory</p> <p>Process Engineering: Core qualification: Compulsory</p>

Course L0316: Power Industry	
Typ	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Martin Kaltschmitt, Prof. Andreas Wiese
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Electrical energy in the energy system • Demand and use of electrical energy (households, industry, "new" buyers (including e-mobility)) • Electricity generation <ul style="list-style-type: none"> ◦ electricity generation technologies using fossil fuels and their characteristics ◦ combined heat and power technologies and their production characteristics ◦ electricity generation from renewable energy technologies and their characteristics • Power distribution <ul style="list-style-type: none"> ◦ "classic" distribution of electrical energy ◦ challenges of fluctuating electricity generation by distributed systems (electricity market, electricity stock exchange, emissions trading) • District heating industry • Legal and administrative aspects <ul style="list-style-type: none"> ◦ Energy Act ◦ support instruments for renewable energy ◦ CHP Act • Cost and efficiency calculation
Literature	Folien der Vorlesung

Course L0315: Energy Systems and Energy Industry	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Kaltschmitt
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Energy: development and significance • Fundamentals and basic concepts • Energy demand and future trends (heat, electricity, fuels) • Energy reserve and sources • Cost and efficiency calculation • Final and effective energy from petroleum, natural gas, coal, uranium and other • Legal, administrative and organizational aspects of energy systems • Energy systems as a permanent optimization task
Literature	<ul style="list-style-type: none"> • Kopien der Folien

Course L0313: Renewable Energy	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Martin Kaltschmitt
Language	DE/EN
Cycle	SoSe
Content	<ul style="list-style-type: none"> • introduction • solar energy for heat and power generation • wind power for electricity generation • hydropower for electricity generation • ocean energy for electricity generation • geothermal energy for heat and electricity generation
Literature	<ul style="list-style-type: none"> • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007

Course L1434: Renewable Energy	
Typ	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Martin Kaltschmitt
Language	DE/EN
Cycle	SoSe
Content	<p>Students work on different tasks in the field of renewable energies. They present their solutions in the exercise lesson and discuss it with other students and the lecturer.</p> <p>Possible tasks in the field of renewable energies are:</p> <ul style="list-style-type: none"> • Solar thermal heat • Concentrating solare power • Photovoltaic • Windenergie • Hydropower • Heat pump • Deep geothermal energy
Literature	<ul style="list-style-type: none"> • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2006, 4. Auflage • Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Renewable Energy - Technology, Economics and Environment; Springer, Berlin, Heidelberg, 2007

Module M0887: Transportation Planning and Traffic Engineering

Courses

Title	Typ	Hrs/wk	CP
Transport Planning and Traffic Engineering (L0997)	Project-/problem-based Learning	4	6
Module Responsible	Prof. Carsten Gertz		
Admission Requirements	None		
Recommended Previous Knowledge	None		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
<i>Knowledge</i>	Students are able to <ul style="list-style-type: none"> • understand the facts, contexts and objectives of transport planning. • correctly apply definitions and concepts of transport planning. • reproduce basic concepts of transport modelling. • explain the fundamentals of traffic engineering and transport infrastructure construction. 		
<i>Skills</i>	Students are able to <ul style="list-style-type: none"> • analyse transport supply based on key metrics. • estimate transport demand using key metrics. • design transport networks, links and junctions. • calculate traffic signal plans. • assess transport concepts. 		
Personal Competence			
<i>Social Competence</i>	Students are able to <ul style="list-style-type: none"> • get together in groups and constructively discuss and analyse set problems. • in a group agree on solutions and document them. 		
<i>Autonomy</i>	Students are able to <ul style="list-style-type: none"> • produce reports on group work. • structure the tasks and timing for working out a set problem. 		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	Compulsor	Bonus	Form
	Yes	None	Group discussion
	No	5 %	Excercises
Examination	Subject theoretical and practical work		

Examination duration and scale	Project report in four work packages, in small groups, during the semester; mandatory interim presentation
Assignment for the Following Curricula	Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Logistics and Mobility: Core qualification: Compulsory

Course L0997: Transport Planning and Traffic Engineering	
Typ	Project-/problem-based Learning
Hrs/wk	4
CP	6
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56
Lecturer	Prof. Carsten Gertz
Language	DE
Cycle	WiSe
Content	<p>The course provides an introductory overview over the fundamentals of urban and regional transport planning, including the sub-topic traffic engineering. The following subject areas are covered:</p> <ul style="list-style-type: none"> • objectives of transport planning, • key mobility metrics, • measuring and predicting demand, • designing and planning transport infrastructure, • fundamentals of traffic engineering and • an introduction to transport concepts and planning processes.
Literature	<p>Steierwald, Gerd; Kühne, Hans Dieter; Vogt, Walter (Hrsg.) (2005) Stadtverkehrsplanung: Grundlagen, Methoden, Ziele. Springer Verlag. Berlin.</p> <p>Bosserhoff, Dietmar (2000) Integration von Verkehrsplanung und räumlicher Planung. Schriftenreihe der Hessischen Straßen- und Verkehrsverwaltung, Heft 42. Hessisches Landesamt für Straßen- und Verkehrswesen. Wiesbaden.</p> <p>Lohse, Dieter; Schnabel, Werner (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung: Band 1; Straßenverkehrstechnik. Beuth Verlag. Berlin.</p> <p>Forschungsgesellschaft für Straßen- und Verkehrswesen (2007) Richtlinien für die Anlage von Stadtstraßen - RAST 06. FGSV-Verlag. Köln (FGSV, 200).</p>

Module M0631: Reinforced Concrete Structures II

Courses

Title	Typ	Hrs/wk	CP
Project Concrete Structures II (L0894)	Project Seminar	1	1
Concrete Structures II (L0348)	Lecture	2	3
Concrete Structures II (L0349)	Recitation (large)	Section 2	2

Module Responsible	Prof. Günter Rombach
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Admission Requirements	None
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Recommended Previous Knowledge	<ul style="list-style-type: none"> Knowledge of loads on structures and combination of actions Basics of safety format are required. Knowledge in design of beams and columns for ultimate limit state Modules: Reinforced Concrete Structures I, Structural Analysis I+II, Mechanics I+II
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Educational Objectives	After taking part successfully, students have reached the following learning results
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Professional Competence	<p>The students know the basic principles which are required for design of reinforced concrete structures. They know the various methods to estimate the member forces in simple one and two-way slabs.</p> <ul style="list-style-type: none"> The students can design reinforced concrete structure in the ultimate limit state (shear, bending, torsion) and in the serviceability limit state (crack and deflection control) including detailing (anchorage and links etc.). The students can estimate the member forces of simple slabs. The students know the content and the layout of a structural analysis
<i>Knowledge</i>	
<i>Skills</i>	
Personal Competence	
<i>Social Competence</i>	Cooperation in a project work, where they design in a team a real concrete building and present the results at the end.
<i>Autonomy</i>	

Workload in Hours	Independent Study Time 110, Study Time in Lecture 70
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Credit points	6
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Course achievement	Compulsory	Bonus	Form	Description
	Yes	None	Excercises	

Examination	Written exam
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Examination duration and scale	120 minutes
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Assignment for the Following	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory
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Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory General Engineering Science (English program, 7 semester): Specialisation Civil Engineering: Elective Compulsory
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Course L0894: Project Concrete Structures II	
Typ	Project Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Björn Schütte
Language	DE
Cycle	WiSe
Content	Design of a truss structure
Literature	Skript zur Lehrveranstaltung "Stahlbetonbau II"

Course L0348: Concrete Structures II	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Design of concrete members for shear, punching and torsion • Design for serviceability limit state (durability): crack- and deflection control • Detailing • Design of discontinuity regions (e.g. corbels, frame corner) • design of footings • Introduction in the design of slabs • Layout and content of a structural design
Literature	<ul style="list-style-type: none"> • Vorlesungsumdrucke zum downloaden im STUDiP • Zilch K., Zehetmaier G.: Bemessung im konstruktiven Betonbau. Springer Verlag, 2010 • König G., Tue N.: Grundlagen des Stahlbetonbaus. Teubner Verlag, Stuttgart 1998 • Deutscher Beton- und Bautechnikverein E.V.: Beispiele zur Bemessung von Betontragwerken nach Eurocode 2. Band 1: Hochbau, Bauverlag GmbH, Wiesbaden 2011 • Dahms K.-H.: Rohbauzeichnungen, Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997 • Grasser E., Thielen G.: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken. Deutscher Ausschuss für Stahlbeton, Heft 240, Verlag Ernst & Sohn, Berlin 1978 • DIN EN 1992-1-1:2011: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 1: Allgemeine Bemessungsregeln für den Hochbau.

Course L0349: Concrete Structures II	
Typ	Recitation Section (large)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M1631: Construction Informatics			
Courses			
Title	Typ	Hrs/wk	CP
Construction Informatics (L2468)	Integrated Lecture	2	3
Construction Informatics (L2469)	Recitation (small)	Section 2	3
Module Responsible	NN		
Admission Requirements	None		
Recommended Previous Knowledge	Students can describe and analyze existing software programs in the discipline based on their essential characteristics. The students are able to reproduce the elementary basics and theoretical concepts of engineering informatics and to apply elementary solution algorithms to engineering problems. They are also able to define database principles and make simple queries to common database systems.		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	The students are able to convert typical problems of civil engineering into structured programs, to apply spreadsheet programs to engineering problems and to evaluate the advantages and disadvantages of different digital illustrations of geometric models. In addition, the students are able to explain and create profiles and sections of technical drawings in accordance with standards and to design construction plans, 2D and 3D models in a CAD system.		
<i>Knowledge</i>			
<i>Skills</i>			
Personal Competence			
<i>Social Competence</i> <i>Autonomy</i>			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Subject theoretical and practical work		
Examination duration and scale	Computer aided Application and written-theoretical part		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory		

Course L2468: Construction Informatics	
Typ	Integrated Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	WiSe
Content	<ul style="list-style-type: none"> • Basic structures and special features of current and sustainable programming languages (like AC30 Python) • Data Formats • Creating, modifying and working process models of databases as a basis for Building Information Modeling (BIM) • Insight into the application of numerical methods (mesh-free, meshed, discrete element methods) for solving application-related engineering problems • pre- and post-processing • Discretization of time and place, accuracy, sensitivity • Exemplary application to civil engineering tasks
Literature	

Course L2469: Construction Informatics	
Typ	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M0829: Foundations of Management

Courses

Title	Typ	Hrs/wk	CP
Management Tutorial (L0882)	Recitation (small)	Section 2	3
Introduction to Management (L0880)	Lecture	3	3

Module Responsible	Prof. Christoph Ihl
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Admission Requirements	None
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Recommended Previous Knowledge	Basic Knowledge of Mathematics and Business
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Educational Objectives	After taking part successfully, students have reached the following learning results
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Professional Competence	<p>After taking this module, students know the important basics of many different areas in Business and Management, from Planning and Organisation to Marketing and Innovation, and also to Investment and Controlling. In particular they are able to</p> <ul style="list-style-type: none"> • explain the differences between Economics and Management and the sub-disciplines in Management and to name important definitions from the field of Management • explain the most important aspects of and goals in Management and name the most important aspects of entrepreneurial projects • describe and explain basic business functions as production, procurement and sourcing, supply chain management, organization and human resource management, information management, innovation management and marketing • explain the relevance of planning and decision making in Business, esp. in situations under multiple objectives and uncertainty, and explain some basic methods from mathematical Finance • state basics from accounting and costing and selected controlling methods.
<i>Knowledge</i>	
<i>Skills</i>	<p>Students are able to analyse business units with respect to different criteria (organization, objectives, strategies etc.) and to carry out an Entrepreneurship project in a team. In particular, they are able to</p> <ul style="list-style-type: none"> • analyse Management goals and structure them appropriately • analyse organisational and staff structures of companies • apply methods for decision making under multiple objectives, under uncertainty and under risk • analyse production and procurement systems and Business information systems • analyse and apply basic methods of marketing • select and apply basic methods from mathematical finance to predefined problems • apply basic methods from accounting, costing and controlling to predefined problems
Personal Competence	<p>Students are able to</p> <ul style="list-style-type: none"> • work successfully in a team of students • to apply their knowledge from the lecture to an entrepreneurship project and

	Mechatronics: Core qualification: Compulsory Orientierungsstudium: Core qualification: Elective Compulsory Naval Architecture: Core qualification: Compulsory Technomathematics: Core qualification: Compulsory Process Engineering: Core qualification: Compulsory
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Course L0882: Management Tutorial	
Typ	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christoph Ihl, Katharina Roedelius, Tobias Vlcek
Language	DE
Cycle	WiSe/SoSe
Content	<p>In the management tutorial, the contents of the lecture will be deepened by practical examples and the application of the discussed tools.</p> <p>If there is adequate demand, a problem-oriented tutorial will be offered in parallel, which students can choose alternatively. Here, students work in groups on self-selected projects that focus on the elaboration of an innovative business idea from the point of view of an established company or a startup. Again, the business knowledge from the lecture should come to practical use. The group projects are guided by a mentor.</p>
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.

Course L0880: Introduction to Management	
Typ	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Thorsten Blecker, Prof. Christian LÜthje, Prof. Christian Ringle, Prof. Kathrin Fischer, Prof. Cornelius Herstatt, Prof. Wolfgang Kersten, Prof. Matthias Meyer, Prof. Thomas Wrona
Language	DE
Cycle	WiSe/SoSe
Content	<ul style="list-style-type: none"> • Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management • Important definitions from Management, • Developing Objectives for Business, and their relation to important Business functions • Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management, Marketing and Sales • Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management • Definitions as information, information systems, aspects of data security and strategic information systems • Definition and Relevance of innovations, e.g. innovation opporunities, risks etc. • Relevance of marketing, B2B vs. B2C-Marketing • different techniques from the field of marketing (e.g. scenario technique), pricing strategies • important organizational structures • basics of human ressource management • Introduction to Business Planning and the steps of a planning process • Decision Analysis: Elements of decision problems and methods for solving decision problems • Selected Planning Tasks, e.g. Investment and Financial Decisions • Introduction to Accounting: Accounting, Balance-Sheets, Costing • Relevance of Controlling and selected Controlling methods • Important aspects of Entrepreneurship projects
Literature	<p>Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008</p> <p>Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003</p> <p>Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006.</p> <p>Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001.</p> <p>Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008.</p> <p>Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl., Stuttgart 2005.</p> <p>Weber, J., Schäffer, U. : Einführung in das Controlling, 12. Auflage, Stuttgart 2008.</p> <p>Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.</p>

Module M1630: Sanitary Engineering II				
Courses				
Title	Typ	Hrs/wk	CP	
Management of Wastewater Infrastructure (L2467)	Seminar	2	3	
Drinking Water Treatment (L2466)	Seminar	2	3	
Module Responsible	Prof. Mathias Ernst			
Admission Requirements	None			
Recommended Previous Knowledge	Basic knowledge in the field of drinking water supply and waste water disposal.			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
<i>Knowledge</i>	The students can exemplify their expert knowledge on drinking water, waste water treatment and the associated infrastructure systems. They are capable of reproducing the relevant empirical assumptions and scientific simplifications in detail. The students can model some processes mathematically. They can also assess existing problems in the field of sanitary engineering, such as removal of nitrate, and place them in a socio-political context. Furthermore, they know how to draft the features and effectiveness of important technologies of the future such as high- and low-pressure membrane filtration systems and techniques.			
<i>Skills</i>	The students are able to apply the relevant standards and guidelines for the design and operation of urban water infrastructures independently. Their expertise comprises expert skills to design drinking water supply and urban drainage systems as well as the associated treatment facilities. Besides the acquirement of technical skills the students are able to address and solve biochemical problems in the field of drinking water and wastewater treatment. The students are also able to develop ideas of their own to improve the existing water related infrastructures, systems and concepts.			
Personal Competence				
<i>Social Competence</i>	The students are able to develop a specific topic in a team and to work out milestones according to a given plan.			
<i>Autonomy</i>	Students are in a position to work on a subject and to organize their work flow independently. They can also present on this subject.			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and scale	Written-theoretical part and modelling			
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory			

Course L2467: Management of Wastewater Infrastructure	
Typ	Seminar
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	DE
Cycle	SoSe
Content	<p>The seminar ""Infrastructure Management Wastewater"" develops the understanding of infrastructure systems in relation to wastewater systems, but also addresses other infrastructure systems.</p> <p>Initially, an overview of the entire system is given, including water catchment areas, water distribution, the origin of wastewater in households and industry, stormwater runoff management, and the treatment and reuse of water (constituents). Thereby the design tools especially of digital modelling are understood by practical application. Energetic considerations as well as planning and restoration of pipeline systems are covered.</p> <p>For wastewater treatment, the basis developed in Sanitary Engineering I will be deepened and significantly expanded, especially the resource recovery of nutrients and water. Sanitary solutions for different socio-economic and climatic conditions are understood and calculated.</p>
Literature	<p>Gujer, W. (2007): Siedlungswasserwirtschaft, Springer, Berlin Heidelberg</p> <p>Metcalf and Eddy (2003): Wastewater Engineering : Treatment and Reuse, Boston, McGraw-Hill</p> <p>Henze, M. (1997): Wastewater Treatment : Biological and Chemical Processes, Berlin, Springer</p> <p>Stein D., Stein R. (2014): Instandhaltung von Kanalisationen, Verlag Prof. Dr.-Ing. Stein & Partner GmbH</p> <p>Wossog, G. (2016): Handbuch für den Rohrleitungsbau Band 1 und 2</p> <p>Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall (2009): Abwasserableitung : Bemessungsgrundlagen, Regenwasserbewirtschaftung, Fremdwasser, Netzsanierung, Grundstücksentwässerung, Weimar, Univ.-Verl.</p> <p>DWA Arbeitsblätter</p>

Course L2466: Drinking Water Treatment	
Typ	Seminar
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Mathias Ernst, Dr. Klaus Johannsen
Language	DE
Cycle	SoSe
Content	The seminar deepens and expands the knowledge of the processes of drinking water treatment. The seminar deals with ion exchange, oxidation, disinfection, gas exchange and hybrid treatment processes. Further topics include pH adjustment and energy efficiency in water supply. Within the scope of the course, the students work out a seminar performance (presentation, design, modelling) on the basis of a task.
Literature	<p>Worch, E. (2019): Drinking Water Treatment, De Gruyter-Verlag</p> <p>Worch, E. (2015): Hydrochemistry, De Gruyter-Verlag</p> <p>Jekel, M., Czekalla, C. (2016): Wasseraufbereitung - Grundlagen und Verfahren (DVGW Lehr- und Handbuch Wasserversorgung, Band 6), DIV Deutscher Industrieverlag</p>

Module M1629: Geoinformation Science				
Courses				
Title	Typ	Hrs/wk	CP	
Introduction to Geoinformation Science (L2465)	Project-/problem-based Learning	3	3	
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous Knowledge	Principles of analysis and linear algebra			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence				
<i>Knowledge</i>	The students are able to define the tasks and terms from the field of application of geo information systems. They can report the basics, the basic approaches and methods of geo information systems and are able to transfer these to practical questions.			
<i>Skills</i>	Students are able to apply the basic methods used in geo-information systems to practical problems. They are able to apply them to simple applications of geographic information systems and to transfer them to other problems. The students can process a simple GIS project and present their results.			
Personal Competence				
<i>Social Competence</i>	The students can work together groups cooperatively and productively.			
<i>Autonomy</i>	Students are able to organize their work flow to prepare themselves before presentations and discussion. They can acquire appropriate knowledge by making enquiries independently.			
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42			
Credit points	3			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and scale	Computer aided GIS-Application and written-theoretical part			
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Compulsory			

Course L2465: Introduction to Geoinformation Science	
Typ	Project-/problem-based Learning
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Yohannis Tadesse
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Theoretical basics of Geo-Information-Systems • Data models, geographical coordinates, geo-referencing, map-views • Data mining and -analyses of geo-data • Analysis techniques
Literature	

Module M0612: Steel Structures II

Courses

Title	Typ	Hrs/wk	CP
Steel Structures II (L0301)	Lecture	2	3
Steel Structures II (L0302)	Recitation (large)	Section 2	3
Module Responsible	Prof. Marcus Rutner		
Admission Requirements	None		
Recommended Previous Knowledge	Steel Structures I		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence	<p>After successful completion students can</p> <ul style="list-style-type: none"> • describe and explain the behaviour of bolted and welded connections • design and check simple halls and buildings • calculate forces and stresses of simple structures (trusses, beams, frames) • illustrate and dimension the main details (framework, column base, load application points) 		
<i>Knowledge</i>			
<i>Skills</i>	Students are able to design simple structures and connections, describe the load distribution and recognize the possible modes of failure. They can apply structural imperfections, calculate according to 2nd order theory and verify their results.		
Personal Competence			
<i>Social Competence</i>	--		
<i>Autonomy</i>	--		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Written exam		
Examination duration and scale	120 minutes		
Assignment for the Following Curricula	General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Core qualification: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory		

Course L0301: Steel Structures II	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Welded connections • Simple constructions <ul style="list-style-type: none"> ◦ Trusses ◦ Plate girders ◦ Frames ◦ Columns • Buildings with several storeys • Halls
Literature	Petersen, C.: Stahlbau, 4. Auflage 2013, Springer-Vieweg Verlag Wagenknecht, G.: Stahlbau-Praxis nach Eurocode 3, Bauwerk-Verlag 2011 <ul style="list-style-type: none"> • Band 1 Tragwerksplanung, Grundlagen • Band 2 Verbindungen und Konstruktionen

Course L0302: Steel Structures II	
Typ	Recitation Section (large)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Marcus Rutner
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M0985: Introduction to Railways				
Courses				
Title	Typ	Hrs/wk	CP	
Introduction to Railways (L1184)	Lecture	2	4	
Introduction to Railways (L1185)	Recitation (large)	Section 1	2	
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
Recommended Previous Knowledge	none			
Educational Objectives	After taking part successfully, students have reached the following learning results			
Professional Competence	Students can...			
<i>Knowledge</i>	<ul style="list-style-type: none"> • give definitions for basic terms related to railways • explain specifics concerning the handling of goods on railways • explain the required infrastructure • describe the work at the track super structure 			
<i>Skills</i>	--			
Personal Competence	Students can...			
<i>Social Competence</i>	<ul style="list-style-type: none"> • work at tasks in groups and come to results together • discuss contents in groups, summarize them and present them in front of others • convey contents to other by processing them in writing 			
<i>Autonomy</i>	Students can work out and understand contents themselves during the lecture through literature research			
Workload in Hours	Independent Study Time 138, Study Time in Lecture 42			
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and scale	Written exam 60 minutes			
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Logistics and Mobility: Specialisation Logistics and Mobility: Elective Compulsory			

Course L1184: Introduction to Railways	
Typ	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	Friedrich Pech
Language	DE
Cycle	SoSe
Content	--
Literature	Wird im Modul erarbeitet und hängt von den jeweilig benutzten Quellen der Studierenden ab; es werden während der Vorlesung Hinweise gegeben.

Course L1185: Introduction to Railways	
Typ	Recitation Section (large)
Hrs/wk	1
CP	2
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Friedrich Pech
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M1633: Planning Law and Environmental Law/ Sustainable Urban Development

Courses

Title	Typ	Hrs/wk	CP
Sustainable Urban Development (L2474)	Lecture	2	3
Planning law and Environmental law (L2473)	Lecture	2	3
Module Responsible	Prof. Ralf Otterpohl		
Admission Requirements	None		
Recommended Previous Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence <i>Knowledge</i> <i>Skills</i>			
Personal Competence <i>Social Competence</i> <i>Autonomy</i>			
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56		
Credit points	6		
Course achievement	None		
Examination	Subject theoretical and practical work		
Examination duration and scale	Written-theoretical part and report		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory		

Course L2474: Sustainable Urban Development

Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Irene Peters
Language	DE
Cycle	SoSe
Content	
Literature	

Course L2473: Planning law and Environmental law	
Typ	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Martin Wickel
Language	DE
Cycle	SoSe
Content	
Literature	

Module M1632: Applied Water Management

Courses

Title	Typ	Hrs/wk	CP
Groundwater Hydrology and -modelling (L2471)	Project-/problem-based Learning	2	2
Groundwater Hydrology and -modelling (L2470)	Lecture	2	2
Nature-oriented Hydraulic Engineering (L2472)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Peter Fröhle		
Admission Requirements	None		
Recommended Previous Knowledge	<ul style="list-style-type: none"> • Basic knowledge of analysis and differential equations • hydromechanical and hydraulic engineering principles 		
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
<i>Knowledge</i>	Students are able to define the basic tasks and terms of nature-oriented hydraulic engineering und groundwater hydrology. They can describe the basics concepts, the basic approaches and methods of nature-oriented hydraulic engineering, groundwater hydrology and groundwater modelling and are able to apply these to practical problems.		
<i>Skills</i>	The students are able to apply the methods and approaches of nature-oriented hydraulic engineering and of groundwater hydrology to practical problems. They can demonstrate to transfer and apply these to simple hydraulic engineering systems. In addition, they are able to apply the approaches commonly used in groundwater hydrology. They can exemplarily explain and reason how to apply them as a basis for geo-hydrological questions. In addition, students can apply basic groundwater modelling methods to simple problems of groundwater movement and groundwater recharge.		
Personal Competence			
<i>Social Competence</i>	Students are able to help each other solving case studies. The students are able to deploy their gained knowledge in applied problems of the practical nature-based hydraulic engineering. Additionally, they will be able to demonstrate to work cooperatively in teams consisting of engineers from different subject areas.		
<i>Autonomy</i>	The students will be able to independently extend their knowledge and apply it to new problems.		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84		
Credit points	6		
Course achievement	None		
Examination	Subject theoretical and practical work		
Examination duration and scale	Written-theoretical part and modelling		
Assignment for the Following	Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory		

Curricula	Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory
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Course L2471: Groundwater Hydrology and -modelling	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L2470: Groundwater Hydrology and -modelling	
Typ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Hydrologic water balance • aquifertyps • groundwater velocities • Darcy law • groundwater contour lines • storage capacity • flow equation • pumping tests • method of Beyer • solute transport in groundwater • Basics and theoretical background of simulation methods for the analysis of water movement in vadose zone • groundwater recharge
Literature	<p>Todd, K. (2005): Groundwater Hydrology</p> <p>Fetter, C. W. (2001): Applied Hydrogeology</p> <p>Hölting, B. & Coldewey, W. (2005): Hydrogeologie</p> <p>Charbeneau, R. J. (2000): Groundwater Hydraulics and pollutant Transport</p>

Course L2472: Nature-oriented Hydraulic Engineering	
Typ	Project-/problem-based Learning
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Peter Fröhle
Language	DE
Cycle	SoSe
Content	<ul style="list-style-type: none"> • Regime-theory and application for the development of environmental guiding principles of rivers • Engineering-biological measures for the stabilization of rivers • design techniques for water engineering • hydraulic dimensioning of river bed and bank protection • design principles and design techniques for fish passages (fish ladder, ramps etc.)
Literature	

Thesis

Module M-001: Bachelor Thesis

Courses

Title	Typ	Hrs/wk	CP
Module Responsible	Professoren der TUHH		
Admission Requirements	<ul style="list-style-type: none"> According to General Regulations §21 (1): <p>At least 126 ECTS credit points have to be achieved in study programme. The examinations board decides on exceptions.</p>		
Recommended Previous Knowledge			
Educational Objectives	After taking part successfully, students have reached the following learning results		
Professional Competence			
<i>Knowledge</i>	<ul style="list-style-type: none"> The students can select, outline and, if need be, critically discuss the most important scientific fundamentals of their course of study (facts, theories, and methods). On the basis of their fundamental knowledge of their subject the students are capable in relation to a specific issue of opening up and establishing links with extended specialized expertise. The students are able to outline the state of research on a selected issue in their subject area. 		
<i>Skills</i>	<ul style="list-style-type: none"> The students can make targeted use of the basic knowledge of their subject that they have acquired in their studies to solve subject-related problems. With the aid of the methods they have learnt during their studies the students can analyze problems, make decisions on technical issues, and develop solutions. The students can take up a critical position on the findings of their own research work from a specialized perspective. 		
Personal Competence			
<i>Social Competence</i>	<ul style="list-style-type: none"> Both in writing and orally the students can outline a scientific issue for an expert audience accurately, understandably and in a structured way. The students can deal with issues in an expert discussion and answer them in a manner that is appropriate to the addressees. In doing so they can uphold their own assessments and viewpoints convincingly. 		
<i>Autonomy</i>	<ul style="list-style-type: none"> The students are capable of structuring an extensive work process in terms of time and of dealing with an issue within a specified time frame. The students are able to identify, open up, and connect knowledge and material necessary for working on a scientific problem. The students can apply the essential techniques of scientific work to research of their own. 		

Workload in Hours	Independent Study Time 360, Study Time in Lecture 0
Credit points	12
Course achievement	None
Examination	Thesis
Examination duration and scale	According to General Regulations
Assignment for the Following Curricula	<p>General Engineering Science (German program, 7 semester): Thesis: Compulsory</p> <p>Civil- and Environmental Engineering: Thesis: Compulsory</p> <p>Bioprocess Engineering: Thesis: Compulsory</p> <p>Computer Science: Thesis: Compulsory</p> <p>Data Science: Thesis: Compulsory</p> <p>Digital Mechanical Engineering: Thesis: Compulsory</p> <p>Electrical Engineering: Thesis: Compulsory</p> <p>Energy and Environmental Engineering: Thesis: Compulsory</p> <p>Engineering Science: Thesis: Compulsory</p> <p>General Engineering Science (English program, 7 semester): Thesis: Compulsory</p> <p>Computational Science and Engineering: Thesis: Compulsory</p> <p>Logistics and Mobility: Thesis: Compulsory</p> <p>Mechanical Engineering: Thesis: Compulsory</p> <p>Mechatronics: Thesis: Compulsory</p> <p>Naval Architecture: Thesis: Compulsory</p> <p>Technomathematics: Thesis: Compulsory</p> <p>Teilstudiengang Lehramt Elektrotechnik-Informationstechnik: Thesis: Compulsory</p> <p>Teilstudiengang Lehramt Metalltechnik: Thesis: Compulsory</p> <p>Process Engineering: Thesis: Compulsory</p>