

Module Manual

Bachelor of Science (B.Sc.)

Civil- and Environmental Engineering

Cohort: Winter Term 2021 Updated: 31st May 2023

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Program description

Content

Program structure

Core Qualification

Module M0687: Chem	istry			
Courses				
Title		Тур	Hrs/wk	СР
Chemistry I+II (L0460)		Lecture	4	4
Chemistry I+II (L0475)		Recitation Section (large)	2	2
Module Responsible	Dr. Dorothea Rechtenbach			
Admission Requirements	None			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fo	bllowing learning results		
Professional Competence				
Knowledge	The students are able to name and to describe basic princi table, chemical bonds), physical chemistry (aggregate chemistry (acid/base, pH-value, salts, solubility, redox, me carbonyl compounds, aromates, reaction mechanisms, na explain basic chemical terms.	states, separating processes, t tals) and organic chemistry (aliph	thermodynamics, natic hydrocarbon	kinetics), inorganic s, functional groups,
Skills	After successful completion of this module students are abl they are capable of explaining, choosing and applying spec			ounds. On this basis,
Personal Competence				
Social Competence	Students are able to take part in discussions on chemical is contribute to those discussion by their own statements.	ssues and problems as a member	of an interdiscipli	nary team. They can
Autonomy	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.			
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	General Engineering Science (German program, 7 semester	r): Core Qualification: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Core Qualification: Co	ompulsory		
	Technomathematics: Specialisation III. Engineering Science	: Elective Compulsory		

Course L04	60: Chemistry I+II	
Тур	Lecture	
Hrs/wk	4	
	4	
	Independent Study Time 64, Study Time in Lecture 56	
in Hours Lecturer	Dr. Christoph Wutz	
	DE	
5 5	WiSe	
	Chemistry I:	
	- Structure of matter	
	- Periodic table	
	- Electronegativity	
	- Chemical bonds	
	- Solid compounds and solutions	
	- Chemistry of water	
	- Chemical reactions and equilibria	
	- Acid-base reactions	
	- Redox reactions	
	Chemistry II:	
	- Simple compounds of carbon, aliphatic hydrocarbons, aromatic hydrocarbons,	
	- Alkohols, 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	- 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+I	ourse L0475: Chemistry I+II	
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	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	

Engineering"				
Module M0850: Math	ematics I			
Courses				
Title		Тур	Hrs/wk	СР
Analysis I (L1010)		Lecture	2	2
Analysis I (L1012)		Recitation Section (small)	1	1
Analysis I (L1013)		Recitation Section (large)	1	1
Linear Algebra I (L0912)		Lecture	2	2
Linear Algebra I (L0913)		Recitation Section (small)	1	1
Linear Algebra I (L0914)		Recitation Section (large)	1	1
Module Responsible	Prof Anusch Taraz			
Admission Requirements	None			
Recommended Previous Knowledge	School mathematics			
-		ad the fall such a last mine a said		
	After taking part successfully, students have reach	ed the following learning results		
Professional Competence				
Knowledge	 Students can name the basic concepts in examples. Students can discuss logical connections be the help of examples. They know proof strategies and can reprodu 	tween these concepts. They are capable		
Skills	 Students can model problems in analysis an they are capable of solving them by applying Students are able to discover and verify furt For a given problem, the students can dev results. 	g established methods. her logical connections between the conce	ots studied in the	e course.
Personal Competence Social Competence		cepts according to the needs of their coop		
Autonomy	 Students are capable of checking their under precisely and know where to get help in solv Students have developed sufficient persister problems. 	ing them.		
Westless div Harris	la des est dest Charles Times 120. Charles Times in La struc	- 112		
	Independent Study Time 128, Study Time in Lectur	6 114		
Credit points				
Course achievement				
Examination	Written exam			
Examination duration and	60 min (Analysis I) + 60 min (Linear Algebra I)			
scale				
Assignment for the	General Engineering Science (German program, 7 s	semester): Core Qualification: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Core Qualific			
3 • • • • •	Bioprocess Engineering: Core Qualification: Compu			
	Digital Mechanical Engineering: Core Qualification:	•		
	5 5 5 .			
	Electrical Engineering: Core Qualification: Compulse	-		
	Green Technologies: Energy, Water, Climate: Core			
	Computational Science and Engineering: Core Qual			
	Logistics and Mobility: Core Qualification: Compulse	ory		
	Mechanical Engineering: Core Qualification: Compu	llsory		
	Mechatronics: Core Qualification: Compulsory			
	Orientation Studies: Core Qualification: Elective Con	mpulsory		
	Naval Architecture: Core Qualification: Compulsory			
	Process Engineering: Core Qualification: Compulsor Engineering and Management - Major in Logistics a	-		

Course L1010: Analysis I	
Тур	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
	 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	 http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

Course L1012: Analysis I	ourse L1012: Analysis I	
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	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	ourse L1013: Analysis I	
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dozenten des Fachbereiches Mathematik der UHH, Dr. Simon Campese	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0912: Linear Algebra	al
Ţ	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Anusch Taraz, Dr. Dennis Clemens, Prof. Marko Lindner
Language	DE
Cycle	WiSe
Content	 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 R^n, Gram-Schmidt-Orthonormalization
Literature	 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	al
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Anusch Taraz, Dr. Dennis Clemens, Prof. Marko Lindner
Language	DE
Cycle	WiSe
Content	 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	 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	urse L0914: Linear Algebra I	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Christian Seifert, Dr. Dennis Clemens	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Module M0889: Mech	anics I (Statics)					
Courses						
Title		Тур	Hrs/wk	СР		
Mechanics I (Statics) (L1001)		Lecture	2	3		
Mechanics I (Statics) (L1002)		Recitation Section (small)	2	2		
Mechanics I (Statics) (L1003)		Recitation Section (large)	1	1		
Module Responsible	Prof. Robert Seifried					
Admission Requirements	None					
Recommended Previous	Solid school knowledge in mathematics and physics.					
Knowledge						
Educational Objectives	After taking part successfully, students have reached	d the following learning results				
Professional Competence						
Knowledge	The students can					
	 describe the aviematic precedure used in media 	-hanical contaxts				
	 describe the axiomatic procedure used in med explain important steps in model design; 	inanical contexts,				
	 present technical knowledge in stereostatics. 					
	• present technical knowledge in stereostatics.					
Skills	The students can					
	explain the important elements of mathemat	ical / mechanical analysis and model for	mation and annl	v it to the context		
	their own problems;			y it to the context		
		rohlems				
	 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. 					
	• estimate the reach and boundaries of statical	methods and extend them to be applicat	ble to wider probl	em sets.		
Personal Competence						
Social Competence	The students can work in groups and support each o	ther to overcome difficulties.				
Autonomy	Students are capable of determining their own stren	gths and weaknesses and to organize the	eir time and learn	ing based on those		
Workload in Hours	Independent Study Time 110, Study Time in Lecture	70				
Credit points						
Course achievement						
	Written exam					
Examination duration and						
scale						
Assignment for the		mester): Core Qualification: Compulsory				
Following Curricula						
· · · · · · · · · · · · · · · · · · ·	Bioprocess Engineering: Core Qualification: Compuls					
	Data Science: Specialisation Mechanics: Compulsory	•				
	Digital Mechanical Engineering: Core Qualification: C					
	Electrical Engineering: Core Qualification: Elective Co	ompulsory				
	Green Technologies: Energy, Water, Climate: Core Q					
	Computational Science and Engineering: Specialisation II. Mathematics & Engineering Science: Elective Compulsory					
	Logistics and Mobility: Core Qualification: Compulsor					
	Mechanical Engineering: Core Qualification: Compute	sory				
	Mechatronics: Core Qualification: Compulsory					
	Orientation Studies: Core Qualification: Elective Corr	pulsory				
	Naval Architecture: Core Qualification: Compulsory					
	Technomathematics: Core Qualification: Compulsory					
	Technomathematics: Core Qualification: Compulsory Process Engineering: Core Qualification: Compulsory					

Course L1001: Mechanics I (S	Statics)
Тур	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	 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	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).

Course L1002: Mechanics I (S	Statics)
Тур	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	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).

Course L1003: Mechanics I (Course L1003: Mechanics I (Statics)				
Тур	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 Responsible	Dagmar Richter
Admission Requirements	
Recommended Previous	
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence	
Knowledge	The Non-technical Academic Programms (NTA)
	imparts skills that, in view of the TUHH's training profile, professional engineering studies require but are not able to cover ful Self-reliance, self-management, collaboration and professional and personnel management competences. The departme implements these training objectives in its teaching architecture , in its teaching and learning arrangements , in teachi areas and by means of teaching offerings in which students can qualify by opting for specific competences and a competen level at the Bachelor's or Master's level. The teaching offerings are pooled in two different catalogues for nontechnic complementary courses.
	The Learning Architecture
	consists of a cross-disciplinarily study offering. The centrally designed teaching offering ensures that courses in the nontechnic academic programms follow the specific profiling of TUHH degree courses.
	The learning architecture demands and trains independent educational planning as regards the individual development competences. It also provides orientation knowledge in the form of "profiles"
	The subjects that can be studied in parallel throughout the student's entire study program - if need be, it can be studied in one two semesters. In view of the adaptation problems that individuals commonly face in their first semesters after making t transition from school to university and in order to encourage individually planned semesters abroad, there is no obligation study these subjects in one or two specific semesters during the course of studies.
	Teaching and Learning Arrangements
	provide for students, separated into B.Sc. and M.Sc., to learn with and from each other across semesters. The challenge of deal with interdisciplinarity and a variety of stages of learning in courses are part of the learning architecture and are deliberat encouraged in specific courses.
	Fields of Teaching
	are based on research findings from the academic disciplines cultural studies, social studies, arts, historical studies, migrati studies, communication studies and sustainability research, and from engineering didactics. In addition, from the winter semes 2014/15 students on all Bachelor's courses will have the opportunity to learn about business management and start-ups in a go oriented way.
	The fields of teaching are augmented by soft skills offers and a foreign language offer. Here, the focus is on encouraging go oriented communication skills, e.g. the skills required by outgoing engineers in international and intercultural situations.
	The Competence Level
	of the courses offered in this area is different as regards the basic training objective in the Bachelor's and Master's fields. The differences are reflected in the practical examples used, in content topics that refer to different professional application contex and in the higher scientific and theoretical level of abstraction in the B.Sc.
	This is also reflected in the different quality of soft skills, which relate to the different team positions and different group leaders functions of Bachelor's and Master's graduates in their future working life.
	Specialized Competence (Knowledge)
	Students can
	 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 t 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 representati 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.
Skills	Professional Competence (Skills)
	In selected sub-areas students can
	 apply basic methods of the said scientific disciplines, auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned special discipline, to handle simple questions in aforementioned scientific disciplines in a sucsessful manner, justify their decisions on forms of organization and application in practical questions in contexts that go beyond t technical relationship to the subject.
Personal Competence	
Social Competence	Personal Competences (Social Skills)
	Students will be able

Autopomy	 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.
Autonomy	
	Students are able in selected areas
	• 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 writen form or verbaly
	• 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

Courses

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

Courses					
Title		Тур	Hrs/wk	СР	
Building Physics (L0217)		Lecture	2	2	
Building Physics (L0219)		Recitation Section (large)	1	1	
Building Physics (L0247)	Recitation Section (small)	1	1		
Principles of Building Materials (L02	215)	Lecture	2	2	
Module Responsible	Prof. Frank Schmidt-Döhl				
Admission Requirements	None				
Recommended Previous	Knowledge of physics, chemistry and	mathematics from school			
Knowledge					
Educational Objectives	After taking part successfully, studen	ts have reached the following learning results			
Professional Competence					
Skills	behaviour, to describe the structure of building materials and the correlations between structure and other properties, show methods of joining and of corrosion processes and to describe the most important regularities and properties of buildi materials and structures and their measurement in the field of protection against moisture, coldness, fire and noise. The students are able to work with the most important standardized methods and regularities in the field of moisture protection				
		ing fire protection and poice protection in the case of		i moisture protecti	
Personal Competence	the German regulation for energy sav	ing, fire protection and noise protection in the case of		i moisture protecti	
•		ing, fire protection and noise protection in the case of nother to learn the very extensive specialist knowledge	a small building.	i moisture protecti	
Social Competence	The students are able to support each		a small building. Je.		
Social Competence Autonomy	The students are able to support each	n other to learn the very extensive specialist knowledgen and the operation steps to learn the specialist kn	a small building. Je.		
Social Competence Autonomy	The students are able to support each The students are able to make the tin Independent Study Time 96, Study Ti	n other to learn the very extensive specialist knowledgen and the operation steps to learn the specialist kn	a small building. Je.		
Social Competence Autonomy Workload in Hours	The students are able to support each The students are able to make the tin Independent Study Time 96, Study Tin 6	n other to learn the very extensive specialist knowledgen and the operation steps to learn the specialist kn	a small building. Je.		
Social Competence Autonomy Workload in Hours Credit points Course achievement	The students are able to support each The students are able to make the tin Independent Study Time 96, Study Tin 6	n other to learn the very extensive specialist knowledgen and the operation steps to learn the specialist kn	a small building. Je.		
Social Competence Autonomy Workload in Hours Credit points Course achievement	The students are able to support each The students are able to make the tin Independent Study Time 96, Study Tim 6 None Written exam	n other to learn the very extensive specialist knowledgen and the operation steps to learn the specialist kn	a small building. Je.		
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination	The students are able to support each The students are able to make the tin Independent Study Time 96, Study Tim 6 None Written exam	n other to learn the very extensive specialist knowledgen and the operation steps to learn the specialist kn	a small building. Je.		
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale	The students are able to support each The students are able to make the tin Independent Study Time 96, Study Tim 6 None Written exam 2 h written exam	n other to learn the very extensive specialist knowledgen and the operation steps to learn the specialist kn	a small building. Je. owledge of a very o		
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students are able to support each The students are able to make the tin Independent Study Time 96, Study Tim 6 None Written exam 2 h written exam	n other to learn the very extensive specialist knowledge ning and the operation steps to learn the specialist knowledge me in Lecture 84	a small building. Je. owledge of a very o		
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students are able to support each The students are able to make the tin Independent Study Time 96, Study Tim 6 None Written exam 2 h written exam General Engineering Science (German	n other to learn the very extensive specialist knowledge ning and the operation steps to learn the specialist knowledge me in Lecture 84	a small building. Je. owledge of a very o		

Course L0217: Building Phys	ics
Тур	Lecture
Hrs/wk	2
СР	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, HM. ; 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 Phys	urse L0219: Building Physics			
Тур	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 Phys	Course L0247: Building Physics		
Тур	Recitation Section (small)		
Hrs/wk	1		
СР	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		

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

Module M0590: Build	ing Materials ar	nd Building C	Chemistry				
Courses							
Title				Тур	Hrs/wk	СР	
Building Materials and Building Che	emistry (L0248)			Lecture	4	4	
Building Materials and Building Che	emistry (L0249)			Recitation Section (small)	1	2	
Module Responsible	Prof. Frank Schmidt-D	öhl					
Admission Requirements	None						
Recommended Previous	Module Principles of B	uilding Materials a	nd Building Physics				
Knowledge							
Educational Objectives	After taking part succ	essfully, students l	have reached the follow	ng learning results			
Professional Competence							
Knowledge	The students are al	ole to explain the	e most important com	ponents, the manufacture	e, the structure, t	he most importar	
	characteristics of the	mechanical behave	viour and the corrosion	behaviour, the material te	sting and the field	s of utilization of a	
	relevant building mate	erials.					
Skills	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 parame					
	They are able to selec	t suitable material	ls and mixtures to avoid	damage processes.			
Personal Competence							
Social Competence	The students are able	e to support each o	other to learn the very	extensive specialist knowled	dge in learning gro	ups and to carry ou	
	exercises in small gro	ups in the lab.					
Autonomy	The students are able	to make the timin	g and the operation step	os to learn the specialist kno	wledge of a very e	xtensive field.	
	Independent Study Ti	me 110, Study Tim	ie in Lecture 70				
Credit points		F	Description				
Course achievement	Compulsory Bonus	Form Presentation	Description				
Examination	Written exam	resentation					
Examination duration and							
examination duration and scale							
Assignment for the	General Engineering	cience (Corman n	rogram 7 somostor). Sr	ecialisation Civil Engineerin	a: Compulsory		
Following Curricula	5 5		ore Qualification: Compu		g. compuisory		
Following curricula	Orientation Studies: C			пзогу			
	onentation studies. C		Liective Compuisoly				

Course L0248: Building Materials and Building Chemistry	
Тур	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 Mate	Course L0249: Building Materials and Building Chemistry	
Тур	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, Andre Rössler	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Module M0696: Mech	anics II: Mechanics of Materia	als		
Courses				
Title		Тур	Hrs/wk	СР
Mechanics II (L0493)		Lecture	2	2
Mechanics II (L0494)		Recitation Section (small)	2	2
Mechanics II (L1691)		Recitation Section (large)	2	2
Module Responsible	Prof. Christian Cyron			
Admission Requirements	None			
Recommended Previous	Mechanics I			
Knowledge				
Educational Objectives	After taking part successfully, students ha	ve reached the following learning results		
Professional Competence				
	elastostatics, in particular stress, strain, stability of structures. Having accomplished this module, the stud - apply the fundamental concepts of mathe	ematical and mechanical modeling and analysis to to problems of engineering, in particular in the des	ailure analysis, e	energy methods and choice
Personal Competence Social Competence Autonomy Workload in Hours	- - Independent Study Time 96, Study Time ir	n Lecture 84		
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and	90 min			
scale				
Assignment for the	General Engineering Science (German pro	gram, 7 semester): Core Qualification: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Core			
, , , , , , , , , , , , , , , , , , ,	Bioprocess Engineering: Core Qualification			
	Data Science: Specialisation Mechanics: Co			
	Digital Mechanical Engineering: Core Quali	ification: Compulsory		
	Electrical Engineering: Core Qualification:			
	Green Technologies: Energy, Water, Clima			
	Logistics and Mobility: Core Qualification: (Compulsory		
	Mechanical Engineering: Core Qualification	n: Compulsory		
	Mechatronics: Core Qualification: Compuls	ory		
	Orientation Studies: Core Qualification: Ele	ective Compulsory		
	Naval Architecture: Core Qualification: Cor	npulsory		
	Technomathematics: Specialisation III. Eng	gineering Science: Elective Compulsory		
	Process Engineering: Core Qualification: Co	ompulsory		
	······································	cinpulsory		

Course L0493: Mechanics II	
Тур	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	 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	
Тур	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	
Тур	Recitation Section (large)
Hrs/wk	2
СР	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 M0851: Mathematics II				
Courses				
Title		Тур	Hrs/wk	СР
Analysis II (L1025)		Lecture	2	2
			1	1
Analysis II (L1026)		Recitation Section (large)		
Analysis II (L1027)		Recitation Section (small)	1 2	1 2
Linear Algebra II (L0915)		Lecture	2	
Linear Algebra II (L0916)		Recitation Section (small)		1
Linear Algebra II (L0917)		Recitation Section (large)	1	1
Module Responsible	Prof. Anusch Taraz			
Admission Requirements	None			
Recommended Previous	Mathematics I			
Knowledge				
-	After taking part successfully, students have reach	ad the following learning regults		
Educational Objectives	After taking part successfully, students have reach	led the following learning results		
Professional Competence				
Knowledge				
	 Students can name further concepts in a 	nalysis and linear algebra. They are able	e to explain the	em using appropriate
	examples.			
	Students can discuss logical connections be	etween these concepts. They are capable	of illustrating th	ese connections with
	the help of examples.			
	 They know proof strategies and can reprodu 	ice them.		
	· mey men provi strategies and can reprode			
Skills				
	 Students can model problems in analysis and 		epts studied in tl	his course. Moreover,
	they are capable of solving them by applyin	g established methods.		
	 Students are able to discover and verify further 	ther logical connections between the conce	pts studied in the	e course.
	• For a given problem, the students can de	velop and execute a suitable approach, a	nd are able to c	ritically evaluate the
	results.			
	results			
Personal Competence				
Social Competence				
, ,	 Students are able to work together in teams 	s. They are capable to use mathematics as	a common langu	age.
	 In doing so, they can communicate new corr 	ncepts according to the needs of their coop	perating partners	. Moreover, they can
	design examples to check and deepen the u	Inderstanding of their peers.		
Autonomy	Chudrata and samelals of shareling their used			
	 Students are capable of checking their und 		wn. They can sp	ecity open questions
	precisely and know where to get help in solv	ving them.		
	 Students have developed sufficient persist 	ence to be able to work for longer period	s in a goal-orien	ted manner on hard
	problems.			
Workload in Hours	Independent Study Time 128, Study Time in Lectu	re 112		
Credit points	8			
Course achievement	None			
Examination				
Examination duration and	60 min (Analysis II) + 60 min (Linear Algebra II)			
scale				
	General Engineering Science (German program, 7	semester): Core Qualification: Compulsory		
Assignment for the				
-		cation: Compulsory		
Assignment for the Following Curricula	Civil- and Environmental Engineering: Core Qualifie			
-	Civil- and Environmental Engineering: Core Qualific Bioprocess Engineering: Core Qualification: Compu	Ilsory		
-	Civil- and Environmental Engineering: Core Qualific Bioprocess Engineering: Core Qualification: Compu Digital Mechanical Engineering: Core Qualification:	ilsory Compulsory		
-	Civil- and Environmental Engineering: Core Qualific Bioprocess Engineering: Core Qualification: Compu	ilsory Compulsory		
-	Civil- and Environmental Engineering: Core Qualific Bioprocess Engineering: Core Qualification: Compu Digital Mechanical Engineering: Core Qualification:	llsory Compulsory sory		
-	Civil- and Environmental Engineering: Core Qualifie Bioprocess Engineering: Core Qualification: Compu- Digital Mechanical Engineering: Core Qualification: Electrical Engineering: Core Qualification: Compuls Green Technologies: Energy, Water, Climate: Core	Ilsory Compulsory sory Qualification: Compulsory		
-	Civil- and Environmental Engineering: Core Qualifie Bioprocess Engineering: Core Qualification: Compu- Digital Mechanical Engineering: Core Qualification: Electrical Engineering: Core Qualification: Compuls Green Technologies: Energy, Water, Climate: Core Computational Science and Engineering: Core Qua	Ilsory Compulsory sory Qualification: Compulsory Ilification: Compulsory		
-	Civil- and Environmental Engineering: Core Qualifie Bioprocess Engineering: Core Qualification: Compu- Digital Mechanical Engineering: Core Qualification: Electrical Engineering: Core Qualification: Compuls Green Technologies: Energy, Water, Climate: Core Computational Science and Engineering: Core Qua Logistics and Mobility: Core Qualification: Compuls	Ilsory Compulsory ory Qualification: Compulsory Ilification: Compulsory ory		
-	Civil- and Environmental Engineering: Core Qualific Bioprocess Engineering: Core Qualification: Compu- Digital Mechanical Engineering: Core Qualification: Electrical Engineering: Core Qualification: Compuls Green Technologies: Energy, Water, Climate: Core Computational Science and Engineering: Core Qua Logistics and Mobility: Core Qualification: Compuls Mechanical Engineering: Core Qualification: Compuls	Ilsory Compulsory ory Qualification: Compulsory Ilification: Compulsory ory		
-	Civil- and Environmental Engineering: Core Qualifie Bioprocess Engineering: Core Qualification: Compu- Digital Mechanical Engineering: Core Qualification: Electrical Engineering: Core Qualification: Compuls Green Technologies: Energy, Water, Climate: Core Computational Science and Engineering: Core Qua Logistics and Mobility: Core Qualification: Compuls	Ilsory Compulsory ory Qualification: Compulsory Ilification: Compulsory ory		
-	Civil- and Environmental Engineering: Core Qualific Bioprocess Engineering: Core Qualification: Compu- Digital Mechanical Engineering: Core Qualification: Electrical Engineering: Core Qualification: Compuls Green Technologies: Energy, Water, Climate: Core Computational Science and Engineering: Core Qua Logistics and Mobility: Core Qualification: Compuls Mechanical Engineering: Core Qualification: Compuls	Ilsory Compulsory ory Qualification: Compulsory lification: Compulsory ory ulsory		
-	Civil- and Environmental Engineering: Core Qualific Bioprocess Engineering: Core Qualification: Compu- Digital Mechanical Engineering: Core Qualification: Electrical Engineering: Core Qualification: Compuls Green Technologies: Energy, Water, Climate: Core Computational Science and Engineering: Core Qua Logistics and Mobility: Core Qualification: Compuls Mechanical Engineering: Core Qualification: Compuls Mechanical Engineering: Core Qualification: Compuls Orientation Studies: Core Qualification: Elective Core	Ilsory Compulsory cory Qualification: Compulsory lification: Compulsory ory ulsory		
-	Civil- and Environmental Engineering: Core Qualifi Bioprocess Engineering: Core Qualification: Compu- Digital Mechanical Engineering: Core Qualification: Electrical Engineering: Core Qualification: Compuls Green Technologies: Energy, Water, Climate: Core Computational Science and Engineering: Core Qua Logistics and Mobility: Core Qualification: Compuls Mechanical Engineering: Core Qualification: Compuls Mechanical Engineering: Core Qualification: Compulsory Orientation Studies: Core Qualification: Elective Con Naval Architecture: Core Qualification: Compulsory	Ilsory Compulsory Gualification: Compulsory lification: Compulsory ory ulsory		
-	Civil- and Environmental Engineering: Core Qualific Bioprocess Engineering: Core Qualification: Compu- Digital Mechanical Engineering: Core Qualification: Electrical Engineering: Core Qualification: Compuls Green Technologies: Energy, Water, Climate: Core Computational Science and Engineering: Core Qua Logistics and Mobility: Core Qualification: Compuls Mechanical Engineering: Core Qualification: Compuls Mechanical Engineering: Core Qualification: Compuls Orientation Studies: Core Qualification: Elective Core	Ilsory Compulsory Sory Qualification: Compulsory lification: Compulsory ory Julsory mpulsory ry		

Course L1025: Analysis II	
-	Lecture
Hrs/wk	
СР	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	 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	 http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

ourse L1026: Analysis II	
Тур	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, Dr. Sebastian Götschel
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L1027: Analysis II	ourse L1027: Analysis II	
Тур	Recitation Section (small)	
Hrs/wk	1	
СР	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	a II
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Anusch Taraz, Dr. Dennis Clemens, Prof. Marko Lindner
Language	DE
Cycle	SoSe
Content	 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	 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	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Anusch Taraz, Dr. Dennis Clemens, Prof. Marko Lindner
Language	DE
Cycle	SoSe
Content	 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	 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	urse L0917: Linear Algebra II		
Тур	Recitation Section (large)		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Prof. Anusch Taraz, Dr. Christian Seifert, Dr. Dennis Clemens, Prof. Marko Lindner		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Module M0660: Const	ruction Industry and Const	ruction Management		
Module Modol. Const	ruction mutativy and const			
Courses				
Title		Тур	Hrs/wk	СР
Construction Management (L0396)		Lecture	2	2
Construction Management (L0397)		Recitation Section (large)	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	none			
Knowledge				
Educational Objectives	After taking part successfully, students	have reached the following learning results		
Professional Competence				
Knowledge	After successful completion of the mod	ule, students are able to		
	 understand basic knowledge of or 	-		
	 choose appropriate methodes of 	construction project management to solve problems,		
	 capture basic structures and ant 	agonisms of European enviromental legislation,		
	 locate and apply relevant enviro 	mental regulations		
	 implement any environmental reg 	gulation to the realisation of an construction project an	d to capture the	signifiacance for th
	civil engineer			
	 recognize basic structures of ger 	neral civil and construction law as well as standards for	construction wo	rks
	capture the content of contracts	which are important for building design and execution		
Skills				
Personal Competence				
Social Competence				
Autonomy				
,	Independent Study Time 110, Study Tir	me in Lecture 70		
Credit points				
Course achievement	None			
Examination	Written exam			
Examination duration and	120 minutes			
scale				
Assignment for the	Civil- and Environmental Engineering: (Core Qualification: Compulsory		
Following Curricula				

Course L0396: Construction	Course L0396: Construction Management		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Jürgen Grabe		
Language	DE		
Cycle	SoSe		
Content	 Project development Project management Announcement Order acquisition Project execution Project supervision 		
Literature	 Vorlesungsskript, s. www.tuhh.de/gbt Baugeräteliste BGL Honorarordnung für Architekten und Ingenieure HOAI Verdingungsordnung im Bauwesen VOB mit Kommentaren 		

Course L0397: Construction Management		
Тур	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 Buildin	g Contracts
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Schmeel
Language	DE
Cycle	SoSe
Content	 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	 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: Environmenta	il Law
Тур	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	The lecture focusses on:
	 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	 Erbguth, Wilfried; Schlacke, Sabine, Umweltrecht, 6. Auflage 2016 Gesetzessammlung Umweltrecht, 26. Auflage 2016 (Beck Texte im dtv)

Module M1627: Wate	r and Environment			
Courses				
Title		Тур	Hrs/wk	СР
Project on Water, Environment, Tra	ffic (L2462)	Project-/problem-based Learning	ng 2	3
Water in the Environment (L2461)		Lecture	2	3
Module Responsible	Prof. Mathias Ernst			
Admission Requirements	None			
Recommended Previous	Basic knowledge of chemistry			
Knowledge				
Educational Objectives	After taking part successfully, students ha	ve reached the following learning results		
Professional Competence				
Knowledge	Students can define generic material inter	ractions between the environmental media. The ca	n demonstrate th	heir knowledge abo
	natural as well as anthropogenic materials. They are capable of explaining the natural condition of waters an			
	environmental media.			
Skills	Students are able to research environme	ent-specific aspects of civil engineering independ	ent. They can p	present their findir
	using accredited academic media (e.g. po	sters) and can give a short summary including scier	tific references.	
Personal Competence				
Social Competence	Students can fulfil a complex environment	-related assignment in the field of civil engineering	by working in a	team.
Autonomy				
	Independent Study Time 124, Study Time	in Lecture 56		
Credit points				
Course achievement	None			
Examination	Subject theoretical and practical work		-	
Examination duration and	Written-theoretical part and project work			
scale				
Assignment for the	General Engineering Science (German pro	ogram, 7 semester): Specialisation Green Technolog	jies, Focus Wate	er and Environment
Following Curricula	Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Core	e Qualification: Compulsory		
	Green Technologies: Energy, Water, Clima	te: Specialisation Water: Elective Compulsory		

Course L2462: Project on Wa	Course L2462: Project on Water, Environment, Traffic				
Тур	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 Civicl Engineering provide duties on environmentally relevant fields of civil engineering for smal student groups (max. 4 students).				
Literature	aufgabenspeziifisch / according to corresponding tasks				

Course L2461: Water in the I	Course L2461: Water in the Environment		
Тур	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	 Basics of global/regional Water Cycle quality of water natural/anthropogenic water ingredients Basics water science water legislation (EU/D) 		
Literature	Schwoerbel, J. 2005: Einführung in die Limnologie. Heidelberg: Elsevier Grohmann, A. u. a. 2011: Wasser. Berlin: de Gruyter Kluth, W. & Schmeddinck, U. 2013: Umweltrecht: Ein Lehrbuch. Wiesbaden: Springer		

Engineering						
Module M0728: Hydro	omechanics a	nd Hydrology				
Courses						
Title				Тур	Hrs/wk	СР
Hydrology (L0909)				Lecture	1	1
Hydrology (L0956)				Project-/problem-based Learning	1	2
Hydromechanics (L0615)				Lecture	2	2
Hydromechanics (L0616)				Project-/problem-based Learning	1	1
Module Responsible	Prof. Peter Fröhle					
Admission Requirements	None					
Recommended Previous	Mathematics I, II ar	nd III				
Knowledge	Machanicalund					
	Mechanics I und II					
Educational Objectives	After taking part su	ccessfully, students have r	eached the followir	ng learning results		
Professional Competence						
Knowledge	The students are a	able to define the basic ter	rms of hydromecha	anics, hydrology groundwater h	ydrology and	water management
	They are able to d	erive the basic formulation	s of i) hydrostatics	, ii) kinematics of flows and iii)	conservation I	aws and to describ
				cycle. Besides, the students of		
				models as well as the concept		
	hydrograph.	5				
	5 5 . 1					
Skills	The students are a	ble to apply the fundament	al formulations of h	hydromechanics to basic practica	al problems. F	urthermore, they ar
	able to run, explain	and document basic hydra	aulic experiments.			
	Desides the second	ala ka analis kanta kunduala		and another de ter stande broderler		
	-	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.					
	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.					
Porconal Compotonco						
Personal Competence		the terms of the survey in the			undering the size of	
Social Competence	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 g	groups.				
Autonomy	Students are capal	ole of organising their indivi	idual work flow to c	contribute to the conduct of expe	eriments and ¹	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.				
		5 5,				
Workload in Hours		Time 110, Study Time in L	ecture 70			
Credit points						
Course achievement		Form	Description	han Uudualania		
	Yes None	Excercises		ben Hydrologie		
	Yes None	Subject theoretical	-	, Dokumentation und Präs	sentation zu	einem Versuch
		practical work	, , , , , , , , , , , , , , , , , , ,	nik oder Hydraulik in Gruppen		
	Yes None	Group discussion		ne Posters zu einer Themat	ik aus dem	Themengebiet de
			Hydrologie in	Gruppen und Präsentation		
Examination						
Examination duration and	150 minutes					
scale						
Assignment for the	-			ecialisation Civil Engineering: Co	mpulsory	
Following Curricula	Civil- and Environmental Engineering: Core Qualification: Compulsory					
	-	ity: Specialisation Traffic Pl				
	Engineering and Ma	anagement - Major in Logis	tics and Mobility: S	pecialisation Traffic Planning and	d Systems: Ele	ective Compulsory

Course L0909: Hydrology	
Тур	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	Introduction to basics of hydrology and groundwater hydrology: 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	Maniak, U. (2017). Hydrologie und Wasserwirtschaft: Eine Einführung für Ingenieure. Springer Vieweg. Skript "Hydrologie und Gewässerkunde"

Course L0956: Hydrology	
Тур	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	Introduction to basics of Hydrology: Hydrological cycle Data acquisition Data analyses and statistical assessment Statistics of extremes Regionalization methods for hydrological values Rainfall-run-off modelling on the basis of a unit hydrograph conceps
Literature	Maniak, Hydrologie und Wasserwirtschaft, Eine Einführung für Ingenieure, Springer Skript Hydrologie und Gewässerkunde

Course L0615: Hydromechan	ics	
Тур	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	Fundamentals of Hydromechanics	
	Characteristics of fluids	
	Hydrostatics	
	Kinematics of flows, laminar and turbulent flows	
	Conservation laws	
	Conservation of mass	
	Conservation of Energy	
	Momentum Equation	
	Application of conservation laws to flow conditions	
Literature	Skript zur Vorlesung Hydromechanik/Hydraulik, Kapitel 1-2	
	E-Learning Werkzeug: Hydromechanik und hydraulik (Link): (http://www.tu-harburg.de/ hydraulik tool/index.html)	
	L-Learning werkzeug, nyuromeenanik unu nyuraank (Link), (nup.//www.tu-narburg.ue/ nyuraank_t001/intex.html)	
	Truckenbrodt, E.: Lehrbuch der angewandten Fluidmechanik, Springer Verlag, Berlin, 1998.	
	Truckenbrodt, E.: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide / Fluidmechanik, Springer Verlag, Berlin, 1996.	

ourse L0616: Hydromechanics	
Тур	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	See interlocking course
Literature	See interlocking course

Module M0740: Struc	tural Analysis	I			
Courses					
Title			Тур	Hrs/wk	СР
Structural Analysis I (L0666)			Lecture	2	3
Structural Analysis I (L0667)	r		Recitation Section (large)	2	3
Module Responsible	Prof. Bastian Oester	le			
Admission Requirements	None				
Recommended Previous	Mechanics I, Mathen	natics I			
Knowledge					
Educational Objectives	After taking part suc	ccessfully, students have re	eached the following learning results		
Professional Competence					
Knowledge	After successfully co	ompleting this module, stu	dents can express the basic aspects of linear	frame analysis of s	statically determinate
	systems.				
Skills	After successful con	nnletion of this module th	e students are able to distinguish between s	statically determina	te and indeterminate
SKIIIS			riables and to construct influence lines of		
	frame and truss stru		mables and to construct innacrice intes of	statically actermine	
Personal Competence					
Social Competence	Students can				
		subject-specific and interc			
		own work results in front of			
	-	scientific development of c	-		
	 Furthermore, 	they can give and accept	professional constructive criticism		
Autonomy	The students are al	ole work in-term homewor	k assignments. Due to the in-term feedbac	k, they are enable	d to self-assess their
	learning progress du	uring the lecture period, all	ready.		
Workload in Hours		Time 124, Study Time in Le	ecture 56		
Credit points	6 Compulsory Bonus	Form	Description		
Course achievement	Compulsory Bonus	Written elaboration	Hausübungen mit Testat, betreut durch	Studentische Tuto	ren (Tutorium)
Examination		Whiteh elaboration	Hadsabangen mit Testat, betreut durch		
examination duration and scale	50 minutes				
	General Engineering	Science (German program	n, 7 semester): Specialisation Civil Engineeri	na: Compulsory	
Following Curricula		ental Engineering: Core Qu		ng. compuisory	
ronoming carricula			anning and Systems: Elective Compulsory		
			ering Science: Elective Compulsory		
			ics and Mobility: Specialisation Traffic Plann	ing and Systems: El	ective Compulsory
	5 <u>5</u> <u>5</u> <u>6</u>			5 jbi Ei	

Course L0666: Structural Analysis I		
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Bastian Oesterle	
Language	DE	
Cycle	WiSe	
Content	Statically determinate structural systems	
	 modelling of structures theory of plane and spacial structures assessment of structural behaviour, degree of static indeterminacy and kinematics analysis of forces and moments, as well as diplscements and rotations principle of virtual work influence lines 	
Literature	 Vorlesungsmanuskript Bletzinger et al.: Aufgabensammlung zur Baustatik: Übungsaufgaben zur Berechnung ebener Stabtragwerke. Hanser. Dinkler: Grundlagen der Baustatik. Springer. Marti: Baustatik. Ernst und Sohn. 	

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

	Engineering"			
Module M0853: Mathematics III				
Courses				
Title		Тур	Hrs/wk	СР
Analysis III (L1028)		Lecture	2	2
Analysis III (L1029)		Recitation Section (small)	1	1
Analysis III (L1030)	Differential Equations (11021)	Recitation Section (large)	1 2	1 2
Differential Equations 1 (Ordinary E Differential Equations 1 (Ordinary E	-	Lecture Recitation Section (small)	1	1
Differential Equations 1 (Ordinary E		Recitation Section (large)	1	1
Module Responsible				
Admission Requirements				
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have reached th	he following learning results		
Professional Competence		5 5		
Knowledge				
	 Students can name the basic concepts in the are 	ea of analysis and differential equations	. They are able	to explain them using
	appropriate examples.			
	 Students can discuss logical connections between 	en these concepts. They are capable	of illustrating th	ese connections with
	the help of examples.			
	 They know proof strategies and can reproduce the 	nem.		
Skills	Students can model problems in the area of ana	lysis and differential equations with the	e help of the cor	ncepts studied in this
	course. Moreover, they are capable of solving the		·	
	• Students are able to discover and verify further I	ogical connections between the concep	ts studied in the	e course.
	• For a given problem, the students can develop	and execute a suitable approach, ar	nd are able to c	ritically evaluate the
	results.			
Personal Competence				
Social Competence				
	Students are able to work together in teams. The			
	 In doing so, they can communicate new concept 		erating partners	. Moreover, they can
	design examples to check and deepen the under	standing of their peers.		
4				
Autonomy	Students are capable of checking their understa	anding of complex concepts on their ov	vn. They can sp	ecify 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-orien	ted manner on hard
	problems.			
Workload in Hours	Independent Study Time 128, Study Time in Lecture 11	.2		
Credit points				
Course achievement				
	Written exam			
Examination duration and	60 min (Analysis III) + 60 min (Differential Equations 1)			
scale				
scale Assignment for the	5 5 7 7 5 7			
scale	Civil- and Environmental Engineering: Core Qualification	n: Compulsory		
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory	n: Compulsory		
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification	n: Compulsory / on: Compulsory		
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com	n: Compulsory / on: Compulsory		
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory	n: Compulsory / on: Compulsory apulsory		
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qua	n: Compulsory / pon: Compulsory npulsory lification: Compulsory		
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory	n: Compulsory / pon: Compulsory apulsory lification: Compulsory ompulsory		
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qual Computer Science in Engineering: Core Qualification: C	n: Compulsory / nn: Compulsory npulsory lification: Compulsory ompulsory npulsory		
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qual Computer Science in Engineering: Core Qualification: Com	n: Compulsory / nn: Compulsory npulsory lification: Compulsory ompulsory npulsory nd Systems: Elective Compulsory	sory	
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification: Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qual Computer Science in Engineering: Core Qualification: Cor Integrated Building Technology: Core Qualification: Cor Logistics and Mobility: Specialisation Traffic Planning an	n: Compulsory / n: Compulsory npulsory lification: Compulsory ompulsory npulsory nd Systems: Elective Compulsory ement and Processes: Elective Compuls	sory	
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification: Com Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qual Computer Science in Engineering: Core Qualification: Con Integrated Building Technology: Core Qualification: Con Logistics and Mobility: Specialisation Traffic Planning ar Logistics and Mobility: Specialisation Production Manag	n: Compulsory , pon: Compulsory npulsory iffication: Compulsory ompulsory npulsory nd Systems: Elective Compulsory ement and Processes: Elective Compulsory iology: Compulsory	sory	
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qual Computer Science in Engineering: Core Qualification: Con Integrated Building Technology: Core Qualification: Con Logistics and Mobility: Specialisation Traffic Planning ar Logistics and Mobility: Specialisation Information Technology	n: Compulsory , pon: Compulsory npulsory iffication: Compulsory ompulsory npulsory nd Systems: Elective Compulsory ement and Processes: Elective Compulsory iology: Compulsory	sory	
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qual Computer Science in Engineering: Core Qualification: Co Integrated Building Technology: Core Qualification: Con Logistics and Mobility: Specialisation Traffic Planning ar Logistics and Mobility: Specialisation Information Techn Mechanical Engineering: Core Qualification: Compulsory	n: Compulsory , pon: Compulsory npulsory iffication: Compulsory ompulsory npulsory nd Systems: Elective Compulsory ement and Processes: Elective Compulsory iology: Compulsory	sory	
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qual Computer Science in Engineering: Core Qualification: Co Integrated Building Technology: Core Qualification: Con Logistics and Mobility: Specialisation Traffic Planning ar Logistics and Mobility: Specialisation Information Techn Mechanical Engineering: Core Qualification: Com Mechatronics: Core Qualification: Compulsory	n: Compulsory , pon: Compulsory npulsory iffication: Compulsory ompulsory npulsory nd Systems: Elective Compulsory ement and Processes: Elective Compulsory iology: Compulsory	sory	
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qual Computer Science in Engineering: Core Qualification: Co Integrated Building Technology: Core Qualification: Con Logistics and Mobility: Specialisation Traffic Planning ar Logistics and Mobility: Specialisation Information Techn Mechanical Engineering: Core Qualification: Compulsory Mechatronics: Core Qualification: Compulsory Naval Architecture: Core Qualification: Compulsory	n: Compulsory y n: Compulsory npulsory ification: Compulsory ompulsory mpulsory nd Systems: Elective Compulsory ement and Processes: Elective Compuls tology: Compulsory y	-	ective Compulsory
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qual Computer Science in Engineering: Core Qualification: Co Integrated Building Technology: Core Qualification: Con Logistics and Mobility: Specialisation Traffic Planning ar Logistics and Mobility: Specialisation Information Techn Mechanical Engineering: Core Qualification: Com Mechatronics: Core Qualification: Compulsory Naval Architecture: Core Qualification: Compulsory Process Engineering: Core Qualification: Compulsory	n: Compulsory y n: Compulsory npulsory ification: Compulsory ompulsory mpulsory nd Systems: Elective Compulsory ement and Processes: Elective Compuls iology: Compulsory y Mobility: Specialisation Traffic Planning	and Systems: El	
scale Assignment for the	Civil- and Environmental Engineering: Core Qualification Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualificatio Digital Mechanical Engineering: Core Qualification: Com Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Core Qual Computer Science in Engineering: Core Qualification: Co Integrated Building Technology: Core Qualification: Con Logistics and Mobility: Specialisation Traffic Planning ar Logistics and Mobility: Specialisation Information Techn Mechanical Engineering: Core Qualification: Compulsory Mechatronics: Core Qualification: Compulsory Naval Architecture: Core Qualification: Compulsory Process Engineering: Core Qualification: Compulsory Engineering and Management - Major in Logistics and M	n: Compulsory y n: Compulsory npulsory ification: Compulsory ompulsory mpulsory nd Systems: Elective Compulsory ement and Processes: Elective Compuls iology: Compulsory y Mobility: Specialisation Traffic Planning	and Systems: El	

Course L1028: Analysis III	
Тур	Lecture
Hrs/wk	2
СР	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	Main features of differential and integrational calculus of several variables
Literature	 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 http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

Course L1029: Analysis III	
Тур	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	
Тур	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)	
Тур	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	Main features of the theory and numerical treatment of ordinary differential equations
Literature	 Introduction and elementary methods Exsitence 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	 http://www.math.uni-hamburg.de/teaching/export/tuhh/index.html

Course L1032: Differential Equations 1 (Ordinary Differential Equations)		
Тур	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 E	quations 1 (Ordinary Differential Equations)	
Тур	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

Engineering"				
Module M0579: Struct	tural Design			
Courses				
Title		Гур	Hrs/wk	СР
Basics in Structural Design (L0209)	F	Project-/problem-based Learning	2	4
Basics of Structural Design (L0205)	L	ecture	2	1
Basics in Structural Design (L0208)	F	Recitation Section (large)	1	1
Module Responsible	Sebastian Rybczynski			
Admission Requirements	None			
	Contents of module "Principles of Building Materials and Building Physics"			
Knowledge				
-	After taking part successfully, students have reached the following	g learning results		
Professional Competence				
Knowledge	After attending the "Building Construction" module students are a	ble		
	 to define the basics of building regulations law 			
	 to explain load effects and associated concepts 			
	to describe overriding conventions of the construction indus	stry		
	 to specify typical building components 			
	 to distinguish between different possibilities of load bearing 	behaviour and risks due to lac	k of stability	
	 to explain the main objective of fire control. 			
Skills	After the successful completion of the "Building Construction" module, students will be able			
	 to apply industry-specific drawing conventions 			
	carry out preliminary dimensioning of basic building compo	nents		
	 develop stability and foundation concepts 			
	use BIM software			
	 and to design and construct standard cross-sections due to 	structural aspects.		
Personal Competence				
-	After attending the course students are able			
	 to work in a team and to persent the results of the team wo 	rk		
	• to use the feedback from other students to improve the own results			
	 to give a feedback to other students in a constructive mann 	ner		
Autonomy	After attending the course students are able			
	 to control and improve their knowledge with the help of wee 	eekly presentations (lecture roo	om) and tests (STUD.IP)
	 to divide the main task in different parts, to deduce the nee 			
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	Desing, Construction and prelimnary design in a written form			
	General Engineering Science (German program, 7 semester): Spec	cialisation Civil Engineering: Co	mpulsory	
5	Civil- and Environmental Engineering: Core Qualification: Compuls		. ,	
5	Integrated Building Technology: Core Qualification: Compulsory	-		

Course L0209: Basics in Structural Design			
Тур	Project-/problem-based Learning		
Hrs/wk	2		
CP	4		
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28		
Lecturer	Sebastian Rybczynski		
Language	DE		
Cycle	WiSe		
Content			
	 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 funcionality (sealing, facades, roofs) Design and approve of the funcionality of the component interconnections Proofing and assessing of moisture behaviour, energy comsumption, 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	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung		
	Neumann, Dietrich (Hestermann, Ulf.; Rongen, Ludwig.; Weinbrenner, Ulrich) Frick/Knöll Baukonstructionslehre 1 / [Internet-Ressource] ISBN: 978-3-8351-9121-1 Wiesbaden : B.G. Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2006		
	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		
	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		
	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		
	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			
Тур			
Hrs/wk			
CP	1		
	Independent Study Time 2, Study Time in Lecture 28		
Lecturer			
Language			
Cycle	WiSe		
Content	Basics of building regulation laws		
	Foundation of buildings		
	Sealing of basements		
	facades		
	Ceilings		
	Roofs		
	Windows, doors and post-and-beam constructions Steineage		
	Staircases		
	Basics of structural engineering design Structural fire provention		
	Structural fire prevention		
	Optional tests on STUD.IP		
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD. IP zum download zur Verfügung		
	Schneider Bautabellen (Hrsg. A. Albert)		
	23., überarbeitete Aufl.		
	ISBN 978-3-8462-0880-9		
	Reguvis Fachmedien GmbH, 2018		
	Neumann, Dietrich (Hestermann, U.; Rongen, L.; Weinbrenner, U.)		
	Frick/Knöll Baukonstructionslehre 1 / [Internet-Ressource]		
	ISBN: 978-3-8351-9121-1		
	Wiesbaden: Vieweg+Teubner Verlag, 2006		
	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		
	Thespaden, vieweg i reabilet verlag, 2000		
	Dierks, Klaus (Wormuth, R.)		
	Baukonstruktion		
	ISBN: 978-3-8041-5045-4		
	Neuwied : Werner, 2007		
	Neufert, Ernst (Kister, J.)		
	Bauentwurfslehre (42. Aufl.)		
	ISBN: 978-3-8348-0732-8		
	Wiesbaden : Vieweg + Teubner, 2018		
	Wendehorst, Reinhard (Wetzell, O. W.,; Baumgartner, H.,)		
	Wendehorst Bautechnische Zahlentafeln		
	ISBN: 978-3-8351-0055-8		
	Stuttgart/Berlin: Teubner/Beuth, 2018		

Course L0208: Basics in Stru	ctural Design
Тур	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Sebastian Rybczynski
Language	DE
Cycle	WiSe
Content	 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 funcionality of the component interconnections
	Proofing and assessing of moisture behaviour, energy comsumption, acoustic protection and fire control
	Assessing the building stabilty
	Basics of building services
	Each week the results of different work steps are presented in oral and written form
Literature	Vortragsfolien der Lehrveranstaltung stehen über STUD.IP zum download zur Verfügung
	Neumann, Dietrich (Hestermann, Ulf.; Rongen, Ludwig.; Weinbrenner, Ulrich)
	Frick/Knöll Baukonstructionslehre 1 / [Internet-Ressource]
	ISBN: 978-3-8351-9121-1
	Wiesbaden : B.G. Teubner Verlag / GWV Fachverlage GmbH, Wiesbaden, 2006
	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
	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
	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
	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

Linghiedining				
Module M0706: Geote	chnics I			
-				
Courses				
Title		Тур	Hrs/wk	СР
Soil Mechanics (L0550)		Lecture	2	2
Soil Mechanics (L0551)		Recitation Section (large)	2	2
Soil Mechanics (L1493)		Recitation Section (small)	2	2
Module Responsible				
Admission Requirements				
Recommended Previous	Modules :			
Knowledge	Mechanics I-II			
		have reached the following learning results		
Professional Competence				
Knowledge		echanics as the structure and characteristics of soil,		
		ent calculations, as well as failure of the soil due to		
Skills		module the students should be able to describe the		
		andard tests. They can calculate stresses and def		oils due to weight o
	influence of structures. They are are abl	le to prove the usability (settlements) for shallow for	undations.	
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time	e in Lecture 84		
Credit points	6			
Course achievement	Compulsory Bonus Form	Description		
	No 20 % Attestation			
Examination	Written exam			
Examination duration and	90 minutes			
scale				
Assignment for the	General Engineering Science (German p	program, 7 semester): Specialisation Civil Engineerin	g: Compulsory	
Following Curricula	Civil- and Environmental Engineering: Co	ore Qualification: Compulsory		
	Logistics and Mobility: Specialisation Tra	affic Planning and Systems: Elective Compulsory		
	Technomathematics: Specialisation III. E	Engineering Science: Elective Compulsory		
	Engineering and Management Major in	Logistics and Mobility: Specialisation Traffic Plannin		

Course L0550: Soil Mechanic	S
Түр	Lecture
Hrs/wk	
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
	Prof. Jürgen Grabe
Language	DE
Cycle	WiSe/SoSe
Content	 Structure of the soil Ground surveying Compstition 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 tenches
Literature	 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

ourse L0551: Soil Mechanics		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	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 Mechanic	Course L1493: Soil Mechanics		
Тур	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		

Courses						
Title				Тур	Hrs/wk	СР
Project Seminar Concrete I (L0896)				Seminar	1	1
Reinforced Concrete Design I (L03)				Lecture	2	3
Reinforced Concrete Design I (L03)				Recitation Section (large)	2	2
	Prof. Günter Rombach					
Admission Requirements	None					
Recommended Previous	Basic knowledge in stru	ictural analysis and	d building materials.			
Knowledge	Modules: Structural An	alysis I, Mechanics	5 1+11			
Educational Objectives	After taking part succes	ssfully, students ha	ave reached the follow	ing learning results		
Professional Competence						
Knowledge	The students can outlin	e the history of co	oncrete construction ar	nd explain the basics of stru	ctural engineering,	including usual I
				limension simple structures	, as well as to evalu	uate and discuss
	behaviour of the materi	ials and of structur	al members			
	benaviour of the materi		ur members.			
	behaviour of the materi		armembers.			
Skills	The students are able t	o apply basic proc	cedures of the concept	tion and dimensioning to pr	-	
Skills	The students are able t simple concrete struct	to apply basic proc cures and to desi	cedures of the concept gn them for bending	and bending with axial f	orce, and to plan	
Skills	The students are able t simple concrete struct	to apply basic proc cures and to desi	cedures of the concept gn them for bending		orce, and to plan	
Skills	The students are able t simple concrete struct	to apply basic proc cures and to desi	cedures of the concept gn them for bending	and bending with axial f	orce, and to plan	
	The students are able t simple concrete struct	to apply basic proc cures and to desi	cedures of the concept gn them for bending	and bending with axial f	orce, and to plan	
Personal Competence	The students are able t simple concrete struct	to apply basic proc cures and to desi	cedures of the concept gn them for bending	and bending with axial f	orce, and to plan	
Personal Competence Social Competence	The students are able t simple concrete struct execution. Moreover, th	to apply basic proc tures and to desi ney can make desir	cedures of the concept gn them for bending gn and construction sk	and bending with axial f etches and draw up technic	orce, and to plan al descriptions.	their detailing
Personal Competence Social Competence	The students are able t simple concrete struct execution. Moreover, th	to apply basic proc tures and to desi ney can make desir	cedures of the concept gn them for bending gn and construction sk	and bending with axial f	orce, and to plan al descriptions.	their detailing
Personal Competence Social Competence	The students are able t simple concrete struct execution. Moreover, th	to apply basic proc tures and to desi ney can make desi o carry out simple	cedures of the concept gn them for bending gn and construction sk tasks in the conceptio	and bending with axial f etches and draw up technic	orce, and to plan al descriptions.	their detailing
Personal Competence Social Competence Autonomy	The students are able t simple concrete struct execution. Moreover, th The students are able t	to apply basic proc tures and to desi ney can make desi o carry out simple	cedures of the concept gn them for bending gn and construction sk tasks in the conceptio	and bending with axial f etches and draw up technic	orce, and to plan al descriptions.	their detailing
Personal Competence Social Competence Autonomy Workload in Hours	The students are able t simple concrete struct execution. Moreover, th The students are able to Independent Study Tim 6 Compulsory Bonus	to apply basic proc cures and to desi ney can make desi o carry out simple e 110, Study Time Form	cedures of the concept gn them for bending gn and construction sk tasks in the conceptio	and bending with axial f etches and draw up technic	orce, and to plan al descriptions.	their detailing
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement	The students are able t simple concrete struct execution. Moreover, th The students are able to Independent Study Tim 6 Compulsory Bonus No None	to apply basic proc cures and to desi ney can make desi o carry out simple e 110, Study Time	tedures of the concept gn them for bending gn and construction sk tasks in the conceptio	and bending with axial f etches and draw up technic	orce, and to plan al descriptions.	their detailing
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination	The students are able t simple concrete struct execution. Moreover, th The students are able to Independent Study Tim 6 Compulsory Bonus No None Written exam	to apply basic proc cures and to desi ney can make desi o carry out simple e 110, Study Time Form	tedures of the concept gn them for bending gn and construction sk tasks in the conceptio	and bending with axial f etches and draw up technic	orce, and to plan al descriptions.	their detailing
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and	The students are able t simple concrete struct execution. Moreover, th The students are able to Independent Study Tim 6 Compulsory Bonus No None Written exam	to apply basic proc cures and to desi ney can make desi o carry out simple e 110, Study Time Form	tedures of the concept gn them for bending gn and construction sk tasks in the conceptio	and bending with axial f etches and draw up technic	orce, and to plan al descriptions.	their detailing
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale	The students are able t simple concrete struct execution. Moreover, th The students are able to Independent Study Tim 6 Compulsory Bonus No None Written exam 120 minutes	to apply basic proc cures and to desi ney can make desir o carry out simple e 110, Study Time Form Excercises	tasks in the concept tasks in the conception tasks in the conception	and bending with axial f eetches and draw up technic n and dimensioning of struc	orce, and to plan al descriptions. tures and to critical	their detailing
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students are able t simple concrete struct execution. Moreover, th The students are able to Independent Study Tim 6 Compulsory Bonus No None Written exam 120 minutes	to apply basic proc cures and to desi ney can make desir o carry out simple e 110, Study Time Form Excercises	tasks in the concept and construction sk tasks in the conceptio in Lecture 70 Description	and bending with axial f eetches and draw up technic n and dimensioning of struc pecialisation Civil Engineerin	orce, and to plan al descriptions. tures and to critical	their detailing

Тур	Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
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 Co	ncrete Design I
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	SoSe
Content	The following subjects/contents are treated:
Literature	 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 Download der Unterlagen zur Vorlesung über Stud.IP! 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 KH.: 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		
Тур	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	

-					
Courses					
Title			Тур	Hrs/wk	СР
Structural Analysis II (L0673)			Lecture	2	3
Structural Analysis II (L0674)			Recitation Section (lar	ge) 2	3
Module Responsible		e			
Admission Requirements	None				
Recommended Previous	Mechanics I/II				
Knowledge	Mathematics I	/11			
	Differential Eq	uations I			
	Structural Ana	lysis I			
Educational Objectives	After taking part suce	cessfully, students have re	eached the following learning results		
Professional Competence					
Knowledge	After successful cor	mpletion of this module,	students can express the basic asp	pects of linear frame	analysis of statica
	indeterminate system	ns.			
Skills			ne students are able to analyze state	variables and to const	ruct influence lines
	statically inderminate	e plane and spatial frame	and truss structures.		
Personal Competence					
Personal Competence Social Competence	Students can				
	participate in s	subject-specific and interd			
	 participate in s defend their o	wn work results in front of	others		
	 participate in s defend their o promote the s 	wn work results in front of cientific development of c	others olleagues		
	 participate in s defend their o promote the s 	wn work results in front of cientific development of c	others		
Social Competence	 participate in s defend their o promote the s Furthermore, s 	wn work results in front of cientific development of c they can give and accept	others olleagues	edback, they are enabl	led to self-assess th
Social Competence	 participate in s defend their o promote the s Furthermore, s 	wn work results in front of cientific development of c they can give and accept	others olleagues professional constructive criticism ork assignments. Due to the in-term fee	edback, they are enabl	led to self-assess th
Social Competence	 participate in s defend their o promote the s Furthermore, s 	wn work results in front of cientific development of c they can give and accept e to work in-term homew	others olleagues professional constructive criticism ork assignments. Due to the in-term fee	edback, they are enabl	led to self-assess th
Social Competence	 participate in s defend their o promote the s Furthermore, s 	wn work results in front of cientific development of c they can give and accept e to work in-term homew	others olleagues professional constructive criticism ork assignments. Due to the in-term fee	edback, they are enabl	led to self-assess th
Social Competence	 participate in s defend their o promote the s Furthermore, t The students are abl learning progress duiting 	wn work results in front of cientific development of c they can give and accept e to work in-term homew	others olleagues professional constructive criticism ork assignments. Due to the in-term fe eady.	edback, they are enabl	led to self-assess th
Social Competence Autonomy	 participate in s defend their o promote the s Furthermore, 1 The students are abl learning progress du Independent Study T	wn work results in front of cientific development of c they can give and accept de to work in-term homew ring the lecture period, alr	others olleagues professional constructive criticism ork assignments. Due to the in-term fe eady.	edback, they are enabl	led to self-assess th
Social Competence Autonomy Workload in Hours	participate in s defend their o promote the s Furthermore, 1 The students are abl learning progress du Independent Study T 6 Compulsory Bonus	wn work results in front of cientific development of c they can give and accept e to work in-term homew ring the lecture period, all ime 124, Study Time in Le	others olleagues professional constructive criticism ork assignments. Due to the in-term fer eady. ecture 56 Description		
Social Competence Autonomy Workload in Hours Credit points Course achievement	 participate in s defend their o promote the s Furthermore, 1 The students are abl learning progress du Independent Study T 6 Compulsory Bonus No 10 %	wn work results in front of cientific development of c they can give and accept de to work in-term homew ring the lecture period, all ime 124, Study Time in Le	others olleagues professional constructive criticism ork assignments. Due to the in-term fer eady.		
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination	participate in s defend their o promote the s Furthermore, 1 The students are abl learning progress du Independent Study T 6 Compulsory Bonus No 10 % Written exam	wn work results in front of cientific development of c they can give and accept e to work in-term homew ring the lecture period, all ime 124, Study Time in Le	others olleagues professional constructive criticism ork assignments. Due to the in-term fer eady. ecture 56 Description		
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and	participate in s defend their o promote the s Furthermore, 1 The students are abl learning progress du Independent Study T 6 Compulsory Bonus No 10 % Written exam	wn work results in front of cientific development of c they can give and accept e to work in-term homew ring the lecture period, all ime 124, Study Time in Le	others olleagues professional constructive criticism ork assignments. Due to the in-term fer eady. ecture 56 Description		
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale	 participate in s defend their o promote the s Furthermore, 1 The students are able learning progress dual learning progress dual learning progress dual learning study T 6 Compulsory Bonus No 10 % Written exam 90 minutes 	wn work results in front of cientific development of c they can give and accept le to work in-term homew ring the lecture period, all ime 124, Study Time in Le Form Written elaboration	others olleagues professional constructive criticism ork assignments. Due to the in-term fer eady. ecture 56 Description Hausübungen mit Testat, betreut c	lurch Studentische Tuto	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and	 participate in s defend their o promote the s Furthermore, 1 The students are able learning progress dual learning progress dual learning progress dual learning progress dual learning between the study T 6 Compulsory Bonus No 10 % Written exam 90 minutes General Engineering	wn work results in front of cientific development of c they can give and accept le to work in-term homew ring the lecture period, all ime 124, Study Time in Le Form Written elaboration	others olleagues professional constructive criticism ork assignments. Due to the in-term fer eady. acture 56 Description Hausübungen mit Testat, betreut of h, 7 semester): Specialisation Civil Engir	lurch Studentische Tuto	

Course L0673: Structural Ana	alysis II
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Bastian Oesterle
Language	DE
Cycle	SoSe
Content	 Analysis of statically indeterminant structures Force method, displacement method coputational methods, direct stiffness method elastically supported structures
Literature	 Vorlesungsmanuskript Bletzinger et al.: Aufgabensammlung zur Baustatik: Übungsaufgaben zur Berechnung ebener Stabtragwerke. Hanser. Dinkler: Grundlagen der Baustatik. Springer. Marti: Baustatik. Ernst und Sohn.

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

Module M0686: Sanit	ary Engineering I				
Courses					
Title		Тур		Hrs/wk	СР
Wastewater Disposal (L0276)		Lecture		2	2
Wastewater Disposal (L0278)			Section (large)	1	1
Drinking Water Supply (L0306)		Lecture		2	1
Drinking Water Supply (L0308)	1	Recitation	Section (large)	1	2
Module Responsible	Prof. Ralf Otterpohl				
Admission Requirements	None				
Recommended Previous	Basic knowledge on Chemistry and	Riology			
Knowledge					
	Hydraulics of pipe systems and op				
	Basic knowledge on water manage		quality		
	 Basic knowledge on Environmenta 	l Legislation: Federal Water Act			
Educational Objectives	After taking part successfully, students h	ave reached the following learning	g results		
Professional Competence					
Knowledge	The students can examplify their expert	knowledge on urban water infras	tructures. They ca	an present the de	rivation and detai
	explanation of important standards for th	e design of drinking water supply	and wastewater o	disposal systems	in Germany and th
	are capable of reproducing the relevant				
	discuss sanitary engineering processes a				
	existing problems in the field of sanitary				
	draft the features and effectiveness of in	5 5 5 5	,		
	systems and techniques for the removal		ure such as migh-	and low-pressure	
	systems and techniques for the removal	or trace polititants.			
Skills	The students are able to apply the relev independently. Their expertise comprises	-	÷ .		
	associated treatment facilities. Besides t				
	problems in the filed of drinking water				
	improve the existing water related infrasi				deus of their own
	improve the existing water related initias	inclures, systems and concepts.			
Demonstration of the second seco					
Personal Competence					
Social Competence	Social skills are not targeted in this modu	lle.			
Autonomy	Students are able to form concepts on	their own to optimize urban wat	er infrastructure p	processes. Therefore	ore they can acqu
	appropriate knowledge when being give	n some clues or information with	n regard to the ap	proach to proble	ms (preparation a
	follow-up of the exercises).				
	· · · · · · · · · · · · · · · · · · ·				
Workload in Hours		in Lecture 84			
Credit points					
Course achievement					
Examination					
Examination duration and scale	120 min				
	Conoral Engineering Science (Correct and	aram 7 comostor), Enocializatio	n Groon Tachnalar		
Assignment for the			n Green Technolog	nes: compulsory	
Following Curricula					
	Green Technologies: Energy, Water, Clim		ry		
	Integrated Building Technology: Core Qua	alification: Compulsory			

ırse L0276: Wastewater D	
	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	DE
Cycle	SoSe
Content	This lecture focusses on urban drainage and wastewater treatment.
	Urban Drainage
	 Design of urban drainage systems (combined and separate sewer systems)
	Special structures
	Rainwater management
	Wastewater treatement
	 Mechanical treatment (Screens, Grit chamber, Preliminary Sedimentation, Secondary Settlement Tanks, Membr Filtration)
	Biological Treatment (aerobic, anaerobic, anoxic)
	Special Wastewater Treatment Processes (Ozonation, Adsorption)
Literature	Die hier aufgeführte Literatur ist in der Bibliothek der TUHH verfügbar.
	The literature listed below is available in the library of the TUHH.
	 Taschenbuch der Stadtentwässerung : mit 10 Tafeln und 67 Tabellen, Imhoff, K., & . (2009). (31., verbesserte Au 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 völlig neu bearb. Aufl.). Renningen: expert-Verl.
	• Water and wastewater technology Hammer, M. J. 1., & . (2012). (7. ed., internat. ed.). Boston [u.a.]: Pearson Educa 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 D	Course L0278: Wastewater Disposal	
Тур	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 Wate	er Supply
Тур	Lecture
Hrs/wk	2
СР	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	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.
	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.
	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.
Literature	Gujer, Willi (2007): Siedlungswasserwirtschaft. 3., bearb. Aufl., Springer-Verlag.
	Karger, R., Cord-Landwehr, K., Hoffmann, F. (2005): Wasserversorgung. 12., vollst. überarb. Aufl., Teubner Verlag
	Rautenberg, J. et al. (2014): Mutschmann/Stimmelmayr Taschenbuch der Wasserversorgung. 16. Aufl., Springer-Vieweg Verlag.
	DVGW Lehr- und Handbuch Wasserversorgung: Wasseraufbereitung - Grundlagen und Verfahren, m. CD-ROM: Band 6 (2003).

Course L0308: Drinking Wate	Course L0308: Drinking Water Supply	
Тур	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	

Courses				
Title		Тур	Hrs/wk	СР
Steel Structures I (L0299)		Lecture	2	3
Steel Structures I (L0300)		Recitation Section (large)	2	3
Module Responsible	Prof. Marcus Rutner			
Admission Requirements	None			
Recommended Previous Knowledge	Structural analysis I, Structural analysis II			
	Mechanics I, Mechanics II Duilding Metaziala and Building Chamistry			
	 Building Materials and Building Chemistry Principles of Building Materials and Building Ph 	velee		
		ysics		
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	After passing this module students are able to			
	 give a summary of the security concept 			
	 explain the priciples of the design process 			
	describe and illustrate the bhaviour of memory	in tension, compression and bending		
Skills	Students can rate and apply the material steel approp	piately with respect to its properties and	usage.	
	They can use the security concept with respect to loa	ds, forces and resistances.		
	They can check the ultimate limit state and the service	eability of simple members in tension, o	compression and	bending.
Personal Competence				
Social Competence	After participation of an optional course (building of	a simple truss) they are able to organiz	ze themselves in	groups. They will
	successful in guided building a truss with bolted conn	ections according to design drawings.		
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture	56		
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and	120 minutes			
scale				
Assignment for the	General Engineering Science (German program, 7 ser	nester): Specialisation Civil Engineering	: Compulsory	
Following Curricula	Civil- and Environmental Engineering: Core Qualificat	on: Compulsory		

Course L0299: Steel Structures I	
Тур	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	 Introduction to steel constructions Materials Design and security model Tension rods Beams (elsatic and plastic design Column design Bolted connections
Literature	 Petersen, C.: Stahlbau, 4. Auflage 2013, Springer-Vieweg Verlag Wagenknecht, G.: Stahlbau-Praxis nach Eurocode 3, Bauwerk-Verlag 2011 Band 1 Tragwerksplanung, Grundlagen Band 2 Verbindungen und Konstruktionen

Course L0300: Steel Structur	ourse L0300: Steel Structures I	
Тур	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	

Lingineering				
Module M0869: Hydra	ulic Engineering			
Courses				
Title		Тур	Hrs/wk	СР
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	Hydraulic Mechanics and Hydrology			
Knowledge				
Educational Objectives	After taking part successfully, students have reache	d the following learning results		
Professional Competence				
Knowledge	Students are able to define the basic terms of hyd	Iraulic engineering and hydraulics. They are	able to expla	in the application o
	basic hydrodynamic formulations (conservation law	s) to practical hydraulic engineering probler	ns. Besides th	nis, the students ca
	illustrate important tasks of hydraulic engineering a	and give an overview over river engineering,	flood protect	ion, hydraulic powe
	engineering and waterways engineering.	5 5 5		
	5 5 7 5 5			
Skills	The students are able to apply hydraulic engineerir	ng methods and approaches to basic practica	al problems a	nd design respectiv
	hydraulic engineering systems. Besides this, they a	are able to use and apply established approa	ches of hydra	aulics and determin
	water surfaces of channel flows, influences of consti	ructions (weirs, etc.) on channel flows as well	as flow condi	tions of pipe system
	Furthermore, they are able to run, explain and docu	ment basic hydraulic experiments.		
Personal Competence				
	The students are able to deploy their gained know	lodge in applied problems. Additionally, they	will be able t	o work in toom wit
Social competence	engineers of other disciplines in a goal-orientated			
	approaches.	, structured manner. They can explain the	i lesuits by t	use of peer rearring
Autonomy			E uth a reason	they are conching
Autonomy	The students will be able to independently extend the			
	organising their individual work flow to contribute to		iscipline-spec	cific knowledge.
	Independent Study Time 110, Study Time in Lecture	2 70		
Credit points	6			
Course achievement		Description		
		5.	entation zu	einem Versuch
	'	Hydromechanik oder Hydraulik		
Examination				
	The duration of the examination is 2.5 hours. The	examination includes tasks with respect to	the general u	understanding of th
	lecture contents and calculations tasks.			
Assignment for the	General Engineering Science (German program, 7 s	semester): Specialisation Green Technologies	, Focus Water	r and Environmenta
Following Curricula	Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Core Qualifica	ation: Compulsory		
	Green Technologies: Energy, Water, Climate: Specia	lisation Water Technologies: Elective Compu	sory	

Lecture
1
1
ndependent Study Time 16, Study Time in Lecture 14
Prof. Peter Fröhle
DE
NiSe/SoSe
low of incompressible fluids in pipes and open channels
Pumps in hydraulic systems
Open channel flow
Regulative construction in open channel flow
• Weirs
Sliding panels
Cross-section reduction by constructions
Zanke, Ulrich C. , Hydraulik für den WasserbauUrsprünglich erschienen unter: Schröder/Zanke "Technische Hydraulik", Springer-
/erlag, 2003
Naudascher, E.: Hydraulik der Gerinne und Gerinnebauwerke, Springer, 1992

Course L0958: Hydraulics	
Тур	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 Eng	ineering
Тур	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	Fundamentals of hydraulic engineering
	 Introduction and hydrological cycle River engineering Regime theory of natural rivers Sediment transport Regulation of rivers Bank protection / protection of river bed Tidal rivers Flood protection Dikes Flood contraol basins Hydraulic power Inland waterways engineering waterways Locks and ship lifts Fish passages Nature-oriented hydraulic engineering
Literature	Strobl, T. & Zunic, F: Wasserbau, Springer 2006
	Patt, H. & Gonsowski, P: Wasserbau, Springer 2011

Course L0960: Hydraulic Eng	rse L0960: Hydraulic Engineering	
Тур	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	

Module M1635: Applie	cations in Civil / Environmental Er	ngineering		
Courses				
Title		Тур	Hrs/wk	СР
Applied Structural Dynamics (L079)	L)	Lecture	2	2
Soil Laboratory Course (L0499)		Practical Course	1	2
Computational Analysis of Structure	es (L0370)	Lecture	2	3
Digitalization and sustainability in A	EC (L2868)	Project Seminar	3	3
ntroduction in Statitics with R (L02	86)	Lecture	1	1
ntroduction in Statitics with R (L07	76)	Recitation Section (large)	1	1
Excursion construction projects (L1	228)	Project Seminar	2	2
Principles of Geomatics (L0470)		Lecture	2	2
Principles of Geomatics (L0471)		Recitation Section (small)	2	2
Jumeric and Matlab (L0125)		Practical Course	2	2
Practical Course in Drinking Water	Chemistry (L1744)	Practical Course	1	2
Special topics of Civil- and Environr			1	1
Special topics of Civil- and Environr			2	2
Special topics of Civil- and Environr			3	3
Fire Protection and Prevention (L04		Lecture	2	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have read	ched the following learning results		
Professional Competence				
Knowledge	The students are at home doing with typical app	ications of the study programme.		
Skills	Skills 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			ah in haansa lifa	
Social Competence	According to the course chosen students are a discuss and document results accordingly.	ible to perform tasks or to conduct a proje	ct in teams. If s	o, tney can preser
-	According to the course chosen individual studer	its can plan and document tasks and work flo	ow for themselve	s or for the team.
Workload in Hours	Depends on choice of courses			
Credit points	9			
Assignment for the	Civil- and Environmental Engineering: Core Quali	fication: Compulsory		

Course L0791: Applied Structural Dynamics		
	Lecture	
Hrs/wk		
CP		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Examination Form	Mündliche Prüfung	
Examination duration and	15 min	
scale		
Lecturer	Dr. Kira Holtzendorff	
Language	DE	
Cycle	WiSe	
	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. The following topics are covered: 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	Helmut Kramer: Angewandte Baudynamik, Ernst & Sohn Verlag, 2. Auflage 2013 Christian Petersen: Dynamik der Baukonstruktionen, Vieweg Verlag, 2. Auflage von 2000	

Course L0499: Soil Laboratory Course		
Тур	Practical Course	
Hrs/wk	1	
СР	2	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14	
Examination Form	Schriftliche Ausarbeitung	
	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	 Field experiments Short lecture on laboratory tests soil analysis laboratory test soil clasification Creating a ground and foundation report 	
Literature	DIN-Taschenbuch 113, Erkundung und Untersuchung des Baugrundes	

Course L0370: Computational Analysis of Structures		
Тур	Lecture	
Hrs/wk	2	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Examination Form	Klausur	
Examination duration and	60 min	
scale		
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	 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	 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. C1C.36) 	

Ligineering		
Course L2868: Digitalization	and sustainability in AEC	
Тур	Project Seminar	
Hrs/wk	3	
CP	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Examination Form	Schriftliche Ausarbeitung	
Examination duration and	90 Minuten	
scale		
Lecturer	Dr. Thomas Kölzer	
Language	EN	
Cycle	WiSe	
Content		
	Facts about climate change: Modern lifestyle, emissions, damages etc.	
	Concepts and organizations: C2C, IPCC, SDGs etc.	
	Discussion: Nature vs. technology (philosophical views)	
	 The role of AEC regrading sustainability: Cement, sand, timber, transport etc. 	
	Backgrounds: Emissions, gases, greenhouse effect etc.	
	Energy: fossil and renewable sources: Biomass, coal, oil, gas, sun, wind, water etc.	
	Digital technologies: VR, AR, apps, sensors, scanners, robotics, cameras etc.	
	Digital concepts: Big data, blockchain, artificial Intelligence, machine Learning etc.	
	Digital infrastructures: Smart cities, digital twins, autonomous driving, digital contracts etc.	
	 Digital applications in AEC: Scan-to-BIM, computer vision, structural health monitoring, Construction robotics, generative 	
	design etc.	
	Innovative combinations between ecological and digital elements	
Literature	Alpaydin (2016): Machine Learning	
	Boden (2018): Artificial Intelligence	
	Borrmann et al. (2019): Building Information Modeling	
	Braungart (2020): Cradle to Cradle - Remaking The Way We Make Things	
	Dasgupta (2016): Computer Science	
	Edenhofer & Jakob (2019): Klimapolitik	
	Hausknecht & Liebich (2016): BIM-Kompendium	
	Holmes (2017): Big Data	
	IPCC (2021): Assessment reports 1-6	
	Jelley (2020): Renewable Energy	
	Jenkins (2019): Energy Systems	
	Jonas (1979): Das Prinzip Verantwortung	
	Lenzen (2020): Künstliche Intelligenz	
	Maslin (2014): Climate Change	
	Portney (2015): Sustainability	
	Rahmstorf & Schellnhuber (2019): Der Klimawandel	
	Schirrmacher et al. (2015): Technologischer Totalitarismus Thereeu (1954): Welden	
	Thoreau (1854): Walden	
	Winfield, Alan (2012): Robotics	

Course L0286: Introduction i	Course L0286: Introduction in Statitics with R		
Тур	Lecture		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Examination Form	Klausur		
Examination duration and	60 min		
scale			
Lecturer	Dr. Joachim Behrendt		
Language	DE		
Cycle	WiSe		
Content	Introduction to R		
	Graphics with R		
	Descriptive Statistic (Boxplot, Percentiles, outliers)		
	Propability (Combinatorics, relative frequency, dependand probability)		
	random numbers and distibutions (confidence interval, uniform and discrete distributions, test-distributions (t-F-X ² -distribution))		
	Correlation and Regression analysis (Confidence interval of calibration curves, linearity)		
	Statistic test procedures (mean value-t-Test, Chi^2-Test, F-Test)		
	Analysis of variance (ANOVA, Bartlett-Test, Kruskal-Wallis Rank sum test)		
	Introduction time series (tseries)		
	Introduction cluster analysis (k-means)		
Literature	Regionales Rechenzentrum für Niedersachsen		
	Statistik mit R		
	Grundlagen der Datenanalyse		
	, 2013		
	Einführung in die Statistik mit R, Andreas Handl, Skript Uni Bielefeld		
	http://www.wiwi.uni-bielefeld.de/fileadmin/emeriti/frohn/handl_grundausbildung/statskript.pdf		
	und die daturgehörige Aufgehenschmelung		
	und die dazugehörige Aufgabensammlung http://www.wiwi.uni-bielefeld.de/fileadmin/emeriti/frohn/handl_grundausbildung/statauf.pdf		
	ntep//www.wintain belefeld.de/inclainin/enenti/nonin/hand_granddbbindang/stataanpai		
	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		
	R-Referenzcard: http://cran.r-project.org/doc/contrib/Short-refcard.pdfhttp://cran.r-project.org/doc/contrib/Short-refcard.pdf		
	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		

Course L0776: Introduction in Statitics with R	
Тур	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	siehe Vorlesung
scale	
Lecturer	Dr. Joachim Behrendt
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

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

Course L0470: Principles of 0	Geomatics	
Тур	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	schriftliche Ausarbeitungen zu allen fünf Übungen, ggf. Testklausur	
scale		
Lecturer	Dr. Annette Scheider, Prof. Kay Smarsly	
Language	DE	
Cycle	SoSe	
Content	 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	Andree, P.:Grundlagen der Geomatik (Skript)Resnik, B. / Bill, R.:Vermessungskunde für den Planungs- Bau- und Umweltbereich, Wichmann-verlagWitte, B. / Sparla, P.:Vermessungskunde und Grundlagen der Statistik für das Bauwesen, Wichmann-VerlagGruber, F.J. / Joeckel, R.:Formelsammlung für das Vermessungswesen, Vieweg + Teubner-Verlag	

Course L0471: Principles of 0	Course L0471: Principles of Geomatics	
Тур	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	Dr. Annette Scheider, Prof. Kay Smarsly	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L0125: Numeric and I	Matlab
Тур	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	5 Übungsaufgaben jeweils mit Testat am Ende
scale	
Lecturer	Dr. Stefan Benders, Prof. Siegfried Rump
Language	DE
Cycle	SoSe
Content	 Programming in Matlab Numerical methods for systems of nonlinear equations Basics in computer arithmetic Linear and nonlinear optimization Condition of problems and algorithms Verified numerical results with INTLAB
Literature	Literatur (Software-Teil): Moler, C., Numerical Computing with MATLAB, SIAM, 2004 The Math Works, Inc. , MATLAB: The Language of Technical Computing, 2007 Rump, S. M., INTLAB: Interval Labority, http://www.ti3.tu-harburg.de Highham, D. J.; Highham, N. J., MATLAB Guide, SIAM, 2005

Course L1744: Practical Course in Drinking Water Chemistry			
Тур	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	6 Versuchsprotokolle		
scale			
Lecturer	Dr. Klaus Johannsen		
Language	DE		
Cycle	WiSe		
Content	!Max.12 students!		
	The students learn basic experimental work in the laboratory. The experiments give an overview about the most important		
	hemical 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.		
	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	Siehe Skript.		
	See Script.		

Course L2411: Special topics of Civil- and Environmental Engineering		
Тур		
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Examination Form	laut FSPO	
Examination duration and	wird zu Beginn der Lehrveranstaltung festgelegt	
scale		
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		
Тур		
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Examination Form	laut FSPO	
Examination duration and	wird zu Beginn der Lehrveranstaltung festgelegt	
scale		
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	Course L2413: Special topics of Civil- and Environmental Engineering 3LP		
Тур			
Hrs/wk	3		
CP	3		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42		
Examination Form	laut FSPO		
Examination duration and	wird zu Beginn der Lehrveranstaltung festgelegt		
scale			
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 Protectio	n and Prevention
Тур	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	20 min
scale	
Lecturer	Philipp Below, Ulrich Körner
Language	DE
Cycle	SoSe
Content	 Introduction fire in residential and office buildings town planning: location of residential, office and industry areas, location of fire stations design of roads an water pipes explosions
Literature	• Schneider U. : Ingenieurmethoden im baulichen Brandschutz. Expert Verlag, 2. Aufl., 2002

Specialization Civil Engineering

Module M0755: Geote	echnics II				
Courses					
Title		Тур	Hrs/wk	СР	
Foundation Engineering (L0552)		Lecture	2	2	
Foundation Engineering (L0553)		Recitation Section (large)	2	2	
Foundation Engineering (L1494)		Recitation Section (small)	2	2	
Module Responsible	Prof. Jürgen Grabe				
Admission Requirements	None				
Recommended Previous	Modules:				
Knowledge					
	Mechanics I-II				
	Geotechnics I				
Educational Objectives	After taking part successfully, students have	reached the following learning results			
Professional Competence					
Knowledge	The students know the basic principles and r	methods which are required to verificate the stab	ility of geotechni	cal structures.	
Skills	After successful completion of the module the	ne students are able to:			
	 varificate the stability and usability of foundations 				
	 verificate the stability and usability of foundations, know individual methods of ground improvement and apply them in their range of application, 				
	 know individual methods of ground improvement and apply them in their range of application, design retaining walls. 				
	• design retaining wails.				
Personal Competence					
Social Competence					
Autonomy					
Workload in Hours	Independent Study Time 96, Study Time in L	ecture 84			
Credit points	6				
Course achievement	Compulsory Bonus Form	Description			
	No 20 % Attestation				
Examination	Written exam				
Examination duration and	90 minutes				
scale					
Assignment for the	General Engineering Science (German progr	am, 7 semester): Specialisation Civil Engineering	Elective Compu	lsory	
Following Curricula	Civil- and Environmental Engineering: Specia	alisation Civil Engineering: Compulsory			
	Civil- and Environmental Engineering: Specia	alisation Traffic and Mobility: Elective Compulsory	,		
	Civil- and Environmental Engineering: Specia	alisation Water and Environment: Elective Compu	lsory		
	Technomathematics: Specialisation III. Engin	eering Science: Elective Compulsory			

Course L0552: Foundation Engineering		
Тур	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	 Shallow foundations Pile foundations Ground improvement Retaining walls Underpinning Groundwater Conservation Cut-off Walls 	
Literature	 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		
Тур	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	
Тур	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

Engineering"							
Module M0983: Mobil	ity Concepts						
Courses							
Title				Тур	Hrs/wk	СР	
Mobility Research and Transportati	on Projects (L1181)			Project-/problem-based Learning	3	3	
Mobility in Megacities and Develop	ing Countries (L1182)			Seminar	3	3	
Module Responsible	Dr. Philine Gaffron	r. Philine Gaffron					
Admission Requirements	None						
Recommended Previous	Module Transportation Plan	Iodule Transportation Planning and Traffic Engineering					
Knowledge							
Educational Objectives	After taking part successfu	lly, students have reache	ed the followir	ig learning results			
Professional Competence							
Knowledge	Students are able to:						
	 name the different i 	Irban transport systems (ovicting aroun	d the world			
		t challenges in Asian and					
				ems on the one hand and ecolo	gical, socio-cu	ltural and econom	
	problem areas on th				g,		
			n development	and transport (in Germany and	I developing co	untries).	
		, of external framework fac			1 5		
Skills	Students are able to:						
	analyse and evaluat		Leitiee				
	-	sults to other regions and		t and transport (in doveloping a	ountrioc)		
				t and transport (in developing on sures and the implementation of the second sec		piects in the light	
	the UN Millennium D		plainea mea	sures and the implementation s	si ciunspore pre	Jeeus in the light	
			gical, poverty	oriented, gender balanced an	d economical)	solutions for urba	
	personal and goods	transport					
Demonstration of Community of							
Personal Competence	Chudanta ara abla ta						
Social Competence	Students are able to:						
	 present and explain 	independently generated	d findings.				
	 constructively discutively 	ss potentially controversi	ial topics in a	group context.			
Autonomy	Students are able to:						
	 carry out independent 	nt literature research an	d analycic				
		or a written report on a g	-				
	• independently durit	si a whiteh report of a g	iven topic.				
Workload in Hours	Independent Study Time 9	6, Study Time in Lecture	84				
Credit points	6						
Course achievement	Compulsory Bonus Form	n	Description				
eta. se demetement		ticipation in excursions					
Examination	Written elaboration						
Examination duration and	All assignments in groups	(2-4 students): written re	port, 2000 wc	ords (incl. 2 short presentations	of 10 mins.); fi	nal presentation, 2	
scale	mins. plus discussion (incl.	slides) and 1000 word re	eport incl. pee	r review (individual).			
Assignment for the	Civil- and Environmental E	ngineering: Specialisatior	n Traffic and M	lobility: Compulsory			
Following Curricula	Civil- and Environmental E	ngineering: Specialisatior	n Civil Enginee	ering: Elective Compulsory			
	Civil- and Environmental E	ngineering: Specialisatior	n Water and E	nvironment: Elective Compulso	ry		
	Logistics and Mobility: Spe	cialisation Traffic Plannin	g and System	s: Compulsory			
	Engineering and Managem	ent - Major in Logistics a	nd Mobility: S	pecialisation Traffic Planning an	d Systems: Cor	npulsory	

Course L1181: Mobility Research and Transportation Projects			
Тур	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	This course places its focus on transport and mobility in Germany. It deals with questions such as:		
	 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? 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: 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 Me	gacities and Developing Countries
Тур	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	The course provides and 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. The following examples could be suitable case studies: Singapore (Metro), Lagos (BRT Light), Guanghzou, Bogota, Jakarta (Full BRT), Sao Paulo, Medellin (Cable Car Systems), Johannesburg (Minibus-Taxi). 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).
Literature	

Courses				
Title	Тур)	Hrs/wk	СР
Circular flow economy and structural recycling (L2464)		ect-/problem-based Learning	3	3
Sustainable Building (L2463)	Ser	ninar	3	3
Module Responsible	NN			
Admission Requirements	None			
Recommended Previous	Basic knowledge of building materials, building chemistry, building construction and building project management			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence				
Knowledge	Students are able to reproduce essential features of sustainable constructional and environmental properties of recyclates and descril overview of the history, definition and to provide strategic approach environmental perspective. Furthermore, they can explain relevant of field of sustainable construction (e.g. environmental impacts of the p energy and climate-optimised planning and construction, material pr discuss the fundamental relationship between the origin and type characterising them.	be the sampling and analysis hes to the sustainability disc objectives, strategies and ex roduction and use of building rinciples of renewable raw m	s process. The cussion from cemplary field g materials, li naterials). Stu	ey are able to give a constructional a ds of research in f fe cycle assessme idents will be able
Skills	S Students can relate relevant legal requirements to practical problems of environmentally sound design and construction and thu justify the application of specific limit values for individual areas of application. Students are able to assess risks that may aris 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 propos approaches for alternative solutions exemplarily, e.g. for the processing and recycling of construction waste.			
Personal Competence				
Social Competence	The students are able to work out their own solutions for specific propurpose, they can organise themselves in a division of labour and ca are able to appoint group members to coordinate the cooperation w presentation of work results in the seminar.	n give themselves a work ar	nd project pla	n. Furthermore, th
Autonomy	Students can coordinate their individual work performance with the other members of the group and prepare for it efficiently by use of scientific media.			
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	Written-theoretical part and project work			
scale				
Assignment for the	Civil- and Environmental Engineering: Specialisation Water and Enviro	onment: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobil			
-	Civil- and Environmental Engineering: Specialisation Civil Engineering			
	Integrated Building Technology: Core Qualification: Compulsory			

Course L2464: Circular flow economy and structural recycling		
Тур	Project-/problem-based Learning	
Hrs/wk	3	
СР	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	NN	
Language	DE	
Cycle	SoSe	
Content	 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 B	uilding
Тур	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	 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	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)

Engineering"				
Module M1715: Renew	vable Energies			
Courses				
Title		Тур	Hrs/wk	СР
Renewable Energies I (L2740)		Lecture	2	2
Renewable Energies I (L2742)		Recitation Section (large)	1	1
Renewable Energies II (L2741)		Lecture	2	2
Renewable Energies II (L2743)		Recitation Section (large)	1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	None			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have read	ched the following learning results		
Professional Competence				
Knowledge	Upon completion of this module, students will be	able to provide an overview of characterist	tics of renewable e	energy systems. They
5	will be able to explain the issues that arise in th			
	energy distribution and energy trading in this co			
	can explain this knowledge in detail for such er	-		
	environmental impact of using renewable energ			
	options.			ion of the respective
	options.			
Skills	Students are able to apply methodologies for determining energy demand or energy supply to different types of renewable energy			
	systems. Furthermore, they can evaluate such e	nergy systems technically, ecologically an	d economically as	well as systemically
	and also design them under certain given conditi	ons. They are able to select the regulations	s necessary for this	s in a subject-specific
	manner, especially by means of non-standard sol			
	Students are able to orally explain issues from t	he subject area and approaches to dealing	g with them and to	classify them in the
	respective context.			
Personal Competence				
Social Competence	Students are able to investigate suitable technic	cal alternatives and ultimately evaluate th	em based on tech	nical economic and
Secial competence	ecological criteria - and thus from a sustainability			
		perspective.		
Autonomy	Students will be able to independently access so	urces about the field, acquire knowledge ar	nd transform it to a	iddress new issues.
	Independent Study Time 96, Study Time in Lectu	re 84		
	90 min			
	Concrete Engineering Colores (Concrete a)		alaa. Canturita	
Following Curricula			gies: Compulsory	
	Civil- and Environmental Engineering: Specialisat		, ,	
	Civil- and Environmental Engineering: Specialisat	ion Water and Environment: Elective Comp	ulsory	
	Chemical and Bioprocess Engineering: Specialisa	tion Chemical Engineering: Compulsory		
	Green Technologies: Energy, Water, Climate: Cor	e Qualification: Compulsory		
	Process Engineering: Core Qualification: Compuls	ory		
scale	None Written exam 90 min General Engineering Science (German program, General Engineering Science (German program, Civil- and Environmental Engineering: Specialisat Civil- and Environmental Engineering: Specialisat Civil- and Environmental Engineering: Specialisat Chemical and Bioprocess Engineering: Specialisa Green Technologies: Energy, Water, Climate: Cor	7 semester): Specialisation Green Technolo ion Civil Engineering: Elective Compulsory ion Traffic and Mobility: Elective Compulsor ion Water and Environment: Elective Comp tion Chemical Engineering: Compulsory e Qualification: Compulsory	gies: Compulsory	

Course L2740: Renewable En	ourse L2740: Renewable Energies I		
Тур	Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Martin Kaltschmitt		
Language	DE		
Cycle	SoSe		
Content	This module includes a presentation of the renewable energy supply and a discussion of the respective technologies for providing the desired final or useful energy. Specifically, this includes the options for solar energy use for heat and power generation (i.e., passive solar energy use, solar collectors for low-temperature heat provision, solar thermal power generation, photovoltaic power generation), wind energy use for power generation (i.e. onshore and offshore wind power use), hydroelectric power use for electricity generation (i.e., run-of-river and storage hydroelectric power), ocean energy use for electricity generation (including tidal power plants), and geothermal energy use for heat and electricity generation (i.e., near-surface use by means of heat pumps, deep geothermal energy use for heat and/or electricity generation).		
Literature	Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2020, 6. Auflage		

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Course L2742: Renewable Energies I		
Тур	Recitation Section (large)	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Martin Kaltschmitt	
Language	DE	
Cycle	SoSe	
	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. Possible tasks in the field of renewable energies are: • Solar thermal heat • Concentrating solare power • Photovoltaic • Windenergie • Hydropower • Heat pump Deep geothermal energy	
Literature	Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2020, 6. Auflage	

ourse L2741: Renewable Energies II		
	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	
	This lecture covers all options for energy supply from biomass; this includes the supply of heat, electricity and fuels. The biomass resource and its origin will be discussed first. Afterwards the biomass supply is addressed, which bridges the gap between biomass generation and utilization. Subsequently, the different conversion options are discussed. Only those options are presented in depth that have a corresponding significance on the market in Germany and Europe. This includes (a) heat generation from biogenic solid fuels in small and large-scale plants (b) power generation from solid biomass via combustion (c) a biogas production from residues, by-products and waste, (d) alcohol production from sugar and starch (e) biodiesel production from vegetable oils. Special attention is also paid to the corresponding environmental aspects. An economic classification of the various options is also provided.	
Literature	Unterlagen der Vorlesung	

Course L2743: Renewable Energies II		
	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Martin Kaltschmitt	
Language	DE	
Cycle	SoSe	
Content	The students work on tasks in the field of renewable energies the field "energy from biomass". They present their solution approaches in the exercise group and discuss them with their fellow students and the teaching staff afterwards.	
Literature	Unterlagen der Vorlesung	

Module M0631: Reinf	orced Concrete	Structures	11			
Courses						
Title Project Concrete Structures II (L089 Concrete Structures II (L0348) Concrete Structures II (L0349)	94)			Typ Project Seminar Lecture Recitation Section (large)	Hrs/wk 1 2 2	CP 1 3 2
Module Responsible	Prof. Günter Rombac	'n				
Admission Requirements	None					
Recommended Previous Knowledge	Basics of safetKnowledge in of	y format are requ design of beams a	s and combination of acti ired. nd columns for ultimate li rructures I, Structural Ana	imit state		
Educational Objectives	After taking part succ	essfully, students	have reached the followi	ng learning results		
Professional Competence Knowledge Skills	methods to estimate The students serviceability I The students of 	the member force can design reinfo imit state (crack a an estimate the n	es in simple one and two-vorced concrete structure	in the ultimate limit state luding detailing (anchorage a labs.	(shear, bending,	
Personal Competence <i>Social Competence</i> <i>Autonomy</i>				al concrete building and pres es and evaluate the results.	ent the results at	the end.
Workload in Hours	Independent Study T	me 110, Study Ti	me in Lecture 70			
Credit points						
Course achievement	Compulsory Bonus No None	Form Excercises	Description			
Examination		2.000.01000				
Examination duration and	120 minutes					
scale						
Assignment for the	General Engineering	Science (German	program, 7 semester): Sp	ecialisation Civil Engineering	: Elective Compul	lsory
Following Curricula			Specialisation Civil Engine			
				Mobility: Elective Compulsory Environment: Elective Compu		

Course L0894: Project Concrete Structures II	
Тур	Project Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	Design of a truss structure
Literature	Skript zur Lehrveranstaltung "Stahlbetonbau II"

ourse L0348: Concrete Structures II			
Тур	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	 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	 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 KH.: 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 Stru	ourse L0349: Concrete Structures II	
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	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	

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bageserror hterony bages of the second of th	Courses				
topic bio	itle		Тур	Hrs/wk	СР
Medias Registment Into thistoph III Admission Requirement basis: Knowledge of Mathematics and Subiness Kecommended Previous Admission Status Exclusional Objective After taking part successfully, students have reached the following learning results Professional Compations Admission Status Admission Status Admission Status Professional Compations Admission Status Admission Status Basis Intergenetic Status Admission Status Admission Status Admission Status Basis Intergenetic Intergenetic Status Admission Pathogenetic Intergenetic Status Basis Intergenetic Int	Management Tutorial (L0882)				3
Admission Requirements New Median Recommended provides Sate Monologie of Mahematics and Business Recommended provides Sate Mahamatics and Business Recommended provides and Admission and also be investment and controlling. In particular they are able to and Degratisation to Marketing and Immovides of and goals in Management, and the sub-displication in many and the admission and also be investment and controlling. In particular they are able to and Degratisation to Marketing and Immovides of and goals in Management and name the most important aspects of contegorers 4 organ the most important aspects of and goals in Management and name the most important aspects of contegor 4 organ the most important aspects of and goals in Management and name the most important aspects of contegor 4 organ the most important aspects of and goals in Management and name the most important aspects of contegor 4 organ the most important aspects of and goals in Management and name the most important aspects of contegor 4 organ the relevance of parining and disciption making in Banagement and instrumt multiple objectives 4 organization and using in advectivity and interface them aspects of and goals in Management and instrumt multiple objectives 4 organization and satif Matcures of companies 4 organization and proceeding matcures 4 organization and satif Matcures of companies 4 organization Matcures and duri	ntroduction to Management (L088	0)	Lecture	3	3
Recommended Previous Data: Knowledge of Mathematics and Business Educational Objectives After taking part successfully, students have nearbed the following warring results Professional Competence Accessions After taking part successfully, students have nearbed the following warring results After taking his module, students how the important backs of many different areas in Business and Management, from PB and Organisation to Marketing and Innovation, and also to Investment and Cartrolling. In particular they are able to important definitions from the field of Management and Dispatch definitions from the field of Management and Dispatch definitions from the field of Management and Dispatch definitions in the manufacture of Management and the sub- dispatch definition of Management and and addition the Management and Business information, ediperitions, estrategies etc.) and the enargive comparison and addition of Management and Business information, systems and Dispatch definition and Staff structures of cormanics and Dispatch definition of Management and Business information, systems and Dispatch definition of Management and Business information, systems and Dispatch definition of Management and Addition and Dispatch definition of Dispatch definition of Management and Dispatch definition of Cardina and Dispatch definitin Compolicity and Dispatch definition of Cardina and Disp	Module Responsible	Prof. Christoph Ihl			
Resolution Statistical Competence Resolution Objective Anti-statistic grant scientificity, students have mested the following rearing multis Professional Competence Anti-scientific grant scientific grant scientific grant back is and statistic of many different areas in backness and Management, from Pile • explain the differences between Economics and Kanagement and the subdiciplines in Management and to a more difference scientific grant scienti scinter scientific grant scinte grant scientific grant	Admission Requirements	None			
Educational Objective Professional Competence Researcher After taking part successfully, subseris have neached the following learning results Researcher Addressing this module, students know the important backs of many different areas in baunces and Management, from PB and Organisation to Manteting and Innovation, and also to Investment and Controlling In particular they are able to inspirate definitions from the field of Management. and the sub-disciplens in Management and the inspirate definitions from the field of Management. • explain the differences between Economics and Management and name the most important aspects of an dispirate inspirate appendix of Management. • explain the management, information management, information management, information and manatistical generation the relevance of partness actions and spirate management, information management, and manatistical explanation and furnam resource management, information in backs. Statist Students are able to analyse baciness on this with respect to different citeral organization, objectives, strategies etc.) and the axis in firetermenturing projects and additionation many and backs. Statist Students are able to analyse baciness on the action of marking explanation and partner interviets from accounting. Costing and controlling to predefined problems • axisyse Management quotes in marking and increasing systems • axisyse management quotes in marking generating systems • axisyse management quotes in marking and controlling to predefined problems • axisyse management quotes in marking generating systems • axisyse Management and addition to formation the marki	Recommended Previous	Basic Knowledge of Mathematics and Business			
Professional Competence Konneget Konneg	Knowledge				
Advances of Constraints income the important basics of many different areas in Busines and Kangament, from Pa englan the differences between Commiss and Management and the sub-disciplins in Management and to important definitions from the field of Management. • explain the most important aspects of mission in Management and the sub-disciplins in Management and the sub-discipline from the most important aspects of mission in Management and name the meat important aspects of interprint protects • explain the relevance of planning and design and uncerted formation management, more multiple objectives • explain the relevance of planning and design and uncerted formation management, more multiple objectives • uncertainty, and explain some basic methods from mathematical Finance • state basics from accurating and cating and uncerted formation makes and sub-approximation, dejectives, strategies etc.) and to concertainty, and explain some basic methods from mathematical Finance • state basics from accurating and cating and uncerted formation patients. • Stell • Steller Students are able to analyze business units, under multiple objectives, under uncertainty and under risk. • analyze management gala and stratifictures of comparises • analyze management gala and stratifictures of comparises • analyze management and objectives • analyze plants for defections missing under multiple objectives, under uncertainty and under risk. • analyze mathematical finance • a social Competence Social Competence Social Competence • to communicate appropriately and • a work is a term and to arganize the term themselves • to communicate appropriately and • a work is a term and to organize the term themselves • to ordinate appropriately and • a work is a term and the organize the term themselves • to ordination state and plant the secret Catenet as properties (Social and multiple descrites, under under term of the project Social Competence • to apply their involves in plant. The Misselling Finance Social 	Educational Objectives	After taking part successfully, students have reached t	ne following learning results		
exclusion to Marketing and Innovation, and also to Investment and Costrolling, In particular they are able to exclusion the differences between Economics and Management and the sub-disciplines in Management. exclusion the mask important displation from the field of Management and the sub-disciplines in Management. exclusion the mask important displation from the field of Management. exclusion the displation basic business functions as production, procurement and sourcing, supply chain management. exclusion the displation basic business the weak in the masking in Business. exclusion the displation basic business thread weak on the field sourcing. exclusion the displation basic busines with weak to field on the masking in Busines. exclusion the displation basic busines with weak respect to difference the displation. exclusion taking and displation the displation displation the magnetization. exclusion taking and proceeners systems. exclusion taking under multiple displation. exclusion taking under multiple displations. exclusion taking under multiple displations. exclusion taking and discrete them appropriately. exclusion taking under multiple displations. exclusion taking under multiple displations. exclusion taking and discrete them appropriately. exclusion taking and distribute them appropriately. exclusin taking and displation taking and distrib	Professional Competence				
important definitions from the field of Management important aspects of and gabls in Management and name the most important aspects of entrepr projects exclusion and human resource management, information management, information management and marketing exclusion and human resource management, information management, information management and marketing exclusion and human resource management, information management, and marketing exclusion accounting and costing and existent controlling methods. Still: Students are able to analyse Management gabls and Structure them aspropriately early aspect opails and structure data structure data material information systems earlyse and apply basic methods form material and basics from data and structure them aspropriately earlyse and apply basic methods for marketing earlyse and apply basic methods form accounting. costing and controlling to predifined problems earlyse and apply basic methods from accounting. costing and controlling to predifined problems earlyse and bot marketing work successfully in a team of students to work successfully in a team of students earlyse and bot marketing work in a team and to arganize the team themselves is write a coherent report on the project. to cooperate respectively with their releve students. functioned and provide and proteins is write a report and torganize the team themselves is write a report and torganize the team themselves is write a report and torganize the team themselves is write a report and torganize the team themselves is writ	Knowledge	and Organisation to Marketing and Innovation, and also	to Investment and Controlling. In part	ticular they are at	ole to
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Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio Engineering: Elective Compulsory Chemical and Bioprocess Engineering: Specialisation Chemical Engineering: Elective Compulsory Chemical and Bioprocess Engineering: Specialisation Chemical Engineering: Elective Compulsory Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation Biotechnologies: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Energy Systems / Renewable Energies: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Energy Technology: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Maritime Technologies: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Water Technologies: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Water Technologies: Elective Compulsory Computer Science in Engineering: Core Qualification: Compulsory Integrated Building Technology: Core Qualification: Compulsory Logistics and Mobility: Core Qualification: Compulsory Mechanical Engineering: Core Qualification: Compulsory Mechatronics: Specialisation Naval Engineering: Compulsory	-				
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Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation Biotechnologies: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Energy Systems / Renewable Energies: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Energy Technology: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Energy Technology: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Maritime Technologies: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Water Technologies: Elective Compulsory Green Technologies: Energy, Water, Climate: Specialisation Water Technologies: Elective Compulsory Computer Science in Engineering: Core Qualification: Compulsory Integrated Building Technology: Core Qualification: Compulsory Logistics and Mobility: Core Qualification: Compulsory Mechanical Engineering: Core Qualification: Compulsory Mechatronics: Specialisation Naval Engineering: Compulsory		Chemical and Bioprocess Engineering: Specialisation B	o Engineering: Elective Compulsory		
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Computer Science in Engineering: Core Qualification: Compulsory Integrated Building Technology: Core Qualification: Compulsory Logistics and Mobility: Core Qualification: Compulsory Mechanical Engineering: Core Qualification: Compulsory Mechatronics: Specialisation Naval Engineering: Compulsory		Green Technologies: Energy, Water, Climate: Specialisa	tion Maritime Technologies: Elective C	ompulsory	
Integrated Building Technology: Core Qualification: Compulsory Logistics and Mobility: Core Qualification: Compulsory Mechanical Engineering: Core Qualification: Compulsory Mechatronics: Specialisation Naval Engineering: Compulsory		Green Technologies: Energy, Water, Climate: Specialisa	tion Water Technologies: Elective Com	ipulsory	
Logistics and Mobility: Core Qualification: Compulsory Mechanical Engineering: Core Qualification: Compulsory Mechatronics: Specialisation Naval Engineering: Compulsory		Computer Science in Engineering: Core Qualification: C	ompulsory		
Mechanical Engineering: Core Qualification: Compulsory Mechatronics: Specialisation Naval Engineering: Compulsory		Integrated Building Technology: Core Qualification: Cor	npulsory		
Mechatronics: Specialisation Naval Engineering: Compulsory		Logistics and Mobility: Core Qualification: Compulsory			
		Mechanical Engineering: Core Qualification: Compulsor	4		
		Mechatronics: Specialisation Naval Engineering: Compu	llsory		
17:01					

Mechatronics: Specialisation Electrical Systems: Compulsory	
Mechatronics: Specialisation Dynamic Systems and AI: Compulsory	
Mechatronics: Core Qualification: Compulsory	
Mechatronics: Specialisation Robot- and Machine-Systems: Compulsory	
Mechatronics: Specialisation Medical Engineering: Compulsory	
Orientation Studies: Core Qualification: Elective Compulsory	
Orientation Studies: Core Qualification: Elective Compulsory	
Naval Architecture: Core Qualification: Compulsory	
Technomathematics: Core Qualification: Compulsory	
Process Engineering: Core Qualification: Compulsory	
Engineering and Management - Major in Logistics and Mobility: Core Qualification: Compulsory	

Course L0882: Management Tutorial			
Тур	Recitation Section (small)		
Hrs/wk	2		
СР	3		
Workload	Independent Study Time 62, Study Time in Lecture 28		
in Hours			
Lecturer	Prof. Christoph Ihl, Katharina Roedelius		
Language	DE		
Cycle	WiSe/SoSe		
Content	In the management tutorial, the contents of the lecture will be deepened by practical examples and the application of the discussed tools.		
	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 se 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 busin knowledge from the lecture should come to practical use. The group projects are guided by a mentor.		
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.		

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Course L0880: Introduction t	to Management	
Тур	Lecture	
Hrs/wk	3	
CP	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
	Prof. Thomas Wrona, Prof. Thorsten Blecker, Prof. Wolfgang Kersten	
Language	DE	
Cycle	WiSe/SoSe	
Content	 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	 Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008 Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003 Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006. Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001. Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008. Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl. Stuttgart 2005. Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008. Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006. 	

Courses				
Title		Тур	Hrs/wk	СР
Transport Planning and Traffic Engi	neering (L0997)	Project-/problem-based Learning	4	6
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached th	e following learning results		
Professional Competence				
Knowledge	Students are able to			
	- understand the factor contouts and chiestives of	wanaa ark alaaning		
	 understand the facts, contexts and objectives of correctly apply definitions and concepts of transp 			
	 reproduce basic concepts of transport modelling. 	or planning.		
	 explain the fundamentals of traffic engineering a 	ad transport infrastructure construction		
	• explain the fundamentals of traine engineering a			
Skills	Students are able to			
	 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				
Social Competence	Students are able to			
	 get together in groups and constructively discuss 	and analyse set problems.		
	• in a group agree on solutions and document ther	1.		
Autonomy	Students are able to			
	 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			
Credit points Course achievement		iption		
Course achievement	No 5 % Excercises			
Examination	Subject theoretical and practical work			
Examination duration and	Project report in four work packages, in small groups, d	uring the semester		
scale	,	5		
Assignment for the	Civil- and Environmental Engineering: Specialisation Tra	ffic and Mobility: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisation Wa			
-	Civil- and Environmental Engineering: Specialisation Civ			
	Engineering and Management - Major in Logistics and M			

Course L0997: Transport Planning and Traffic Engineering		
Тур	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	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: 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	Bosserhoff, Dietmar (2000) Integration von Verkehrsplanung und räumlicher Planung. Schriftenreihe der Hessischen Straßen- und Verkehrsverwaltung, Heft 42. Hessisches Landesamt für Straßen- und Verkehrswesen. Wiesbaden. Lohse, Dieter; Schnabel, Werner (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung: Band 1; Straßenverkehrstechnik. Beuth Verlag. Berlin. Forschungsgesellschaft für Straßen- und Verkehrswesen (2006) Richtlinien für die Anlage von Stadtstraßen - RASt 06. FGSV- Verlag. Köln (FGSV, 200). Vallée, Dirk; Engel, Barbara; Vogt, Walter (2021) Stadtverkehrsplanung Band 3, Springer Verlag. Berlin.	

Module M1631: Engin	eering Informa	tice				
Module M1051: Engin	leering morma	ucs				
Courses						
Title			Тур	Hrs	s/wk	СР
Databases (L2758)			Integrated Lectur	e 1		1
Databases (L2759)			Recitation Section	n (small) 1		1
Object-oriented Modelling (L2468)			Integrated Lectur	e 2		2
Object-oriented Modelling (L2469)			Recitation Section	n (small) 2		2
Module Responsible	Prof. Kay Smarsly					
Admission Requirements	None					
Recommended Previous	Students can describ	e and analyze existing	software programs in the discipli	ne based on their	essential o	characteristics. T
Knowledge	students are able to r	eproduce the elementary	basics and theoretical concepts of	engineering inform	atics and t	o apply elementa
	solution algorithms to	engineering problems. T	hey are also able to define databas	e principles and ma	ke simple	queries to commo
	database systems.					
Educational Objectives	After taking part succ	ossfully, students have re	ached the following learning result	·c		
Professional Competence	Arter taking part succ	essiully, students nave re	actied the following learning result	.5		
•	Final and the last (i) all	the standard				his to develop a
Knowledge			and (ii) database design will be pre			
	to modify software as	well as database system	s required in the area of civil and e	nvironmental engin	eering. In p	part (i), the stude
	will become familiar	with fundamentals of en	gineering informatics programmin	g methodologies, o	bjects and	l classes, metho
	functions, and proce	dures, UML notation (s	uch as association, aggregation	and composition),	control str	uctures, excepti
			classes and interfaces, data stru			
	-			-		
	emphasis on hash tables and tree structures), algorithms and generic programming. Part (ii) follows the database design pro-					
	and primarily covers conceptual design and semantics of database models (with emphasis on the Entity-Relationship Model) logical design (including integrity constraints, anomalies and normalization), relational algebra, relational query languages an					
				-		
	SQL, database views,	physical database desigi	and implementation, concepts of	database applicatio	n developr	ment (JDBC) as w
	as data integration an	d data exchange in civil	engineering.			
Skills						
Personal Competence						
-						
Social Competence						
Autonomy						
Workload in Hours		me 96, Study Time in Lec	ture 84			
Credit points	6					
Course achievement	Compulsory Bonus	Form	Description			
	Yes 15 %	Written elaboration	Als Prüfungsvorleistung wird			-
			umfasst die bis dahin bek	annten Lehrinhalte	und die	nt u.a. dazu, o
			Studierenden auf die Klausur	vorzubereiten.		
Examination	Written exam					
Examination duration and	180 min					
scale						
Assignment for the	Civil- and Environmen	tal Engineering: Core Qu	alification: Compulsory			
Following Curricula			ation Civil Engineering: Elective Co	mpulsory		
i onoming carricula			ation Traffic and Mobility: Elective			
	Civil- and Environmen	tai Engineering: Specialis	ation Water and Environment: Elec	tive Compulsory		

ourse L2758: Databases	
Тур	Integrated Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Kay Smarsly
Language	DE
Cycle	WiSe
Content	 Motivation and basic concepts Terminology and definitions Database design process Conceptual design Semantics of database models The Entity-Relationship Model Relationships in the ER model Other concepts in the ER model Conceptual modeling with UML Logical design The relational model Integrity constraints Anomalies and normalization ER mapping to the relational model Relational algebra Relational query languages Schema definition and modification SQL as a relational query language Modification options in SQL Database views Physical database design and implementation Concepts of database application development
	• JDBC
	Data integration and data exchange in civil engineering
Literature	

Course L2759: Databases		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Kay Smarsly	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L2468: Object-oriente	ed Modelling		
Тур	Integrated Lecture		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Kay Smarsly		
Language	DE		
Cycle	WiSe		
Content	 Fundamentals of engineering informatics Programming languages and programming paradigms Programming methodology Objects and classes Constructors Packages and imports Visibility and validity Methods, functions, and procedures Variables and constants UML notation Control structures Expressions and statements Recursion Exception handling Inputs and outputs Data streams Association, aggregation and composition Inheritance Abstract classes and methods Interfaces Data structures and algorithms (e.g. arrays) Generic programming Lists, queues, and sets 		
	Further notes on algorithms		
Literature			
Course 12460, Object oriente	· · · · · ·		

Course L2469: Object-oriented Modelling		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Kay Smarsly	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Module M1843: Non-l	inear structural analysis			
Courses				
Title		Тур	Hrs/wk	СР
Non-linear structural analysis (L304	41)	Lecture	2	3
Non-linear structural analysis (L304		Recitation Section (large)	2	2
Non-linear structural analysis (L31	35)	Recitation Section (small)	1	1
Module Responsible	Prof. Bastian Oesterle			
Admission Requirements	None			
Recommended Previous				
Knowledge	Mechanics I/II			
	Mathematics I/II Differential Exactles I			
	Differential Equations I			
	Structural Analysis I			
	Structural Analysis II			
Educational Objectives	After taking part successfully, students have	ve reached the following learning results		
Professional Competence				
Knowledge	After successful completion of this module, students can express the basic aspects of non-linear structural analysis of statically			
	indeterminate frame structures.			
Skills	After successful completion of this module, the students will be able to predict the non-linear structural response of frame			
	structures using the appropriate computat	ional approaches and methods.		
Personal Competence				
Social Competence	Students can			
	 participate in subject specific and in 	tordisciplinary discussions		
	 participate in subject-specific and in defend their own work results in from 			
	 promote the scientific development 			
		5		
	Furthermore, they can give and acc	ept professional constructive criticism		
Autonomy	Students are able to gain knowledge of the	e subject area from given and other sources and a	apply it to new pro	blems. Furthermore
	they are able to structure the solution proc	cess for problems in the area of nonlinear structura	al analysis.	
			-	
Workload in Hours		in Lecture 70		
Credit points				
Course achievement				
	Written exam			
Examination duration and	90 min			
scale				
		cialisation Civil Engineering: Elective Compulsory		
Following Curricula	Civil- and Environmental Engineering: Spec	cialisation Civil Engineering: Elective Compulsory		

Course L3041: Non-linear str	ructural analysis
Тур	Lecture
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Bastian Oesterle
Language	DE
Cycle	WiSe
Content	material non-linear methods. The topic pre-steressed systems contains both geometrically non-linear phenomena (e.g. geometrical or initial stress stiffness of pre-stressed cables) and material non-linear phenomena (e.g. failure of concrete under tensile stresses). In all three parts, first the phenomena are described, followed by the derivation of corresponding model and computational methods. The topics cover: Part 1: Geometrically non-linear methods • geometrically non-linear structural behaviour • force and displacement load cases • equilibrium in the deformed configuration • geometrical stiffness • second order theory • displacement method and direct stiffness method considering second order theory • stability analysis
	 bifurcation problems and snap-through problems Part 2: Pre-stressed systems basic principle of pre-stressing internal and external pre-stress compressive pre-stress pre-stressed concrete tensile pre-stress, cables and membranes
	Part 3: Material non-linear methods non-linear material behaviour loading and unloading, self-stressed states theory of plasticity plastic hinge theory ultimate limit states
Literature	 Vorlesungsmanuskript Bletzinger et al.: Aufgabensammlung zur Baustatik: Übungsaufgaben zur Berechnung ebener Stabtragwerke. Hanser. Dinkler: Grundlagen der Baustatik. Springer. Marti: Baustatik. Ernst und Sohn.

Course L3042: Non-linear str	ourse L3042: Non-linear structural analysis		
Тур	Recitation Section (large)		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Bastian Oesterle		
Language	DE		
Cycle	WiSe		
Content	See interlocking course		
Literature	See interlocking course		

Course L3135: Non-linear str	ructural analysis
Τνρ	Recitation Section (small)
Hrs/wk	
CP	
	Independent Study Time 16, Study Time in Lecture 14
	Prof. Bastian Oesterle
Language	
Cycle	
	The module ist structured into three main parts, namely 1. geometrically non-linear methods, 2. pre-stressed systems and 3 material non-linear methods. The topic pre-stressed systems contains both geometrically non-linear phenomena (e.g. geometrica or initial stress stiffness of pre-stressed cables) and material non-linear phenomena (e.g. failure of concrete under tensile stresses). In all three parts, first the phenomena are described, followed by the derivation of corresponding model and computational methods. The topics cover: Part 1: Geometrically non-linear methods • geometrically non-linear structural behaviour • force and displacement load cases • equilibrium in the deformed configuration • geometrical stiffness • second order theory • displacement method and direct stiffness method considering second order theory • stability analysis • bifurcation problems and snap-through problems Part 2: Pre-stressed systems • basic principle of pre-stressing • internal and external pre-stress • compressive pre-stress • pre-stressed concrete • tensile pre-stress, cables and membranes Part 3: Material non-linear methods
	non-linear material behaviour
	loading and unloading, self-stressed states
	theory of plasticity
	plastic hinge theory
	ultimate limit states
Literature	Vorlesungsmanuskript
	 Bletzinger et al.: Aufgabensammlung zur Baustatik: Übungsaufgaben zur Berechnung ebener Stabtragwerke. Hanser.
	 Dickler: Grundlagen der Baustatik. Springer.
	Marti: Baustatik. Ernst und Sohn.

Engineering				
Module M0612: Steel	Structures II			
Courses				
Title		Тур	Hrs/wk	СР
Steel Structures II (L0301)		Lecture	2	3
Steel Structures II (L0302)		Recitation Section (large)	2	3
Module Responsible				
Admission Requirements	None			
Recommended Previous	Steel Structures I			
Knowledge				
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	After successful completition students can			
	 describe and explain the behaviour of bolted a 	and welded connections		
	 design and check simple halls and buildings 			
	 calculate forces and stresses of simple structu 	ires (trusses, beams, frames)		
	 illustrate and dimension he main details (fram 	ework, column base, load application po	pints)	
Skills	Students are able to design simple structures and co		-	
	failure. They can apply structural imperfections, calc	ulate according to 2nd order theory and	verify their result	S.
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecture	56		
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and	120 minutes			
scale				
Assignment for the	General Engineering Science (German program, 7 se	mester): Specialisation Civil Engineering	g: Elective Compul	sory
Following Curricula	Civil- and Environmental Engineering: Specialisation	Civil Engineering: Compulsory		
	Civil- and Environmental Engineering: Specialisation	Traffic and Mobility: Elective Compulsor	У	
	Civil- and Environmental Engineering: Specialisation	Water and Environment: Elective Comp	ulsory	

Course L0301: Steel Structures II		
Тур	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	 Welded connections Simple constructions 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 Band 1 Tragwerksplanung, Grundlagen Band 2 Verbindungen und Konstruktionen 	

Course L0302: Steel Structures II		
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	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	

Courses				
Title		Түр	Hrs/wk	СР
Computational Stuctural Mechanic	5 (L2475)	Integrated Lecture	2	2
Computational Structural Mechanic		Recitation Section (small)	1	1
Module Responsible	Prof. Christian Cyron			
Admission Requirements	None			
Recommended Previous	Engineering Mechanics I, Engineering Me	chanics II, Mathematics I, Mathematics II		
Knowledge				
Educational Objectives	After taking part successfully, students h	ave reached the following learning results		
Professional Competence				
Skills	importance of computational methods in modern solid mechanics and in particular also the theoretical foundations of the finitelement method. Students are able to develop simple computational methods and programs to solve problems in solid mechanics. Moreover student have sufficient basic knowledge about the finite element method to use commercial software in this area for the successful solution of at least simple problems (after a short introduction into the handling of a specific software package).			
Personal Competence				
Social Competence	Students are capable to communicate and work out complex problems and their solutions with professional staff.			
Autonomy	The students are able to assess their own strengths and weaknesses. They can independently and on their own identify and solv problems in the area of Computational Structural Mechanic and acquire the knowledge required to this end.			
Workload in Hours	Independent Study Time 48, Study Time	in Lecture 42		
Credit points	3			
Course achievement	None			
Examination	Written exam			
Examination duration and	90 min			
scale				
Assignment for the	General Engineering Science (German pr	ogram, 7 semester): Specialisation Civil Engineeri	ng: Compulsory	

Course L2475: Computationa	Il Stuctural Mechanics	
Тур	Integrated 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	The lecture Computational Structural Mechanics extends the content of the lecture Engineering Mechanic II. It bridges the gap	
	between the manual calculation of mechanical stress and deformation in systems with a particularly simple geometry and the	
	efficent computer-based computation of general mechanical systems:	
	Basics of linear continuum mechanics	
	Planar structures: plate, membrane, slab	
	Linientragwerke: beam, cable, truss	
	Weak form and Galerkin's method	
	Finite element method: theory and application	
	Principles of mechanics: principle of virtual work, virtual displacements, virtual forces	
Literature	Gross, Hauger, Wriggers, "Technische Mechanik 4", Springer	

Course L2873: Computationa	urse L2873: Computational Structural Mechanics (Exercise)		
Тур	Recitation Section (small)		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Prof. Christian Cyron		
Language	DE		
Cycle	SoSe		
Content	The exercise on Computational Structural Mechanics demonstrates how the theoretical content of the lecture on Computational		
	Structural Mechanics can be applied to solve specific mechanical problems.		
Literature			

Module M1633: Plann	ing Law and Environmental	Law/ Sustainable Urban Develo	opment	
Courses				
Title		Тур	Hrs/wk	СР
Sustainable Urban Development (L		Lecture	2	3
Planning law and Environmental la	N (L2473)	Lecture	2	3
Module Responsible	Prof. Ralf Otterpohl			
Admission Requirements	None			
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students h	nave reached the following learning results		
Professional Competence				
Knowledge				
Skills				
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Tim	e in Lecture 56		
Credit points	6			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and	Written-theoretical part and report			
scale				
Assignment for the	Civil- and Environmental Engineering: Sp	pecialisation Civil Engineering: Elective Compuls	sory	
Following Curricula	Civil- and Environmental Engineering: Sp	ecialisation Water and Environment: Elective C	Compulsory	
	Civil- and Environmental Engineering: Sp	ecialisation Traffic and Mobility: Elective Comp	oulsory	
	Logistics and Mobility: Specialisation Tra	ffic Planning and Systems: Elective Compulsory	1	
	Engineering and Management - Major in	Logistics and Mobility: Specialisation Traffic Pla	anning and Systems: El	ective Compulsory

Course L2474: Sustainable U	purse L2474: Sustainable Urban Development		
Тур	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	Course L2473: Planning law and Environmental law		
Тур	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			

Medule M0005, Interes	lustice to Deiluseus			
Module M0985: Introd	auction to Rallways			
Courses				
Title		T	Hara ta da	65
Introduction to Railways (L1184)		Typ Lecture	Hrs/wk 2	CP 4
Introduction to Railways (L1184)		Recitation Section (large)	1	2
Module Responsible	Prof. Carsten Gertz	-		
	None			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have	reached the following learning results		
Professional Competence				
Knowledge	Students can			
	 give definitions for basic terms related 	to railways		
		-		
	 explain specifics concerning the handling of goods on railways explain the required infrastructure 			
	explain the required infrastructure describe the work at the track super structure			
Skills				
Personal Competence				
Social Competence	Students can			
	 work at tasks in groups and come to re 	esults together		
	 discuss contents in groups, summarized 	e them and present them in front of others		
	 convey contents to other by processin 	g them in writing		
Autonomy	Students can work out and understand conte	nts themselves during the lecture through litera	ature research	
	Independent Study Time 138, Study Time in			
Credit points				
Course achievement				
Examination				
Examination duration and	90 min			
scale				
Assignment for the	Civil- and Environmental Engineering: Specia	lisation Traffic and Mobility: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specia	lisation Civil Engineering: Elective Compulsory		
	Civil- and Environmental Engineering: Specia	lisation Water and Environment: Elective Comp	ulsory	
	Logistics and Mobility: Specialisation Traffic F	Planning and Systems: Elective Compulsory		
	Engineering and Management - Major in Logi	stics and Mobility: Specialisation Traffic Planning	g and Systems: Ele	ective Compulsory

Course L1184: Introduction t	o Railways
Тур	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	André Schoppe
Language	DE
Cycle	SoSe
Content	Lecture:
	The module provides a basic knowledge of the field of railroad engineering. An overview of railroad operations, control and safety technology, railroad superstructure, structural engineering, project management as well as maintenance and design of infrastructure facilities is given. The aim of this module is to give students as much insight as possible into railroad infrastructure. The module is examined by means of a written exam at the end of the semester. Lecture Hall Exercise: In order to give the students practical examples, full-day practical excursions are carried out. New handling techniques and currently available hardware will be presented by visiting the marshalling yard "die Zugbildungsanlage Maschen (ZBA)". Furthermore, the training center for track construction and civil engineering as well as the operations center in Hanover will be visited, where facilities and tasks will be presented. Questionnaires will also be provided for practice purposes. In addition, study papers can be handed out and supervised as required.
Literature	Die maßgebliche Literatur wird in StudIP veröffentlicht. Weitere Hinweise werden in der Veranstaltung gegeben.

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

Courses				
Title		Тур	Hrs/wk	СР
Nature-oriented Hydraulic Engineer	ing (L2472)	Project-/problem-based Learning	2	2
Numerical modelling of soil water d	ynamics (L2471)	Project-/problem-based Learning	2	2
Numerical modelling of soil water d	ynamics (L2470)	Lecture	2	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous Knowledge	 Basic knowledge of analysis and differential equ hydromechanical and hydraulic engineering prir 			
Educational Objectives	After taking part successfully, students have reached t	he following learning results		
Professional Competence				
-	Students are able to define the basic tasks and terms of nature-oriented hydraulic engineering und groundwater hydrology. The cam 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.			
JKIIJ	The students are able to apply the methods and approaches of nature-oriented hydraulic engineering and of groundwat hydrology to practical problems. They can demonstrate to transfer and apply these to simple hydraulic engineering systems. addition, they are able to apply the approaches commonly used in groundwater hydrology. They can exemplarily explain ar reason how to apply them as a basis for geo-hydrological questions. In addition, students can apply basic groundwater modellin methods to simple problems of groundwater movement and groundwater recharge.			
Personal Competence				
Social Competence	Students are able to help each other solving case si problems of the practical nature-based hydraulic engi in teams consisting of engineers from different subject	neering. Additionaly, they will be able to c	-	e
Autonomy	The students will be able to independently extend their	r 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 modeling			
Assignment for the	General Engineering Science (German program, 7 ser	nester): Specialisation Green Technologies	, Focus Water	r and Environment
Following Curricula	Engineering: Elective Compulsory			
-	Civil- and Environmental Engineering: Specialisation Ci	ivil Engineering: Elective Compulsory		
	Civil- and Environmental Engineering: Specialisation Tr			
	Civil- and Environmental Engineering: Specialisation W	ater and Environment: Elective Compulsor	У	

Course L2472: Nature-orient	ed Hydraulic Engineering
Тур	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	 Regime-theory and application for the development of environmental guiding priciples 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	

Course L2471: Numerical mo	urse L2471: Numerical modelling of soil water dynamics		
Тур	Project-/problem-based Learning		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Hannes Nevermann		
Language	EN		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Course L2470: Numerical mo	delling of soil water dynamics
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Milad Aminzadeh
Language	EN
Cycle	SoSe
Content	 Hydrologic water bilance 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	Todd, K. (2005): Groundwater Hydrology Fetter, C. W. (2001): Applied Hydrogeology Hölting, B. & Coldewey, W. (2005): Hydrogeologie Charbeneau, R. J. (2000): Groundwater Hydraulics and pollutant Transport

Module M1723: Buildi	ng Information Modeling				
Courses					
Title			Тур	Hrs/wk	СР
Building Information Modeling (L27	60)		Integrated Lecture	2	2
Building Information Modeling (L27	61)		Recitation Section (small)	2	4
Module Responsible	Prof. Kay Smarsly				
Admission Requirements	None				
Recommended Previous	None				
Knowledge					
Educational Objectives	After taking part successfully, students hav	e reached the followi	ng learning results		
Professional Competence					
	to present methodological knowledge to enable students to introduce, to design, to monitor, and to improve BIM processes in companies and public institutions. An in-depth understanding of the methods and technologies relevant to BIM is essential Emphasis is placed on generally valid principles and techniques independent of specific software products and valid for severa decades. The theoretical content taught in the lecture is complemented by practical exercises, in which state-of-the-art software tools will be used. Topics include computer-aided design and geometry modeling, digital modeling of buildings and infrastructure, BIM data exchange and cooperation (focusing on Industry Foundation Classes), process modeling, job descriptions and BIM applications, BIM tools, and advanced aspects. A central component of this module will be a project work.				
Skills					
Personal Competence					
Social Competence					
Autonomy					
	Independent Study Time 124, Study Time in	n Lecture 56			
Credit points					
Course achievement					
	Written elaboration				
Examination duration and scale	Description of a BIM model with 15-minute oral presentation				
	Civil and Environmental Engineering: Cree	ialication Traffic and	Mobility, Elective Compulser	,	
-	Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory				
ronowing curricula	Civil- and Environmental Engineering: Spec	-		lcon	
	Civii- and Environmental Engineering: Spec		invironment. Elective Compt	lisol y	

Course L2760: Building Infor	mation Modeling		
Тур	Integrated Lecture		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Kay Smarsly		
Language	DE		
Cycle	SoSe		
Content	 Historical development Introduction and motivation Basics of geometry 2D geometry modeling 2½D geometry modeling 3D geometry modeling Digital modeling of buildings and infrastructure, object-oriented, semantic, and parametric modeling Data exchange, interoperability, and communication (with emphasis on Industry Foundation Classes) BIM data storage and data management Process modeling Job profiles and applications BIM tools Advanced aspects of BIM Seminar by external BIM experts and project presentations 		
Literature			

Course L2761: Building Infor	ourse L2761: Building Information Modeling			
Тур	Recitation Section (small)			
Hrs/wk	2			
СР	4			
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28			
Lecturer	Prof. Kay Smarsly			
Language	DE			
Cycle	SoSe			
Content	See interlocking course			
Literature	See interlocking course			

Module M1630: Sanita	ary Engineering II			
Courses				
Title		Тур	Hrs/wk	СР
Management of Wastewater Infrast	ructure (L2467)	Seminar	2	3
Drinking Water Treatment (L2466)		Seminar	2	3
Module Responsible	Prof. Mathias Ernst			
Admission Requirements	None			
Recommended Previous	Basic knowledge in the field of drinking water suppl	y and waste water disposal.		
Knowledge				
Educational Objectives	After taking part successfully, students have reache	ed the following learning results		
Professional Competence				
Personal Competence Social Competence	The students can examplify their expert knowledge on drinking water, waste water treatment and the associated infrastructure systems. They are capable of reproducing the relevant empiricals 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. 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 filed 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. The students are able to develop a specific topic in a team and to work out milestones according to a given plan. 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				
Course achievement				
Examination	Subject theoretical and practical work			
Examination duration and	Written-theoretical part and modelling			
scale				
Assignment for the	General Engineering Science (German program, 7 semester): Specialisation Green Technologies, Focus Water and Environmental			
Following Curricula	Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specialisation	Water and Environment: Compulsory	,	
	Civil- and Environmental Engineering: Specialisation	Civil Engineering: Elective Compulso	ry	
	Civil- and Environmental Engineering: Specialisation	Traffic and Mobility: Elective Comput	sory	
	Green Technologies: Energy, Water, Climate: Specia	alisation Water Technologies: Elective	Compulsory	

Course L2467: Management	of Wastewater Infrastructure			
Тур	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	The seminar ""Infrastructure Management Wastewater"" develops the understanding of infrastructure systems in relation to wastewater systems, but also addresses other infrastructure systems.			
	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.			
	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.			
Literature	Gujer, W. (2007): Siedlungswasserwirtschaft, Springer, Berlin Heidelberg			
	Metcalf and Eddy (2003): Wastewater Engineering : Treatment and Reuse, Boston, McGraw-Hill			
	Henze, M. (1997): Wastewater Treatment : Biological and Chemical Processes, Berlin, Springer			
	Stein D., Stein R. (2014): Instandhaltung von Kanalisationen, Verlag Prof. DrIng. Stein & Partner GmbH			
	Wossog, G. (2016): Handbuch für den Rohrleitungsbau Band 1 und 2			
	Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall (2009): Abwasserableitung : Bemessungsgrundlagen, Regenwasserbewirtschaftung, Fremdwasser, Netzsanierung, Grundstücksentwässerung, Weimar, UnivVerl.			
	DWA Arbeitsblätter			

ourse L2466: Drinking Water Treatment				
Тур	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: Mobi	lity Concepts				
Courses					
Title		Тур	Hrs/wk	СР	
Mobility Research and Transportat	ion Projects (L1181)	Project-/problem-based Learning	3	3	
Mobility in Megacities and Develop	ing Countries (L1182)	Seminar	3	3	
Module Responsible	Dr. Philine Gaffron				
Admission Requirements	None				
Recommended Previous	Module Transportation Planning and Traffic Engineering				
Knowledge					
	After taking part successfully, students have reached the follo	wing learning results			
Professional Competence					
Knowledge	Students are able to:				
	 name the different urban transport systems existing ar 	ound the world.			
	• explain the transport challenges in Asian and African m	ega cities.			
	recognise and relate interactions between transport sy	stems on the one hand and ecolo	gical, socio-cult	tural and economic	
	problem areas on the other.				
	 outline specific issues and problems in urban developm 	ent and transport (in Germany and	developing cou	untries).	
	explain the effects of external framework factors (like effects)	nergy costs) on transport.			
Skills	Students are able to:				
	 analyse and evaluate given case studies. 				
	 transfer learning results to other regions and cities. 				
	analyse specific issues and problems in urban developm aritically assess actors planning chiestives planned p			ianto in the light o	
	 critically assess actors, planning objectives, planned measures and the implementation of transport projects in the light the UN Millegring Development Caster. 				
	the UN Millennium Development Goals • develop and present sustainable (i.e. ecological, pove	arty oriented gender balanced an	d oconomical)	colutions for urbar	
	personal and goods transport	arty offented, gender balanced an			
Personal Competence					
	Students are able to:				
	 present and explain independently generated findings. 				
	constructively discuss potentially controversial topics in	a group context.			
Autonomi	Students are able to				
Autonomy	Students are able to:				
	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					
Course achievement					
course acmeveillent	Yes None Participation in excursions				
Examination	Written elaboration				
Examination duration and	All assignments in groups (2-4 students): written report, 2000	words (incl. 2 short presentations	of 10 mins.); fir	al presentation, 2	
scale			••		
Assignment for the					
Following Curricula					
-	Civil- and Environmental Engineering: Specialisation Water an		y		
	Logistics and Mobility: Specialisation Traffic Planning and Syst	ems: Compulsory			
	Engineering and Management - Major in Logistics and Mobility	: Specialisation Traffic Planning an	d Systems: Con	npulsory	

Course L1181: Mobility Research and Transportation Projects				
Тур	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	This course places its focus on transport and mobility in Germany. It deals with questions such as:			
	 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? 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: 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 Me	ourse L1182: Mobility in Megacities and Developing Countries				
Тур	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	The course provides and 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. The following examples could be suitable case studies: Singapore (Metro), Lagos (BRT Light), Guanghzou, Bogota, Jakarta (Full BRT), Sao Paulo, Medellin (Cable Car Systems), Johannesburg (Minibus-Taxi). 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).				
Literature					

Module M0755: Geote						
module morss. Geole	chnics II					
Courses						
Title				Тур	Hrs/wk	СР
Foundation Engineering (L0552)				Lecture	2	2
Foundation Engineering (L0553)				Recitation Section (large)	2	2
Foundation Engineering (L1494)				Recitation Section (small)	2	2
Module Responsible	Prof. Jürgen Grabe					
Admission Requirements	None					
Recommended Previous	Modules:					
Knowledge						
	 Mechanics I-II 					
	 Geotechnics I 					
Educational Objectives	After taking part succe	ssfully, students	have reached the for	ollowing learning results		
Professional Competence						
Knowledge	The students know the basic principles and methods which are required to verificate the stability of geotechnical structures.					
Skills	After successful completion of the module the students are able to:					
	 verificate the stability and usability of foundations, 					
		-	-			
		-	nd improvement an	d apply them in their range of app	olication,	
	design retaining walls.					
Personal Competence						
Social Competence						
Autonomy						
Workload in Hours	Independent Study Tim	ne 96, Study Tim	e in Lecture 84			
Credit points	6					
Course achievement	Compulsory Bonus	Form	Descripti	on		
	No 20 %	Attestation				
Examination	Written exam					
Examination duration and	90 minutes					
scale						
Assignment for the	General Engineering So	cience (German)	program, 7 semeste	r): Specialisation Civil Engineering	g: Elective Compu	sory
Following Curricula				ngineering: Compulsory		
-	Civil- and Environment	al Engineering: S	Specialisation Traffic	and Mobility: Elective Compulsor	У	
				and Environment: Elective Comp		
		5	,		,	

Course L0552: Foundation E	ourse L0552: Foundation Engineering				
Тур	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	 Shallow foundations Pile foundations Ground improvement Retaining walls Underpinning Groundwater Conservation Cut-off Walls 				
Literature	 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 E	ourse L0553: Foundation Engineering	
Тур	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	
Тур	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

Courses				
Title	Тур)	Hrs/wk	СР
Circular flow economy and structural recycling (L2464)		ect-/problem-based Learning	3	3
Sustainable Building (L2463)	Ser	ninar	3	3
Module Responsible	NN			
Admission Requirements	None			
Recommended Previous	Basic knowledge of building materials, building chemistry, building co	onstruction and building proj	ect managem	nent
Knowledge				
Educational Objectives	After taking part successfully, students have reached the following le	arning results		
Professional Competence				
Knowledge	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.			
Skills	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 o 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.			
Personal Competence				
Social Competence	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.			
Autonomy	Students can coordinate their individual work performance with the other members of the group and prepare for it efficiently by use of scientific media.			
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	Written-theoretical part and project work			
scale				
Assignment for the	Civil- and Environmental Engineering: Specialisation Water and Enviro	onment: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisation Traffic and Mobil			
-	Civil- and Environmental Engineering: Specialisation Civil Engineering			
	Integrated Building Technology: Core Qualification: Compulsory			

Course L2464: Circular flow economy and structural recycling		
Тур	Project-/problem-based Learning	
Hrs/wk	3	
СР	3	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	
Lecturer	NN	
Language	DE	
Cycle	SoSe	
Content	 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 B	uilding
Тур	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	 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	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)

Engineering				
Module M1715: Rene	wable Energies			
Courses				
Title		Тур	Hrs/wk	СР
Renewable Energies I (L2740)		Lecture	2	2
Renewable Energies I (L2742)		Recitation Section	(large) 1	1
Renewable Energies II (L2741)		Lecture	2	2
Renewable Energies II (L2743)		Recitation Section	(large) 1	1
Module Responsible	Prof. Martin Kaltschmitt			
Admission Requirements	None			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have	ve reached the following learning results		
Professional Competence				
Knowledge	Upon completion of this module, students	will be able to provide an overview of ch	aracteristics of renewable	e energy systems. The
	will be able to explain the issues that aris	e in these systems. Furthermore, they a	are able to explain knowle	edge of energy supply
	energy distribution and energy trading in			
	can explain this knowledge in detail for s	-		
	environmental impact of using renewable			
	options.	energy systems and have an overview	or the continue classifie	ation of the respectiv
	options.			
Skills	Students are able to apply methodologies	for determining energy demand or energy	gy supply to different type	es of renewable energ
	systems. Furthermore, they can evaluate	such energy systems technically, ecolog	gically and economically ;	as well as systemically
	and also design them under certain given			
	manner, especially by means of non-stand		· j · · · · · · · · · · · · · · · · · ·	
	Students are able to orally explain issues	from the subject area and approaches t	o dealing with them and	to classify them in the
	respective context.			
Personal Competence				
Social Competence	Students are able to investigate suitable	technical alternatives and ultimately ev	valuate them based on te	chnical economic an
Social Competence			aluate them based on te	
	ecological criteria - and thus from a sustain	lability perspective.		
Autonomy	Students will be able to independently acc	ess sources about the field, acquire know	vledge and transform it to	address new issues.
	Independent Study Time 96, Study Time in	Lecture 84		
Credit points Course achievement				
	Written exam			
Examination duration and				
scale	30 11111			
Assignment for the	General Engineering Science (German prog	aram, 7 semester): Specialisation Green	Technologies: Compulsor	v
Following Curricula	General Engineering Science (German pro			
	Civil- and Environmental Engineering: Spec		5 1 .	
	Civil- and Environmental Engineering: Spec			
	Civil- and Environmental Engineering: Spec			
	Chemical and Bioprocess Engineering: Spe		lisory	
	Green Technologies: Energy, Water, Clima			
	Process Engineering: Core Qualification: Co	ompulsory		

Course L2740: Renewable Energies I		
Тур	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	
	This module includes a presentation of the renewable energy supply and a discussion of the respective technologies for providing the desired final or useful energy. Specifically, this includes the options for solar energy use for heat and power generation (i.e., passive solar energy use, solar collectors for low-temperature heat provision, solar thermal power generation, photovoltaic power generation), wind energy use for power generation (i.e. onshore and offshore wind power use), hydroelectric power use for electricity generation (i.e., run-of-river and storage hydroelectric power), ocean energy use for electricity generation (including tidal power plants), and geothermal energy use for heat and electricity generation (i.e., near-surface use by means of heat pumps, deep geothermal energy use for heat and/or electricity generation).	
Literature	Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2020, 6. Auflage	

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Course L2742: Renewable Energies I		
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Martin Kaltschmitt	
Language	DE	
Cycle	SoSe	
Content	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. Possible tasks in the field of renewable energies are: Solar thermal heat Concentrating solare power Photovoltaic Windenergie Hydropower Heat pump Deep geothermal energy	
Literature	Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2020, 6. Auflage	

Course L2741: Renewable Energies II		
	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	
	This lecture covers all options for energy supply from biomass; this includes the supply of heat, electricity and fuels. The biomass resource and its origin will be discussed first. Afterwards the biomass supply is addressed, which bridges the gap between biomass generation and utilization. Subsequently, the different conversion options are discussed. Only those options are presented in depth that have a corresponding significance on the market in Germany and Europe. This includes (a) heat generation from biogenic solid fuels in small and large-scale plants (b) power generation from solid biomass via combustion (c) a biogas production from residues, by-products and waste, (d) alcohol production from sugar and starch (e) biodiesel production from vegetable oils. Special attention is also paid to the corresponding environmental aspects. An economic classification of the various options is also provided.	
Literature	Unterlagen der Vorlesung	

Course L2743: Renewable Energies II		
	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Martin Kaltschmitt	
Language	DE	
Cycle	SoSe	
Content	The students work on tasks in the field of renewable energies the field "energy from biomass". They present their solution approaches in the exercise group and discuss them with their fellow students and the teaching staff afterwards.	
Literature	Unterlagen der Vorlesung	

Module M0631: Reinforced Concrete Structures II				
Courses				
Title Project Concrete Structures II (L089 Concrete Structures II (L0348) Concrete Structures II (L0349)	94)	Typ Project Seminar Lecture Recitation Section (large)	Hrs/wk 1 2 2	CP 1 3 2
Module Responsible	Prof. Günter Rombach		_	_
Admission Requirements	None			
Recommended Previous Knowledge	 Knowledge of loads on structures and combination of Basics of safety format are required. Knowledge in design of beams and columns for ultin Modules: Reinforced Concrete Structures I, Structures 	nate limit state		
Educational Objectives	After taking part successfully, students have reached the	ollowing learning results		
Professional Competence Knowledge Skills	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.			
	 serviceability limit state (crack and deflection contr The students can estimate the member forces of sir The students know the content and the layout of a student know the content and the layout of a student know the content and the layout of a student know the content and the layout of a student know the content and the layout of a student know the content know the c	nple slabs.	nu links etc.).	
Personal Competence Social Competence Autonomy	Cooperation in a project work, where they design in a tear Students are able to design simple reinforced concrete st		ent the results at	the end.
Autonomy	statents are able to acsign simple remorced concrete st	actures and evaluate the results.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70			
Credit points Course achievement	6 Compulsory Bonus Form Descript No None Excercises	ion		
Examination	Written exam			
Examination duration and	120 minutes			
scale				
Assignment for the	General Engineering Science (German program, 7 semeste		Elective Compul	sory
Following Curricula	Civil- and Environmental Engineering: Specialisation Traffi	c and Mobility: Elective Compulsory		
	Civil- and Environmental Engineering: Specialisation Water	r and Environment: Elective Compul	Isory	

Course L0894: Project Concrete Structures II	
Тур	Project Seminar
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	Design of a truss structure
Literature	Skript zur Lehrveranstaltung "Stahlbetonbau II"

Course L0348: Concrete Stru		
Тур	Lecture	
Hrs/wk	2	
СР	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Günter Rombach	
Language	DE	
Cycle	WiSe	
Content	 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	 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 KH.: 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 Stru	ourse L0349: Concrete Structures II		
Тур	Recitation Section (large)		
Hrs/wk	2		
СР	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		

Courses				
Title		Тур	Hrs/wk	СР
Transport Planning and Traffic Engi	neering (L0997)	Project-/problem-based Learning	4	6
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	Students are able to			
	 understand the facts, contexts and objectives of tra 	unsport planning		
	 correctly apply definitions and concepts of transport 			
	 reproduce basic concepts of transport modelling. 	e planning.		
	 explain the fundamentals of traffic engineering and 	transport infrastructure construction.		
Skills	Students are able to			
	 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				
Social Competence	Students are able to			
	get together in groups and constructively discuss a	nd analyse set problems.		
	 in a group agree on solutions and document them. 			
A	Charlente en oble te			
Autonomy	Students are able to			
	 produce reports on group work. 			
	 structure the tasks and timing for working out a set 	t problem.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Course achievement	Compulsory Bonus Form Descrip	tion		
course acmevement	No 5% Excercises			
Examination	Subject theoretical and practical work			
Examination duration and	Project report in four work packages, in small groups, dur	ng the semester		
scale				
Assignment for the	Civil- and Environmental Engineering: Specialisation Traff	c and Mobility: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisation Wate	r and Environment: Compulsory		
	Civil- and Environmental Engineering: Specialisation Civil	Engineering: Elective Compulsory		
	Engineering and Management - Major in Logistics and Mol	ility: Core Qualification: Compulsory		

Course L0997: Transport Pla	nning and Traffic Engineering
Тур	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	 The course provides an introductory overview over the fundamentals of urban and regional transport planning, including the subtopic traffic engineering. The following subject areas are covered: 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	 Bosserhoff, Dietmar (2000) Integration von Verkehrsplanung und räumlicher Planung. Schriftenreihe der Hessischen Straßen- und Verkehrsverwaltung, Heft 42. Hessisches Landesamt für Straßen- und Verkehrswesen. Wiesbaden. Lohse, Dieter; Schnabel, Werner (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung: Band 1; Straßenverkehrstechnik. Beuth Verlag. Berlin. Forschungsgesellschaft für Straßen- und Verkehrswesen (2006) Richtlinien für die Anlage von Stadtstraßen - RASt 06. FGSV-Verlag. Köln (FGSV, 200). Vallée, Dirk; Engel, Barbara; Vogt, Walter (2021) Stadtverkehrsplanung Band 3, Springer Verlag. Berlin.

	dations of Management			
Courses				
itle		Тур	Hrs/wk	СР
lanagement Tutorial (L0882)		Recitation Section (small)	2	3
ntroduction to Management (L088))	Lecture	3	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous	Basic Knowledge of Mathematics and Business			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence		5 5		
•	After taking this module, students know the important ba	sics of many different areas in Busi	ness and Manage	ment, from Planr
	and Organisation to Marketing and Innovation, and also to			
		····		
	 explain the differences between Economics and 	Management and the sub-discip	lines in Manage	ment and to na
	important definitions from the field of Management			
	 explain the most important aspects of and goals 	n Management and name the mos	t important aspe	cts of entreprneu
	projects			
	 describe and explain basic business functions a 	s production, procurement and s	ourcing, supply	chain managem
	organization and human ressource management, in	formation management, innovation	management an	d marketing
	 explain the relevance of planning and decision 	making in Business, esp. in situa	tions under mul	tiple objectives
	uncertainty, and explain some basic methods from	mathematical Finance		
	 state basics from accounting and costing and selection 	ted controlling methods.		
Skills	Students are able to analyse business units with respect		ojectives, strategi	es etc.) and to ca
	out an Entrepreneurship project in a team. In particular, t	ney are able to		
	 analyse Management goals and structure them appression 	ropriately		
	 analyse organisational and staff structures of comp 			
	 apply methods for decision making under multiple 		nder risk	
	 analyse production and procurement systems and 			
	 analyse and apply basic methods of marketing 			
	 select and apply basic methods from mathematica 	finance to predefined problems		
	 apply basic methods from accounting, costing and 			
	• apply basic methods from decounting, costing and	controlling to predefined problems		
Personal Competence				
Social Competence	Students are able to			
	 work successfully in a team of students 			
	 to apply their knowledge from the lecture to an ent 	repreneurship project and write a co	pherent report on	the project
	 to communicate appropriately and 			
	 to cooperate respectfully with their fellow students 			
Autonomy	Students are able to			
	 work in a team and to organize the team themselve 	S		
	 to write a report on their project. 			
Weather div the own	la de ser deut Chada Time 110. Chada Time in Lestare 70			
	Independent Study Time 110, Study Time in Lecture 70			
Credit points				
Course achievement				
	Subject theoretical and practical work			
	several written exams during the semester			
Examination duration and				
Examination duration and scale				
scale	General Engineering Science (German program, 7 semest	er): Core Qualification: Compulsory		
scale	General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Specialisation Civil			
scale Assignment for the		Engineering: Elective Compulsory	sory	
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil	Engineering: Elective Compulsory r and Environment: Elective Compu	-	
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate	Engineering: Elective Compulsory r and Environment: Elective Compu	-	
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff	Engineering: Elective Compulsory r and Environment: Elective Compu c and Mobility: Elective Compulsory	-	
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory	Engineering: Elective Compulsory r and Environment: Elective Compu c and Mobility: Elective Compulsory ngineering: Elective Compulsory	·	
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I	Engineering: Elective Compulsory r and Environment: Elective Compu c and Mobility: Elective Compulsory ngineering: Elective Compulsory	·	
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Chemical Computer Science: Core Qualification: Compulsory	Engineering: Elective Compulsory r and Environment: Elective Compu c and Mobility: Elective Compulsory ngineering: Elective Compulsory	·	
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Cher Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory	Engineering: Elective Compulsory r and Environment: Elective Compu c and Mobility: Elective Compulsory ngineering: Elective Compulsory	·	
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Cher Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory	Engineering: Elective Compulsory r and Environment: Elective Compu c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls	ory	
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Cher Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation	Engineering: Elective Compulsory r and Environment: Elective Compu c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls n Biotechnologies: Elective Compuls	ory	
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Chemical and Bioprocess Engineering: Specialisation Chemical Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation	Engineering: Elective Compulsory r and Environment: Elective Compulsory c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls n Biotechnologies: Elective Compuls n Energy Systems / Renewable Ene	ory sory rgies: Elective Co	mpulsory
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Chemical and Bioprocess Engineering: Specialisation Chemical Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation Green Technologies: Energy, Water, Climate: Specialisation	Engineering: Elective Compulsory r and Environment: Elective Compulsory c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls n Biotechnologies: Elective Compuls n Energy Systems / Renewable Ene n Energy Technology: Elective Com	ory sory rgies: Elective Co pulsory	mpulsory
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Cher Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation Green Technologies: Energy, Water, Climate: Specialisation Green Technologies: Energy, Water, Climate: Specialisation	Engineering: Elective Compulsory r and Environment: Elective Compulsory c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls n Biotechnologies: Elective Compuls n Energy Systems / Renewable Ene n Energy Technology: Elective Com n Maritime Technologies: Elective C	ory sory rgies: Elective Co pulsory ompulsory	mpulsory
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Chemical and Bioprocess Engineering: Specialisation Chemical Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation Green Technologies: Energy, Water, Climate: Specialisation	Engineering: Elective Compulsory r and Environment: Elective Compulsory c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls n Biotechnologies: Elective Compuls n Energy Systems / Renewable Ene n Energy Technology: Elective Com n Maritime Technologies: Elective C	ory sory rgies: Elective Co pulsory ompulsory	mpulsory
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Cher Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation Green Technologies: Energy, Water, Climate: Specialisation Green Technologies: Energy, Water, Climate: Specialisation	Engineering: Elective Compulsory r and Environment: Elective Compulsory c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls n Biotechnologies: Elective Compuls n Energy Systems / Renewable Ene n Energy Technology: Elective Com n Maritime Technologies: Elective Con n Water Technologies: Elective Com	ory sory rgies: Elective Co pulsory ompulsory	mpulsory
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Cher Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation Green Technologies: Energy, Water, Climate: Specialisation	Engineering: Elective Compulsory r and Environment: Elective Compulsory c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls n Biotechnologies: Elective Compuls n Energy Systems / Renewable Ene n Energy Technology: Elective Com n Maritime Technologies: Elective Com n Water Technologies: Elective Com pulsory	ory sory rgies: Elective Co pulsory ompulsory	mpulsory
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Bio I Chemical and Bioprocess Engineering: Specialisation Cher Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation Green Technologie	Engineering: Elective Compulsory r and Environment: Elective Compulsory c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls n Biotechnologies: Elective Compuls n Energy Systems / Renewable Ene n Energy Technology: Elective Com n Maritime Technologies: Elective Com n Water Technologies: Elective Com pulsory	ory sory rgies: Elective Co pulsory ompulsory	mpulsory
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Dio I Chemical and Bioprocess Engineering: Specialisation Cher Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation Green Technologie	Engineering: Elective Compulsory r and Environment: Elective Compulsory c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls n Biotechnologies: Elective Compuls n Energy Systems / Renewable Ene n Energy Technology: Elective Com n Maritime Technologies: Elective Com n Water Technologies: Elective Com pulsory	ory sory rgies: Elective Co pulsory ompulsory	mpulsory
scale Assignment for the	Civil- and Environmental Engineering: Specialisation Civil Civil- and Environmental Engineering: Specialisation Wate Civil- and Environmental Engineering: Specialisation Traff Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Specialisation Die I Chemical and Bioprocess Engineering: Specialisation Cher Computer Science: Core Qualification: Compulsory Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Specialisation Green Technologies: Energy, Water, Climate: Specialisation Computer Science in Engineering: Core Qualification: Comp Integrated Building Technology: Core Qualification: Comp Logistics and Mobility: Core Qualification: Compulsory	Engineering: Elective Compulsory r and Environment: Elective Compulsory c and Mobility: Elective Compulsory ingineering: Elective Compulsory nical Engineering: Elective Compuls n Biotechnologies: Elective Compuls n Energy Systems / Renewable Ene n Energy Technology: Elective Com n Maritime Technologies: Elective Com pulsory ulsory	ory sory rgies: Elective Co pulsory ompulsory	mpulsory

Mechatronics: Specialisation Electrical Systems: Compulsory	
Mechatronics: Specialisation Dynamic Systems and AI: Compulsory	
Mechatronics: Core Qualification: Compulsory	
Mechatronics: Specialisation Robot- and Machine-Systems: Compulsory	
Mechatronics: Specialisation Medical Engineering: Compulsory	
Orientation Studies: Core Qualification: Elective Compulsory	
Orientation Studies: Core Qualification: Elective Compulsory	
Naval Architecture: Core Qualification: Compulsory	
Technomathematics: Core Qualification: Compulsory	
Process Engineering: Core Qualification: Compulsory	
Engineering and Management - Major in Logistics and Mobility: Core Qualification: Compulsory	

Course L08	382: Management Tutorial
Тур	Recitation Section (small)
Hrs/wk	2
СР	3
Workload	Independent Study Time 62, Study Time in Lecture 28
in Hours	
Lecturer	Prof. Christoph Ihl, Katharina Roedelius
Language	DE
Cycle	WiSe/SoSe
Content	In the management tutorial, the contents of the lecture will be deepened by practical examples and the application of the discussed tools.
	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 se 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 busin knowledge from the lecture should come to practical use. The group projects are guided by a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.

Course L0880: Introduction t	to Management
Тур	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	
	Prof. Thomas Wrona, Prof. Thorsten Blecker, Prof. Wolfgang Kersten
Language	DE
Cycle	WiSe/SoSe
Content	 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 Tacks, 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	 Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008 Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003 Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006. Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001. Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008. Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl. Stuttgart 2005. Weber, J., Schäffer, U.: Einführung in das Controlling, 12. Auflage, Stuttgart 2008. Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Courses					
Title			Тур	Hrs/wk	СР
Databases (L2758)			Integrated Lecture	1	1
Databases (L2759)			Recitation Section (sm	all) 1	1
Object-oriented Modelling (L2468)			Integrated Lecture	2	2
Object-oriented Modelling (L2469)			Recitation Section (sm	all) 2	2
Module Responsible	Prof. Kay Smarsly				
Admission Requirements	None				
Recommended Previous	Students can descri	ibe and analyze existing	software programs in the discipline b	based on their essentia	al characteristics. The
Knowledge	students are able to	reproduce the elementa	ry basics and theoretical concepts of eng	ineering informatics ar	id to apply elementa
	solution algorithms t	to engineering problems.	They are also able to define database pr	inciples and make simp	ole queries to commo
	database systems.				
Educational Objectives	After taking part suc	cessfully students have	reached the following learning results		
Professional Competence	, incer taking part bac	seconding, seadents have			
•	Eurodomontols of (i)	abject arianted modeling	and (ii) database design will be present	od. The students will b	a able to develop ar
Knowledge					
	-	-	ms required in the area of civil and envir		•
			engineering informatics programming m		
	functions, and proc	functions, and procedures, UML notation (such as association, aggregation and composition), control structures, exceptior			
	handling, data strea	ams, inheritance, abstra	ct classes and interfaces, data structur	es (e.g. associative m	emory with particu
	emphasis on hash ta	ables and tree structures), algorithms and generic programming.	Part (ii) follows the dat	tabase design proce
	and primarily cover	rs conceptual design an	I semantics of database models (with	emphasis on the Entit	y-Relationship Mode
	logical design (inclu	iding integrity constrain	s, anomalies and normalization), relatio	nal algebra, relational	query languages a
			gn and implementation, concepts of data		
		and data exchange in civ			-p
	us data integration e	and data exchange in eiv	rengineering.		
Skills					
<i>Skills</i> Personal Competence					
Personal Competence					
Personal Competence Social Competence	Independent Study 1	Time 96, Study Time in L	cture 84		
Personal Competence Social Competence Autonomy		Time 96, Study Time in L	ecture 84		
Personal Competence Social Competence Autonomy Workload in Hours	6 Compulsory Bonus	Form	Description		
Personal Competence Social Competence Autonomy Workload in Hours Credit points	6			schriftlicher Beleg a	ngefertigt. Der Bel
Personal Competence Social Competence Autonomy Workload in Hours Credit points	6 Compulsory Bonus	Form	Description	-	
Personal Competence Social Competence Autonomy Workload in Hours Credit points	6 Compulsory Bonus	Form	Description Als Prüfungsvorleistung wird ein	en Lehrinhalte und	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement	6 Compulsory Bonus	Form	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt	en Lehrinhalte und	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement	6 Compulsory Bonus Yes 15 % Written exam	Form	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt	en Lehrinhalte und	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination	6 Compulsory Bonus Yes 15 % Written exam	Form	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt	en Lehrinhalte und	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination duration and scale	6 Compulsory Bonus Yes 15 % Written exam 180 min	Form Written elaboration	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt Studierenden auf die Klausur vorzu	en Lehrinhalte und	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	6 Compulsory Bonus Yes 15 % Written exam 180 min Civil- and Environme	Form Written elaboration	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt Studierenden auf die Klausur vorzu ualification: Compulsory	en Lehrinhalte und ubereiten.	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination duration and scale	6 Compulsory Bonus Yes 15 % Written exam 180 min Civil- and Environme Civil- and Environme	Form Written elaboration ental Engineering: Core C ental Engineering: Specia	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt Studierenden auf die Klausur vorzu	len Lehrinhalte und ubereiten.	

Course L2758: Databases	
Тур	Integrated Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Kay Smarsly
Language	DE
Cycle	WiSe
Content	 Motivation and basic concepts Terminology and definitions Database design process Conceptual design Semantics of database models The Entity-Relationship Model Relationships in the ER model Other concepts in the ER model Conceptual modeling with UML Logical design The relational model Integrity constraints Anomalies and normalization ER mapping to the relational model Relational query languages Schema definition and modification SQL as a relational query language Modification options in SQL Database views Physical database design and implementation Concepts of database application development JDBC Data integration and data exchange in civil engineering
Literature	
Course L2759: Databases	

Course L2759: Databases	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Kay Smarsly
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

-	ed Modelling
	Integrated Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kay Smarsly
Language	DE
Cycle	WiSe
Content	 Fundamentals of engineering informatics Programming languages and programming paradigms Programming methodology Objects and classes Constructors Packages and imports Visibility and validity Methods, functions, and procedures Variables and constants UML notation Control structures Expressions and statements Recursion Exception handling Inputs and outputs Data streams Association, aggregation and composition Inheritance Abstract classes and methods Interfaces
	 Data structures and algorithms (e.g. arrays) Generic programming
	Lists, queues, and sets
	 Associative memory (particular emphasis on hash tables and tree structures)
	Further notes on algorithms
Literature	

Course L2469: Object-oriented Modelling		
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Kay Smarsly	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Module M0985: Introd	auction to Rallways				
Courses					
		T	U.s. toda	<u></u>	
Title Introduction to Railways (L1184)		Typ Lecture	Hrs/wk 2	CP 4	
Introduction to Railways (L1184)		Recitation Section (large)	1	2	
Module Responsible	Prof. Carsten Gertz				
	None				
Recommended Previous	none				
Knowledge					
Educational Objectives	After taking part successfully, students have	reached the following learning results			
Professional Competence					
Knowledge	Students can				
	 give definitions for basis terms relates 	to rollwove			
	 give definitions for basic terms related to railways explain specifics concerning the handling of goods on railways 				
	 explain specifics concerning the nature explain the required infrastructure 	ing of goods off fallways			
	 describe the work at the track super si 	tructuro			
	• describe the work at the track super s				
Skills					
Personal Competence					
Social Competence	Students can				
	 work at tasks in groups and come to re 	esults together			
	 discuss contents in groups, summarize them and present them in front of others 				
	 convey contents to other by processin 				
Autonomy	Students can work out and understand conto	nts themselves during the lecture through litera	turo rocoarch		
	Independent Study Time 138, Study Time in				
Credit points					
Course achievement					
Examination					
Examination duration and	90 min				
scale					
Assignment for the	Civil- and Environmental Engineering: Specia	lisation Traffic and Mobility: Compulsory			
Following Curricula	Civil- and Environmental Engineering: Specia	lisation Civil Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specia	lisation Water and Environment: Elective Comp	ulsory		
	Logistics and Mobility: Specialisation Traffic F	Planning and Systems: Elective Compulsory			
	Engineering and Management - Major in Logi	stics and Mobility: Specialisation Traffic Planning	g and Systems: Ele	ective Compulsory	

Course L1184: Introduction to Railways		
Тур	Lecture	
Hrs/wk	2	
CP	4	
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28	
Lecturer	André Schoppe	
Language	DE	
Cycle	SoSe	
Content	Lecture:	
	The module provides a basic knowledge of the field of railroad engineering. An overview of railroad operations, control and safety technology, railroad superstructure, structural engineering, project management as well as maintenance and design of infrastructure facilities is given. The aim of this module is to give students as much insight as possible into railroad infrastructure. The module is examined by means of a written exam at the end of the semester. Lecture Hall Exercise: In order to give the students practical examples, full-day practical excursions are carried out. New handling techniques and currently available hardware will be presented by visiting the marshalling yard "die Zugbildungsanlage Maschen (ZBA)". Furthermore, the training center for track construction and civil engineering as well as the operations center in Hanover will be visited, where facilities and tasks will be presented. Questionnaires will also be provided for practice purposes. In addition, study papers can be handed out and supervised as required.	
Literature	Die maßgebliche Literatur wird in StudIP veröffentlicht. Weitere Hinweise werden in der Veranstaltung gegeben.	

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

Module M1629: Geoir	nformation Science			
Courses				
Title		Тур	Hrs/wk	СР
Introduction to Geoinformation Sci	ence (L2465)	Project-/problem-based Learning	3	3
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
Recommended Previous	Principles of analysis and linear algebra			
Knowledge				
Educational Objectives	After taking part successfully, students have	ve reached the following learning results		
Professional Competence				
Knowledge	The students are able to define the tasks	and terms from the field of application of geo inform	ation systems.	. They can report t
	basics, the basic approaches and methods	s of geo information systems and are able to transfer t	hese to practi	cal questions.
Skille	Students are able to apply the basis moth	ode used in goe information systems to practical prol	Nome Thoy ar	a able to apply the
SKIIIS	Skills Students are able to apply the basic methods used in geo-information systems to practical problems. They are able to ap to simple applications of geographic information systems and to transfer them to other problems. The students can simple GIS project and present their results.			
	simple dis project and present their result			
Personal Competence				
Social Competence	The students can work together groups co	operatively and productively.		
Autonomy	Students are able to organize their work	k flow to prepare themselves before presentations	and discussio	n They can acqui
Autonomy	appropriate knowledge by making enquirie		0110 013003310	in. They can acqui
	appropriate knowledge by making enquine	is independently.		
Workload in Hours	Independent Study Time 48, Study Time in	n Lecture 42		
Credit points	3			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and	Computer aided GIS-Application and writte	en-theoretical part		
scale				
Assignment for the	General Engineering Science (German prog	gram, 7 semester): Specialisation Civil Engineering: C	ompulsory	
Following Curricula	Civil- and Environmental Engineering: Spec	cialisation Traffic and Mobility: Compulsory		
	Civil- and Environmental Engineering: Spec	cialisation Water and Environment: Compulsory		

Course L2465: Introduction t	o Geoinformation Science
Тур	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	 Theoretical basics of Geo-Information-Systems Data models, geographical coordinates, geo-referencing, map-views Data mining and -analyses of geo-data Analysis techniques
Literature	

Engineering					
Module M0612: Steel	Structures II				
Courses					
Title		Тур	Hrs/wk	СР	
Steel Structures II (L0301)		Lecture	2	3	
Steel Structures II (L0302)		Recitation Section (large)	2	3	
Module Responsible					
Admission Requirements					
Recommended Previous	Steel Structures I				
Knowledge					
Educational Objectives	After taking part successfully, students have r	eached the following learning results			
Professional Competence					
Knowledge	After successful completition students can				
	 describe and explain the behaviour of b 	olted and welded connections			
	 design and check simple halls and build 				
	 calculate forces and stresses of simple structures (trusses, beams, frames) 				
	illustrate and dimension he main details	(framework, column base, load application)	points)		
Chille	Chudente eve eble te design simple structures	and connections, describe the load distribution	on and recognize t	ha naasihla madaa	
SKIIIS	Students are able to design simple structures failure. They can apply structural imperfection		-	•	
	Tallure. They can apply structural imperiection	s, calculate according to 2nd order theory an	a verify their result	.5.	
Personal Competence					
Social Competence					
Autonomy					
Workload in Hours	Independent Study Time 124, Study Time in L	ecture 56			
Credit points	6				
Course achievement	None				
Examination	Written exam				
Examination duration and	120 minutes				
scale					
Assignment for the	General Engineering Science (German program	n, 7 semester): Specialisation Civil Engineeri	ng: Elective Compu	lsory	
Following Curricula	Civil- and Environmental Engineering: Speciali	sation Civil Engineering: Compulsory			
	Civil- and Environmental Engineering: Speciali	sation Traffic and Mobility: Elective Compulso	ory		
	Civil- and Environmental Engineering: Speciali	sation Water and Environment: Elective Com	pulsory		

Course L0301: Steel Structur	res II
Тур	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	 Welded connections Simple constructions 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 Band 1 Tragwerksplanung, Grundlagen Band 2 Verbindungen und Konstruktionen

Course L0302: Steel Structur	Course L0302: Steel Structures II		
Тур	Recitation Section (large)		
Hrs/wk	2		
СР	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: Plann	ing Law and Environmenta	I Law/ Sustainable Urban Deve	lopment	
Courses				
Title		Тур	Hrs/wk	СР
Sustainable Urban Development (L	2474)	Lecture	2	3
Planning law and Environmental law	N (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				
Knowledge				
Skills				
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Tir	ne in Lecture 56		
Credit points	6			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and	Written-theoretical part and report			
scale				
Assignment for the	Civil- and Environmental Engineering: S	Specialisation Civil Engineering: Elective Comp	ulsory	
Following Curricula	Civil- and Environmental Engineering: S	Specialisation Water and Environment: Elective	e Compulsory	
	Civil- and Environmental Engineering: S	Specialisation Traffic and Mobility: Elective Con	npulsory	
	Logistics and Mobility: Specialisation Tr	affic Planning and Systems: Elective Compulso	bry	
	Engineering and Management - Major in	n Logistics and Mobility: Specialisation Traffic I	Planning and Systems: Ele	ective Compulsory

Course L2474: Sustainable U	ourse L2474: Sustainable Urban Development		
Тур	Lecture		
Hrs/wk	2		
СР	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	Course L2473: Planning law and Environmental law		
Тур	Lecture		
Hrs/wk	2		
СР	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: Sanita	ary Engineering II			
Courses				
Title		Тур	Hrs/wk	СР
Management of Wastewater Infrast	ructure (L2467)	Seminar	2	3
Drinking Water Treatment (L2466)		Seminar	2	3
Module Responsible	Prof. Mathias Ernst			
Admission Requirements	None			
Recommended Previous	Basic knowledge in the field of drinking water suppl	y and waste water disposal.		
Knowledge				
Educational Objectives	After taking part successfully, students have reache	ed the following learning results		
Professional Competence				
Personal Competence Social Competence	systems. They are capable of reproducing the relev can model some processes mathematically. They of removal of nitrate, and place them in a socio-politic of important technologies of the future such as hig The students are able to apply the relevant standa independently. Their expertise comprises expert sk associated treatment facilities. Besides the acquire problems in the filed of drinking water and waste improve the existing water related infrastructures, s The students are able to develop a specific topic in Students are in a position to work on a subject a subject.	an also assess existing problems in t tal context. Furthermore, they know he h- and low-pressure membrane filtration rds and guidelines for the design and ills to design drinking water supply ar ment of technical skills the students are water treatment. The students are all systems and concepts.	the field of sanitary e ow to draft the featur on systems and techn d operation of urban nd urban drainage sy are able to address an iso able to develop in cording to a given pla	engineering, such as es and effectiveness hiques. water infrastructures stems as well as the nd solve biochemical deas of their own to nn.
Workload in Hours	Independent Study Time 124, Study Time in Lecture	- 56		
Credit points				
Course achievement				
Examination	Subject theoretical and practical work			
Examination duration and	Written-theoretical part and modelling			
scale				
Assignment for the	General Engineering Science (German program, 7	semester): Specialisation Green Techr	nologies, Focus Water	and Environmental
Following Curricula	Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specialisation	Water and Environment: Compulsory	,	
	Civil- and Environmental Engineering: Specialisation	Civil Engineering: Elective Compulso	ry	
	Civil- and Environmental Engineering: Specialisation	Traffic and Mobility: Elective Comput	sory	
	Green Technologies: Energy, Water, Climate: Specia	alisation Water Technologies: Elective	Compulsory	

Course L2467: Management	of Wastewater Infrastructure
Тур	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	The seminar ""Infrastructure Management Wastewater"" develops the understanding of infrastructure systems in relation to wastewater systems, but also addresses other infrastructure systems.
	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.
	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.
Literature	Gujer, W. (2007): Siedlungswasserwirtschaft, Springer, Berlin Heidelberg
	Metcalf and Eddy (2003): Wastewater Engineering : Treatment and Reuse, Boston, McGraw-Hill
	Henze, M. (1997): Wastewater Treatment : Biological and Chemical Processes, Berlin, Springer
	Stein D., Stein R. (2014): Instandhaltung von Kanalisationen, Verlag Prof. DrIng. Stein & Partner GmbH
	Wossog, G. (2016): Handbuch für den Rohrleitungsbau Band 1 und 2
	Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall (2009): Abwasserableitung : Bemessungsgrundlagen, Regenwasserbewirtschaftung, Fremdwasser, Netzsanierung, Grundstücksentwässerung, Weimar, UnivVerl.
	DWA Arbeitsblätter

Course L2466: Drinking Wate	er Treatment
Тур	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 M1723: Buildi	ng Information Modeling				
Courses					
Title			Тур	Hrs/wk	СР
Building Information Modeling (L27	60)		Integrated Lecture	2	2
Building Information Modeling (L27	61)		Recitation Section (small)	2	4
Module Responsible	Prof. Kay Smarsly				
Admission Requirements	None				
Recommended Previous	None				
Knowledge					
Educational Objectives	After taking part successfully, students hav	e reached the followi	ng learning results		
Professional Competence					
	to present methodological knowledge to enable students to introduce, to design, to monitor, and to improve BIM processes in companies and public institutions. An in-depth understanding of the methods and technologies relevant to BIM is essential Emphasis is placed on generally valid principles and techniques independent of specific software products and valid for severa decades. The theoretical content taught in the lecture is complemented by practical exercises, in which state-of-the-art software tools will be used. Topics include computer-aided design and geometry modeling, digital modeling of buildings and infrastructure BIM data exchange and cooperation (focusing on Industry Foundation Classes), process modeling, job descriptions and BIM applications, BIM tools, and advanced aspects. A central component of this module will be a project work.				
Skills					
Personal Competence					
Social Competence					
Autonomy					
	Independent Study Time 124, Study Time in	n Lecture 56			
Credit points					
Course achievement					
	Written elaboration				
Examination duration and scale	Description of a BIM model with 15-minute	oral presentation			
	Civil and Environmental Engineering: Cree	ialication Traffic and	Mobility, Elective Compulser	,	
-	Civil- and Environmental Engineering: Spec Civil- and Environmental Engineering: Spec			<i>y</i>	
ronowing curricula	Civil- and Environmental Engineering: Spec	-		lcon	
	Civii- and Environmental Engineering: Spec		invironment. Elective Compt	lisol y	

Course L2760: Building Infor	mation Modeling
Тур	Integrated Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kay Smarsly
Language	DE
Cycle	SoSe
Content	 Historical development Introduction and motivation Basics of geometry 2D geometry modeling 2½D geometry modeling 3D geometry modeling Digital modeling of buildings and infrastructure, object-oriented, semantic, and parametric modeling Data exchange, interoperability, and communication (with emphasis on Industry Foundation Classes) BIM data storage and data management Process modeling Job profiles and applications BIM tools Advanced aspects of BIM Seminar by external BIM experts and project presentations
Literature	

Course L2761: Building Infor	Course L2761: Building Information Modeling		
Тур	Recitation Section (small)		
Hrs/wk	2		
СР	4		
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28		
Lecturer	Prof. Kay Smarsly		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Courses				
Title		Тур	Hrs/wk	СР
Nature-oriented Hydraulic Engineer		Project-/problem-based Learning	2	2
Numerical modelling of soil water o	-	Project-/problem-based Learning	2	2
Numerical modelling of soil water d		Lecture	2	2
Module Responsible				
•	None			
Recommended Previous Knowledge	 Basic knowledge of analysis and differential equations 			
Educational Objectives	After taking part successfully, students have reached the f	bllowing learning results		
Professional Competence				
-	Students are able to define the basic tasks and terms of nature-oriented hydraulic engineering und groundwater hydrology. The cam describe the basics concepts, the basic approaches and methods of nature-oriented hydraulic engineering, groundwat hydrology and groundwater modelling and are able to apply these to practical problems.			
36/115	The students are able to apply the methods and approaches of nature-oriented hydraulic engineering and of groundwa hydrology to practical problems. They can demonstrate to transfer and apply these to simple hydraulic engineering systems. addition, they are able to apply the approaches commonly used in groundwater hydrology. They can exemplarily explain an reason how to apply them as a basis for geo-hydrological questions. In addition, students can apply basic groundwater modellis methods to simple problems of groundwater movement and groundwater recharge.			
Personal Competence				
	Students are able to help each other solving case studies. The students are able to deploy their gained knowledge in applie problems of the practical nature-based hydraulic engineering. Additionaly, they will be able to demonstrate to work cooperativel in teams consisting of engineers from different subject areas. The students will be able to independently extend their knowledge and apply it to new problems.			
	Independent Study Time 96, Study Time in Lecture 84			
Credit points				
Course achievement				
Examination	Subject theoretical and practical work			
	Written-theoretical part and modeling			
scale				
-	General Engineering Science (German program, 7 semest	er): Specialisation Green Technologies	s, Focus Water	r and Environmen
Following Curricula	Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specialisation Civil E			
	Civil- and Environmental Engineering: Specialisation Traffic			
	Civil- and Environmental Engineering: Specialisation Water		-	
	Green Technologies: Energy, Water, Climate: Specialisation	Water Technologies: Elective Compu	lsory	

Course L2472: Nature-orient	Course L2472: Nature-oriented Hydraulic Engineering		
Тур	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	 Regime-theory and application for the development of environmental guiding priciples 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			

Course L2471: Numerical modelling of soil water dynamics	
Тур	Project-/problem-based Learning
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Hannes Nevermann
Language	EN
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Course L2470: Numerical mo	delling of soil water dynamics
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Milad Aminzadeh
Language	EN
Cycle	SoSe
Content	 Hydrologic water bilance 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	Todd, K. (2005): Groundwater Hydrology Fetter, C. W. (2001): Applied Hydrogeology Hölting, B. & Coldewey, W. (2005): Hydrogeologie Charbeneau, R. J. (2000): Groundwater Hydraulics and pollutant Transport

Specialization Water and Environment

Courses				
Гitle		Тур	Hrs/wk	СР
Circular flow economy and structur	al recycling (L2464)	Project-/problem-based Learning	3	3
Sustainable Building (L2463)		Seminar	3	3
Module Responsible	NN			
Admission Requirements	None			
Recommended Previous	Basic knowledge of building materials, building chen	nistry, building construction and building proj	ect manager	nent
Knowledge				
Educational Objectives	After taking part successfully, students have reache	d the following learning results		
Professional Competence				
Knowledge	Students are able to reproduce essential features	of sustainable construction and material	cycles. They	can also name t
	constructional and environmental properties of recy	clates and describe the sampling and analysi	s process. Th	ey are able to give
	overview of the history, definition and to provide si	trategic approaches to the sustainability disc	cussion from	a constructional a
	environmental perspective. Furthermore, they can	explain relevant objectives, strategies and explain	kemplary fiel	ds of research in t
	field of sustainable construction (e.g. environmental	impacts of the production and use of building	g materials, l	ife cycle assessme
	energy and climate-optimised planning and constru	ction, material principles of renewable raw n	- naterials). Stu	udents will be able
	discuss the fundamental relationship between the			
	characterising them.			
	5			
Skills	Students can relate relevant legal requirements to p	practical problems of environmentally sound	design and o	construction and th
	justify the application of specific limit values for inc	dividual areas of application. Students are a	ble to assess	risks that may ar
	from hazardous construction waste in a concise m	anner. They are able to critically examine i	nnovative ar	eas of application
	sustainable construction on the basis of central engi	neering, economic and legal criteria. They ca	n thereafter	evaluate and prop
	approaches for alternative solutions exemplarily, e.g	g. for the processing and recycling of construc	ction waste.	
Personal Competence				
•	The students are able to work out their own solutior	as for specific problems of recycling building	materials in a	small groups. For t
Social competence	purpose, they can organise themselves in a division			
	are able to appoint group members to coordinate t	-		
		the cooperation with other working groups of	the module	
	presentation of work results in the seminar.			
Autonomy	Students can coordinate their individual work perfo	rmance with the other members of the grou	p and prepa	re for it efficiently
	use of scientific media.			
Werkland in Hours	Independent Chudu Time O.C. Chudu Time in Leeture (24		
Credit points	Independent Study Time 96, Study Time in Lecture 8 6	54		
Course achievement				
	Subject theoretical and practical work			
Examination duration and	Written-theoretical part and project work			
scale	·····			
Assignment for the	Civil- and Environmental Engineering: Specialisation	Water and Environment: Compulsory		
	Civil- and Environmental Engineering: Specialisation			
	s and Environmental Engineering. Specialisation			
ronowing curricula	Civil- and Environmental Engineering: Specialisation	Civil Engineering: Elective Compulsory		

Course L2464: Circular flow of	economy and structural recycling
Тур	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	 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 B	uilding
Тур	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	 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	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)

FitleTypHrs/wkCPFoundation Engineering (L0552)Lecture22Foundation Engineering (L0553)Recitation Section (large)22	Engineering					
Circle of the stability of foundations, inclusion of the module the students are able to: Typ Hrs/wk CP Professional Completence Social Completence So	Module M0755: Geote	echnics II				
Circle of the stability of foundations, inclusion of the module the students are able to: Typ Hrs/wk CP Professional Completence Social Completence So						
Jundation Engineering (LDS52) Gundation Engineering (LDS53) Recitation Section (large) 2 2 Module Responsible Admission Requirements Porf_jürgen Grabe 2 2 Admission Requirements None	Courses					
ioundation Engineering (L053) Recitation Section (large) 2 2 ioundation Engineering (L053) Prof. Jürgen Grabe 2 2 Module Responsible None	Title		Тур		Hrs/wk	СР
Bediation Engineering (L194) Recitation Section (small) 2 2 Module Responsible Porf_Urigen Grabe None Image: Complexibility of Complexibility Complexibility of Complexibility of Complexibility	Foundation Engineering (L0552)		Lecture		2	2
Module Responsible Prof. Jürgen Grabe Admission Requirements None Recommended Previous Knowledge Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Geotechnics I Professional Competence Knowledge After taking part successfully, students have reached the following learning results Professional Competence Knowledge The students know the basic principles and methods which are required to verificate the stability of geotechnical structures. Skills After successful completion of the module the students are able to: • verificate the stability and usability of foundations, • know individual methods of ground improvement and apply them in their range of application, • design retaining walls. Personal Competence Social Competence Autonomy • form Vorkload in Hours Independent Study Time 96, Study Time in Lecture 84 Course achievement Computery Bonus No 20 % Attestation Examination Written exam Examination duration and scale General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and	Foundation Engineering (L0553)		Recitation Se	ection (large)	2	2
Admission Requirements None Recommended Previous Knowledge Modules: • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnics I • Mechanics I-II • Geotechnical structures. • After successful completion of the module the students are able to: • verificate the stability and usability of foundations, • know individual methods of ground improvement and apply them in their range of application, • design retaining walls. • Personal Competence Social Competence Automomy • Mechanics I = Mechanics I • Mechanics I • Mechanics I • Oregulatory Bonus Automomy Form Description No 20 % Attestation • Course achievement Credit points Form Description No 20 % Attestation • Examination and scale 90 minutes • Geoteral Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Enginenering: Specialisation Civil Engineering: Compulsory	Foundation Engineering (L1494)		Recitation Se	ection (small)	2	2
Recommended Previous Knowledge Modules: • Mechanics I-II • Geotechnics I-II • Geotechnics I Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge 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: • verificate the stability and usability of foundations, • know individual methods of ground improvement and apply them in their range of application, • design retaining walls. Personal Competence Social Competence Autonomy Independent Study Time 96, Study Time in Lecture 84 Course achievement Compulsory Bonus 00 % Attestation Examination Examination Scale Form Description No 20 % Attestation Second Scale Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory	Module Responsible	Prof. Jürgen Grabe				
Knowledge ····································	Admission Requirements	None				
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Educational Objectives After taking part successfully, students have reached the following learning results Professional Competence Knowledge The students know the basic principles and methods which are required to verificate the stability of geotechnical structures. Skills After successful completion of the module the students are able to: verificate the stability of foundations, know individual methods of ground improvement and apply them in their range of application, design retaining walls. Personal Competence social Competence attonomy Morkload in Hours Independent Study Time 96, Study Time in Lecture 84 Course achievemento 20 % Attestation Resamination duration and go minutes 20 % Attestation Examination duration and scale 90 minutes Scale scale Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory						
Professional Competence Knowledge The students know the basic principles and methods which are required to verificate the stability of geotechnical structures. Skills After successful completion of the module the students are able to: 		Geotechnics I				
Professional Competence Knowledge The students know the basic principles and methods which are required to verificate the stability of geotechnical structures. Skills After successful completion of the module the students are able to: 						
Professional Competence Knowledge The students know the basic principles and methods which are required to verificate the stability of geotechnical structures. Skills After successful completion of the module the students are able to: 						
Knowledge The students know the basic principles and methods which are required to verificate the stability of geotechnical structures. Kills After successful completion of the module the students are able to: Skills After successful completion of the module the students are able to: No verificate the stability and usability of foundations, know individual methods of ground improvement and apply them in their range of application, General Competence Verificate the stability and usability of foundations, Autonomy Idependence Autonomy Form Occurse achievement form Course achievement Social Completion No 20 % Attestation Examination duration and solution and solution and solution and apply them in their range of application civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Water	Educational Objectives	After taking part successfully, students h	ave reached the following learning r	esults		
Skills After successful completion of the module the students are able to: • verificate the stability and usability of foundations, • know individual methods of ground improvement and apply them in their range of application, • design retaining walls. • design retaining walls. Personal Competence • verificate the study Time walls. Autonomy • verificate the study Time of explored the study Time in Lecture 84 Credit point 6 Course achievement Compulsory No 20 % Attestation Examination Written examination Assignment for the General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory	Professional Competence					
 verificate the stability and usability of foundations, know individual methods of ground improvement and apply them in their range of application, design retaining walls. Personal Competence Social Competence	Knowledge	The students know the basic principles and methods which are required to verificate the stability of geotechnical structures.				
Autonomy individual methods of ground improvement and apply them in their range of application, • design retaining walls. Personal Competence - Social Competence - Autonomy - Workload in Hours Independent Study Time in Lecture 84 Course achievement 0 No 20 % Attestation - Examination duration and scale 90 minutes Assignment for the Following Curricula General Engineering: Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil - and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil - and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory	Skills	After successful completion of the modul	e the students are able to:			
Autonomy individual methods of ground improvement and apply them in their range of application, • design retaining walls. Personal Competence - Social Competence - Autonomy - Workload in Hours Independent Study Time in Lecture 84 Course achievement 0 No 20 % Attestation - Examination duration and scale 90 minutes Assignment for the Following Curricula General Engineering: Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil - and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil - and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory						
Personal Competence Social Competence Social Competence Autonomy Autonomy Independent Study Time 96, Study Time in Lecture 84 Credit points 6 Course achievement Compulsory Bonus Form No 20 % Attestation Examination Written exam Mutestation Examination duration and scale 90 minutes Social Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Following Curricula General Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory						
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Social Competence Autonomy Independent Study Time 96, Study Time in Lecture 84 Workload in Hours Independent Study Time 96, Study Time in Lecture 84 Credit points 6 Course achievement No 20 % Kortent Study Form Description No 20 % Attestation Presenting Written examination Written examination 90 minutes Scale Assignment for the Following Curricula General Engineering: Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory		 design retaining walls. 				
Autonomy Independent Study Time 96, Study Time in Lecture 84 Credit points 6 Course achievement Compulsory Bonus Form Description No 20 % Attestation Independent Study More Study Examination duration and scale 90 minutes Study Study Study Study Assignment for the Following Curricula General Engineering: Secialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory	Personal Competence					
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 duration and scale 90 minutes Assignment for the Following Curricula General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory	Social Competence					
Credit points 6 Course achievement Compulsory No Bonus Form Description No 20 % Attestation Monus Percentro Examination Written exam Description Description Examination duration and scale 90 minutes 90 minutes Percentro Assignment for the Following Curricula General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory	Autonomy					
Course achievement Compulsory No Bonus 20 % Form Attestation Description Examination Written exam Image: Compulsory in the exam I	Workload in Hours	Independent Study Time 96, Study Time	in Lecture 84			
No 20 % Attestation Examination Written exam Examination duration and scale 90 minutes Assignment for the Following Curricula General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory	Credit points	6				
Examination Written exam Examination duration and scale 90 minutes Assignment for the Following Curricula General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory	Course achievement		Description			
Examination duration and scale 90 minutes scale 90 minutes Assignment for the Following Curricula General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective 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		No 20 % Attestation				
scale Assignment for the Following Curricula General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective 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	Examination	Written exam				
Assignment for the General Engineering Science (German program, 7 semester): Specialisation Civil Engineering: Elective Compulsory Following Curricula Civil- and Environmental Engineering: Specialisation Civil Engineering: Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory	Examination duration and	90 minutes				
Following Curricula 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	scale					
Civil- and Environmental Engineering: Specialisation Traffic and Mobility: Elective Compulsory Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory	Assignment for the	General Engineering Science (German pr	ogram, 7 semester): Specialisation (Civil Engineering: E	lective Compul	lsory
Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory	Following Curricula	Civil- and Environmental Engineering: Sp	ecialisation Civil Engineering: Compu	ulsory		
Civil- and Environmental Engineering: Specialisation Water and Environment: Elective Compulsory		Civil- and Environmental Engineering: Sp	ecialisation Traffic and Mobility: Elec	tive Compulsory		
					ory	
					-	

Course L0552: Foundation E	ngineering
Тур	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	 Shallow foundations Pile foundations Ground improvement Retaining walls Underpinning Groundwater Conservation Cut-off Walls
Literature	 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 E	ourse L0553: Foundation Engineering	
Тур	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			
Тур	Recitation Section (small)		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	rof. Jürgen Grabe		
Language	DE		
Cycle	WiSe/SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Engineering"								
Module M0983: Mobil	ity Concepts							
Courses								
Title				Тур	Hrs/wk	СР		
Mobility Research and Transportati	on Projects (L1181)			Project-/problem-based Learning	3	3		
Mobility in Megacities and Develop	ing Countries (L1182)			Seminar	3	3		
Module Responsible	Dr. Philine Gaffron	r. Philine Gaffron						
Admission Requirements	None							
Recommended Previous	Module Transportation Pla	anning and Traffic Enginee	ering					
Knowledge								
Educational Objectives	After taking part successf	ully, students have reache	ed the followin	ig learning results				
Professional Competence								
Knowledge	Students are able to:							
	 name the different 	urban transport systems	ovicting aroun	d the world				
		ort challenges in Asian and						
				ems on the one hand and ecolo	gical, socio-cu	ltural and econom		
	problem areas on t				g,			
			n development	and transport (in Germany and	I developing co	untries).		
		of external framework fac						
Skills	Students are able to:							
	- analysis and avalue	to sives sees studies						
	analyse and evaluation transfer learning relations	ite given case studies. Isults to other regions and	L cition					
	-	-		t and transport (in developing o	countrios)			
				sures and the implementation		piects in the light		
		Development Goals	plainea mea	sures and the implementation s	si ciunspore pre	Jeeus in the light		
			gical, poverty	oriented, gender balanced an	d economical)	solutions for urba		
	personal and goods	s transport						
Dense l Comptense								
Personal Competence	Students are able to							
Social Competence	Students are able to:							
	 present and explain 	n independently generated	d findings.					
	constructively discu	uss potentially controversi	ial topics in a	group context.				
Autonomy	Students are able to:							
	 carry out independ 	ent literature research an	d analysis					
		or a written report on a g	-					
Workload in Hours	Independent Study Time 9	96, Study Time in Lecture	84					
Credit points	6							
Course achievement		rm	Description					
		rticipation in excursions						
Examination	Written elaboration							
Examination duration and	All assignments in groups	(2-4 students): written re	eport, 2000 wo	rds (incl. 2 short presentations	of 10 mins.); fi	nal presentation, 2		
scale	mins. plus discussion (incl	I. slides) and 1000 word re	eport incl. pee	r review (individual).				
Assignment for the	Civil- and Environmental E	Engineering: Specialisation	n Traffic and M	lobility: Compulsory				
Following Curricula	Civil- and Environmental E	Engineering: Specialisatior	n Civil Enginee	ering: Elective Compulsory				
	Civil- and Environmental E	Engineering: Specialisatior	n Water and E	nvironment: Elective Compulso	У			
	Logistics and Mobility: Spe	ecialisation Traffic Plannin	ig and System	s: Compulsory				
	Engineering and Manager	nent - Major in Logistics a	nd Mobility: Sp	pecialisation Traffic Planning an	d Systems: Cor	npulsory		

Course L1181: Mobility Resea	arch and Transportation Projects
Тур	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	This course places its focus on transport and mobility in Germany. It deals with questions such as:
	 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? 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: 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 Me	egacities and Developing Countries
Тур	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	The course provides and 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. The following examples could be suitable case studies: Singapore (Metro), Lagos (BRT Light), Guanghzou, Bogota, Jakarta (Full BRT), Sao Paulo, Medellin (Cable Car Systems), Johannesburg (Minibus-Taxi). 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).
Literature	

Engineering"						
Module M1715: Rene	wable Energies					
Courses						
Courses			_			
Title			Гур	Hrs/wk	CP	
Renewable Energies I (L2740) Renewable Energies I (L2742)			ecture Recitation Section (large)	2 1	2	
Renewable Energies II (L2742)			ecture	2	2	
Renewable Energies II (L2743)			Recitation Section (large)	1	1	
Module Responsible	Prof. Martin Kaltschmitt					
Admission Requirements	None					
Recommended Previous	none					
Knowledge						
Educational Objectives	After taking part successfully, students have	reached the following	learning results			
Professional Competence						
Knowledge	Upon completion of this module, students wi	Il be able to provide a	n overview of characteristi	cs of renewable e	energy systems. The	
5	will be able to explain the issues that arise					
	energy distribution and energy trading in thi					
	can explain this knowledge in detail for suc					
	environmental impact of using renewable en					
	options.					
Skills	Students are able to apply methodologies fo	r determining energy	demand or energy supply	to different types	of renewable energy	
	systems. Furthermore, they can evaluate su	ich energy systems te	echnically, ecologically and	economically as	well as systemically	
	and also design them under certain given co	nditions. They are abl	e to select the regulations	necessary for this	s in a subject-specifi	
	manner, especially by means of non-standard solutions to a problem.					
	Students are able to orally explain issues from the subject area and approaches to dealing with them and to classify them in the					
	respective context.					
Personal Competence						
Social Competence	Students are able to investigate suitable technical alternatives and ultimately evaluate them based on technical, economic and					
	ecological criteria - and thus from a sustainability perspective.					
	-					
Autonomy	Students will be able to independently access sources about the field, acquire knowledge and transform it to address new issues.					
Workload in Hours	Independent Study Time 96, Study Time in L	ecture 84				
Credit points						
Course achievement						
	Written exam					
Examination duration and	90 min					
scale		7				
Assignment for the			-			
Following Curricula			5	lies: Compulsory		
	Civil- and Environmental Engineering: Specia	5	5 1 5			
	Civil- and Environmental Engineering: Specia					
	Civil- and Environmental Engineering: Specia	lisation Water and En	vironment: Elective Compu	llsory		
	Chemical and Bioprocess Engineering: Specia	alisation Chemical Eng	gineering: Compulsory			
	Green Technologies: Energy, Water, Climate:		ompulsory			
	Process Engineering: Core Qualification: Corr	npulsory				

Course L2740: Renewable En	ergies I
Тур	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
	This module includes a presentation of the renewable energy supply and a discussion of the respective technologies for providing the desired final or useful energy. Specifically, this includes the options for solar energy use for heat and power generation (i.e., passive solar energy use, solar collectors for low-temperature heat provision, solar thermal power generation, photovoltaic power generation), wind energy use for power generation (i.e. onshore and offshore wind power use), hydroelectric power use for electricity generation (i.e., run-of-river and storage hydroelectric power), ocean energy use for electricity generation (including tidal power plants), and geothermal energy use for heat and electricity generation (i.e., near-surface use by means of heat pumps, deep geothermal energy use for heat and/or electricity generation).
Literature	Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2020, 6. Auflage

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Course L2742: Renewable Er	iergies I			
Тур	Recitation Section (large)			
Hrs/wk				
CP	1			
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14			
Lecturer	Prof. Martin Kaltschmitt			
Language	DE			
Cycle	SoSe			
Content	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. Possible tasks in the field of renewable energies are: • Solar thermal heat • Concentrating solare power • Photovoltaic • Windenergie			
Literature	Hydropower Heat pump Deep geothermal energy Kaltschmitt, M.; Streicher, W.; Wiese, A. (Hrsg.): Erneuerbare Energien - Systemtechnik, Wirtschaftlichkeit, Umweltaspekte; Springer, Berlin, Heidelberg, 2020, 6. Auflage			

Course L2741: Renewable En	ergies II
	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
	This lecture covers all options for energy supply from biomass; this includes the supply of heat, electricity and fuels. The biomass resource and its origin will be discussed first. Afterwards the biomass supply is addressed, which bridges the gap between biomass generation and utilization. Subsequently, the different conversion options are discussed. Only those options are presented in depth that have a corresponding significance on the market in Germany and Europe. This includes (a) heat generation from biogenic solid fuels in small and large-scale plants (b) power generation from solid biomass via combustion (c) a biogas production from residues, by-products and waste, (d) alcohol production from sugar and starch (e) biodiesel production from vegetable oils. Special attention is also paid to the corresponding environmental aspects. An economic classification of the various options is also provided.
Literature	Unterlagen der Vorlesung

Course L2743: Renewable En	nergies II
	Recitation Section (large)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Martin Kaltschmitt
Language	DE
Cycle	SoSe
Content	The students work on tasks in the field of renewable energies the field "energy from biomass". They present their solution approaches in the exercise group and discuss them with their fellow students and the teaching staff afterwards.
Literature	Unterlagen der Vorlesung

Module M0631: Reinf	orced Concrete	Structures	II			
Courses						
Title Project Concrete Structures II (L089 Concrete Structures II (L0348) Concrete Structures II (L0349)	34)			Typ Project Seminar Lecture Recitation Section (large)	Hrs/wk 1 2 2	CP 1 3 2
Module Responsible	Prof. Günter Rombacl	h				
Admission Requirements	None					
Recommended Previous Knowledge	Basics of safetKnowledge in c	y format are requ design of beams a	s and combination of action ired. Ind columns for ultimate li tructures I, Structural Ana	mit state		
Educational Objectives	After taking part succ	essfully, students	have reached the followi	ng learning results		
Professional Competence Knowledge Skills	 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. 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> <i>Autonomy</i>				al concrete building and pres es and evaluate the results.	ent the results at	the end.
Workload in Hours	Independent Study Ti	ime 110, Study Ti	me in Lecture 70			
Credit points						
Course achievement	Compulsory Bonus No None	Form Excercises	Description			
Examination		1.00.0000				
Examination duration and	120 minutes					
scale						
Assignment for the	General Engineering	Science (German	program, 7 semester): Sp	ecialisation Civil Engineering	: Elective Compu	lsory
Following Curricula			Specialisation Civil Engine			
				Mobility: Elective Compulsory Environment: Elective Compu		

Course L0894: Project Concr	Course L0894: Project Concrete Structures II		
Тур	Project Seminar		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	rof. Günter Rombach		
Language	DE		
Cycle	WiSe		
Content	Design of a truss structure		
Literature	Skript zur Lehrveranstaltung "Stahlbetonbau II"		

Course L0348: Concrete Stru	ctures II
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Günter Rombach
Language	DE
Cycle	WiSe
Content	 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 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:
	 bedietette been und badeenmikteren zehr bespiele zur benesseng von beenhaginerken nach Euroeue zu bahr in Hochbau, Bauverlag GmbH, Wiesbaden 2011 Dahms KH.: 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 Stru	ictures II
Тур	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

	dations of Management			
Courses				
itle		Тур	Hrs/wk	СР
Ianagement Tutorial (L0882)		Recitation Section (small)	2	3
ntroduction to Management (L088)	.0)	Lecture	3	3
Module Responsible	Prof. Christoph Ihl			
Admission Requirements	None			
Recommended Previous				
Knowledge	-			
Educational Objectives	After taking part successfully, students have n	eached the following learning results		
Professional Competence		5 5		
•		nportant basics of many different areas in Busir	ess and Manage	ment. from Planr
		and also to Investment and Controlling. In part		
		g		
	explain the differences between Econ	nomics and Management and the sub-discipl	ines in Manage	ment and to na
	important definitions from the field of M	anagement		
	 explain the most important aspects of 	and goals in Management and name the most	important aspe	cts of entreprneu
	projects			
	describe and explain basic business	functions as production, procurement and so	ourcing, supply	chain managem
	organization and human ressource man	agement, information management, innovation	management an	d marketing
	 explain the relevance of planning an 	d decision making in Business, esp. in situal	ions under mul	tiple objectives
	uncertainty, and explain some basic me	thods from mathematical Finance		
	 state basics from accounting and costin 	g and selected controlling methods.		
<i>ci 11</i>				
Skills		ith respect to different criteria (organization, ob	jectives, strategi	es etc.) and to ca
	out an Entrepreneurship project in a team. In p	particular, they are able to		
	analyse Management goals and structure	re them appropriately		
	 analyse organisational and staff structu 			
		er multiple objectives, under uncertainty and un	der risk	
		stems and Business information systems		
	 analyse and apply basic methods of ma 			
		athematical finance to predefined problems		
		osting and controlling to predefined problems		
	• apply basic methods from accounting, c	osting and controlling to predemice problems		
Personal Competence				
Social Competence	Students are able to			
	 work successfully in a team of students 			
		re to an entrepreneurship project and write a co	herent report on	the project
	 to communicate appropriately and 			
	 to cooperate respectfully with their fello 	w students.		
Autonomy	Students are able to			
Autonomy	Students are able to			
	work in a team and to organize the tear	n themselves		
	 to write a report on their project 			
	 to write a report on their project. 			
	• to write a report on their project.			
Workload in Hours		ecture 70		
	Independent Study Time 110, Study Time in Lo	ecture 70		
Credit points	Independent Study Time 110, Study Time in Lo	ecture 70		
Credit points Course achievement	Independent Study Time 110, Study Time in Lo 6 None	ecture 70		
Credit points Course achievement Examination	Independent Study Time 110, Study Time in Lo 6 None Subject theoretical and practical work	ecture 70		
Credit points Course achievement Examination Examination duration and	Independent Study Time 110, Study Time in Lo 6 None Subject theoretical and practical work several written exams during the semester	ecture 70		
Credit points Course achievement Examination	Independent Study Time 110, Study Time in Lo 6 None Subject theoretical and practical work several written exams during the semester	ecture 70		
Credit points Course achievement Examination Examination duration and scale	Independent Study Time 110, Study Time in Lo 6 None Subject theoretical and practical work several written exams during the semester			
Credit points Course achievement Examination Examination duration and scale	Independent Study Time 110, Study Time in Lo 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program	n, 7 semester): Core Qualification: Compulsory		
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Lo 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali	n, 7 semester): Core Qualification: Compulsory	sory	
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory	sory	
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory	sory	
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory	5ory	
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Co Chemical and Bioprocess Engineering: Special	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory		
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Co Chemical and Bioprocess Engineering: Special	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulso		
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Co Chemical and Bioprocess Engineering: Special Chemical and Bioprocess Engineering: Special	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulso		
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Co Chemical and Bioprocess Engineering: Special Chemical and Bioprocess Engineering: Special Computer Science: Core Qualification: Computer	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulso sory		
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Co Chemical and Bioprocess Engineering: Special Chemical and Bioprocess Engineering: Special Computer Science: Core Qualification: Compul Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Com	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulso sory	bry	
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Co Chemical and Bioprocess Engineering: Special Computer Science: Core Qualification: Compul Data Science: Core Qualification: Compul Special Engineering: Core Qualification: Compul Data Science: Core Qualification: Compul Green Technologies: Energy, Water, Climate: S	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulso sory ipulsory specialisation Biotechnologies: Elective Compuls	ory	mulsery
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Dioprocess Engineering: Core Qualification: Core Chemical and Bioprocess Engineering: Special Computer Science: Core Qualification: Compul Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Corre Green Technologies: Energy, Water, Climate: S	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulso sory pulsory specialisation Biotechnologies: Elective Compuls specialisation Energy Systems / Renewable Ener	ory gies: Elective Co	mpulsory
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Cor Chemical and Bioprocess Engineering: Special Computer Science: Core Qualification: Compul Data Science: Core Qualification: Compul Data Science: Core Qualification: Com Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory isation Bio Engineering: Elective Compulsory sisation Chemical Engineering: Elective Compulsor sory pulsory specialisation Biotechnologies: Elective Compuls specialisation Energy Systems / Renewable Ener specialisation Energy Technology: Elective Comp	ory gies: Elective Co pulsory	mpulsory
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Core Chemical and Bioprocess Engineering: Special Computer Science: Core Qualification: Compul Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Corre Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S Subject Subject States State	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory isation Bio Engineering: Elective Compulsory sation Chemical Engineering: Elective Compulsory sory pulsory specialisation Biotechnologies: Elective Compuls specialisation Energy Systems / Renewable Ener specialisation Energy Technology: Elective Comp specialisation Maritime Technologies: Elective Comp	ory gies: Elective Co pulsory pompulsory	mpulsory
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Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Core Chemical and Bioprocess Engineering: Special Computer Science: Core Qualification: Compul Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Comformer Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S Computer Science in Engineering: Core Qualification: S S S S S S S S S S S S S S	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Traffic and Mobility: Elective Compulsory mpulsory isation Bio Engineering: Elective Compulsory sistion Bio Engineering: Elective Compulsory sory specialisation Biotechnologies: Elective Compulso specialisation Energy Systems / Renewable Ener specialisation Energy Technology: Elective Compuls specialisation Maritime Technologies: Elective Comp specialisation Water Technologies: Elective Com cation: Compulsory tion: Compulsory pulsory	ory gies: Elective Co pulsory pompulsory	mpulsory
Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study Time 110, Study Time in Le 6 None Subject theoretical and practical work several written exams during the semester General Engineering Science (German program Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Core Chemical and Bioprocess Engineering: Special Computer Science: Core Qualification: Compul Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Comformer Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S Computer Science in Engineering: Core Qualification: Computer Logistics and Mobility: Core Qualification: Computer Series Core Qualification: Computer Computer Science in Engineering: Core Qualification: Computer Logistics and Mobility: Core Qualification: Computer Series Core Qualification: Computer Series Core Qualification: Computer Logistics and Mobility: Core Qualification: Computer Series Core Core Qualification: Computer Series Core Qual	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compul sation Traffic and Mobility: Elective Compulsory mpulsory isation Bio Engineering: Elective Compulsory sistion Chemical Engineering: Elective Compulsory sory specialisation Biotechnologies: Elective Compulso Specialisation Energy Systems / Renewable Ener specialisation Energy Technology: Elective Compuls specialisation Maritime Technologies: Elective Comp specialisation Water Technologies: Elective Com cation: Compulsory tion: Compulsory pulsory pulsory	ory gies: Elective Co pulsory pompulsory	mpulsory

Mechatronics: Specialisation Electrical Systems: Compulsory	
Mechatronics: Specialisation Dynamic Systems and AI: Compulsory	
Mechatronics: Core Qualification: Compulsory	
Mechatronics: Specialisation Robot- and Machine-Systems: Compulsory	
Mechatronics: Specialisation Medical Engineering: Compulsory	
Orientation Studies: Core Qualification: Elective Compulsory	
Orientation Studies: Core Qualification: Elective Compulsory	
Naval Architecture: Core Qualification: Compulsory	
Technomathematics: Core Qualification: Compulsory	
Process Engineering: Core Qualification: Compulsory	
Engineering and Management - Major in Logistics and Mobility: Core Qualification: Compulsory	

Course L08	382: Management Tutorial
Тур	Recitation Section (small)
Hrs/wk	2
СР	3
Workload	Independent Study Time 62, Study Time in Lecture 28
in Hours	
Lecturer	Prof. Christoph Ihl, Katharina Roedelius
Language	DE
Cycle	WiSe/SoSe
Content	In the management tutorial, the contents of the lecture will be deepened by practical examples and the application of the discussed tools.
	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 se 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 busin knowledge from the lecture should come to practical use. The group projects are guided by a mentor.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.

Course L0880: Introduction t	o Management
Тур	Lecture
Hrs/wk	3
CP	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Prof. Christoph Ihl, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Cornelius Herstatt, Prof. Kathrin Fischer, Prof. Matthias Meyer,
	Prof. Thomas Wrona, Prof. Thorsten Blecker, Prof. Wolfgang Kersten
Language	DE
Cycle	WiSe/SoSe
Content	 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	 Bamberg, G., Coenenberg, A.: Betriebswirtschaftliche Entscheidungslehre, 14. Aufl., München 2008 Eisenführ, F., Weber, M.: Rationales Entscheiden, 4. Aufl., Berlin et al. 2003 Heinhold, M.: Buchführung in Fallbeispielen, 10. Aufl., Stuttgart 2006. Kruschwitz, L.: Finanzmathematik. 3. Auflage, München 2001. Pellens, B., Fülbier, R. U., Gassen, J., Sellhorn, T.: Internationale Rechnungslegung, 7. Aufl., Stuttgart 2008. Schweitzer, M.: Planung und Steuerung, in: Bea/Friedl/Schweitzer: Allgemeine Betriebswirtschaftslehre, Bd. 2: Führung, 9. Aufl. Stuttgart 2005. Weber, J., Schäffer, U. : Einführung in das Controlling, 12. Auflage, Stuttgart 2008. Weber, J./Weißenberger, B.: Einführung in das Rechnungswesen, 7. Auflage, Stuttgart 2006.

Courses				
Fitle ntroduction to Microplastics in Env	vironment (L2755)	Typ Integrated Lecture	Hrs/wk 2	CP 2
Research Methods (L2756)		Lecture	1	2
Research Trends (L2757)		Seminar	2	2
Module Responsible	Prof. Nima Shokri			
Admission Requirements	None			
Recommended Previous	Basic knowledge in water and environmental-related in	research		
Knowledge				
Educational Objectives	After taking part successfully, students have reached	the following learning results		
Professional Competence				
Knowledge	The students will be introduced to current research to of microplastics in environment (introductory level). I module.			
Skills		Students' research and academics skills will be improved in this module. How to prepare and deliver an effective resear presentation, how to write an abstract, research paper and proposal will be explained in this module.		
Personal Competence				
Social Competence	Developing teamwork and problem solving skills throu	ugh Research-Based Teaching appro	aches will be at the c	ore of this module
Autonomy	The students will be involved in writing individual p	project reports and giving research	presentation. This w	ill contribute to t
	students' ability and willingness to work independently	ly and responsibly.		
Workload in Hours	Independent Study Time 110, Study Time in Lecture 7	70		
Credit points				
Course achievement				
	Subject theoretical and practical work			
Examination duration and				
scale				
scale	General Engineering Science (German program, 7 se	mester): Specialisation Green Tech	iologies Focus Water	and Environment
Assignment for the				
Assignment for the	Engineering: Elective Compulsory Civil- and Environmental Engineering: Specialisation V		npulsorv	

Course L2755: Introduction t	o Microplastics in Environment
Тур	Integrated Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Nima Shokri
Language	EN
Cycle	WiSe
Content	Introduction - course objectives, expectations and format;
	Source of microplastics in environment;
	Microplastics sampling; Characterization of microplastics;
	Fate and distribution of microplastics in terrestrial environments;
	Effects of microplastics on terrestrial environments;
	Health risks of microplastics in environments
Literature	1- Characterization and Analysis of Microplastics, Volume 75 1st Edition
	Series Volume Editors: Teresa Rocha-Santos Armando Duarte
	Elsevier, published in 2017
	2- Microplastic Pollutants 1st Edition
	Authors: Christopher Blair Crawford, Brian Quinn
	Elsevier Science, published in 2016
	3- Microplastics in Terrestrial Environments
	Authors: Defu He and Yongming Luo
	Springer, published in 2020, DOI https://doi.org/10.1007/978-3-030-56271-7

Course L2756: Research Met	hods
	Lecture
Hrs/wk	
СР	
Workload in Hours	Independent Study Time 46, Study Time in Lecture 14
Lecturer	Prof. Nima Shokri
Language	EN
Cycle	WiSe
Content	Introduction - course objectives, expectations and format
	Analyzing the Audience, purpose and occasion
	Constructing and delivering effective technical presentations
	How to write an abstract
	How to create a scientific poster
	How to write a scientific paper
	Individual project on water and environmental research
	Presentation on water and environmental research
Literature	The Craft of Scientific Writing Fourth edition
	Author: Michael Alley
	Springer-Verlag New York, Copyright 2018, DOI 10.1007/978-1-4419-8288-9
	Supplemental materials and web links which will be available to registered students.

Course L2757: Research Trer	nds
Тур	Seminar
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
	Dr. Salome Shokri-Kuehni
Language	
Cycle	
Content	Introduction - course objectives, expectations and format
	Analyzing the Audience, purpose and occasion
	Constructing and delivering effective technical presentations
	How to write an abstract
	How to write a scientific paper
	Developing competitive and persuasive research proposals
	Databases and resources available for water and environmental research
	Individual proposal on water and environmental research
	Individual project on water and environmental research
	Group projects and presentation on water and environmental research
Literature	The Craft of Scientific Writing Fourth edition
	Author: Michael Alley
	Springer-Verlag New York, Copyright 2018, DOI 10.1007/978-1-4419-8288-9
	Supplemental materials and web links which will be available to registered students.

Courses				
Title		Тур	Hrs/wk	СР
Transport Planning and Traffic Engi	neering (L0997)	Project-/problem-based Learning	4	6
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
Recommended Previous	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	following learning results		
Professional Competence				
Knowledge	Students are able to			
	 understand the facts, contexts and objectives of the 	concourt planning		
	 correctly apply definitions and concepts of transport 			
	 reproduce basic concepts of transport modelling. 	i e pianinig.		
	 explain the fundamentals of traffic engineering an 	d transport infrastructure construction.		
Skills	Students are able to			
	 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. 			
Dersonal Competence				
Personal Competence	Students are able to			
Social Competence				
	get together in groups and constructively discuss	and analyse set problems.		
	 in a group agree on solutions and document them 			
Διιτοροφγ	Students are able to			
Autonomy				
	 produce reports on group work. 			
	 structure the tasks and timing for working out a s 	et problem.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Course achievement	Compulsory Bonus Form Descri	ption		
	No 5 % Excercises			
Examination	Subject theoretical and practical work			
Examination duration and	Project report in four work packages, in small groups, du	ring the semester		
scale				
Assignment for the	Civil- and Environmental Engineering: Specialisation Traf	fic and Mobility: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisation Wat	er and Environment: Compulsory		
	Civil- and Environmental Engineering: Specialisation Civi	Engineering: Elective Compulsory		
	Engineering and Management - Major in Logistics and Mo	bility: Core Qualification: Compulsory		

Course L0997: Transport Pla	nning and Traffic Engineering
Тур	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	 The course provides an introductory overview over the fundamentals of urban and regional transport planning, including the subtopic traffic engineering. The following subject areas are covered: 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	 Bosserhoff, Dietmar (2000) Integration von Verkehrsplanung und räumlicher Planung. Schriftenreihe der Hessischen Straßen- und Verkehrsverwaltung, Heft 42. Hessisches Landesamt für Straßen- und Verkehrswesen. Wiesbaden. Lohse, Dieter; Schnabel, Werner (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung: Band 1; Straßenverkehrstechnik. Beuth Verlag. Berlin. Forschungsgesellschaft für Straßen- und Verkehrswesen (2006) Richtlinien für die Anlage von Stadtstraßen - RASt 06. FGSV-Verlag. Köln (FGSV, 200). Vallée, Dirk; Engel, Barbara; Vogt, Walter (2021) Stadtverkehrsplanung Band 3, Springer Verlag. Berlin.

Courses					
Title			Тур	Hrs/wk	СР
Databases (L2758)			Integrated Lecture	1	1
Databases (L2759)			Recitation Section (sm	all) 1	1
Object-oriented Modelling (L2468)			Integrated Lecture	2	2
Object-oriented Modelling (L2469)			Recitation Section (sm	all) 2	2
Module Responsible	Prof. Kay Smarsly				
Admission Requirements	None				
Recommended Previous	Students can descri	ibe and analyze existing	software programs in the discipline b	based on their essentia	al characteristics. The
Knowledge	students are able to	reproduce the elementa	ry basics and theoretical concepts of eng	ineering informatics ar	id to apply elementa
	solution algorithms t	to engineering problems.	They are also able to define database pr	inciples and make simp	ole queries to commo
	database systems.				
Educational Objectives	After taking part suc	cessfully students have	reached the following learning results		
Professional Competence	, incer taking part bac	seconding, seadents have			
•	Eurodomontols of (i)	abject arianted modeling	and (ii) database design will be present	od. The students will b	a able to develop ar
Knowledge					
	-	-	ms required in the area of civil and envir		•
			engineering informatics programming m		
	functions, and proc	cedures, UML notation	such as association, aggregation and	composition), control	structures, excepti
	handling, data strea	ams, inheritance, abstra	ct classes and interfaces, data structur	es (e.g. associative m	emory with particu
	emphasis on hash ta	ables and tree structures), algorithms and generic programming.	Part (ii) follows the dat	tabase design proce
	and primarily cover	rs conceptual design an	I semantics of database models (with	emphasis on the Entit	y-Relationship Mode
	logical design (including integrity constraints, anomalies and normalization), relational algebra, relational query languages and				
	SQL, database views, physical database design and implementation, concepts of database application development (JDBC) as well				
	as data integration and data exchange in civil engineering.				
	us data integration e	and data exchange in eiv	rengineering.		
Skills					
<i>Skills</i> Personal Competence					
Personal Competence					
Personal Competence Social Competence	Independent Study 1	Time 96, Study Time in L	cture 84		
Personal Competence Social Competence Autonomy		Time 96, Study Time in L	ecture 84		
Personal Competence Social Competence Autonomy Workload in Hours	6 Compulsory Bonus	Form	Description		
Personal Competence Social Competence Autonomy Workload in Hours Credit points	6			schriftlicher Beleg a	ngefertigt. Der Bel
Personal Competence Social Competence Autonomy Workload in Hours Credit points	6 Compulsory Bonus	Form	Description	-	
Personal Competence Social Competence Autonomy Workload in Hours Credit points	6 Compulsory Bonus	Form	Description Als Prüfungsvorleistung wird ein	en Lehrinhalte und	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement	6 Compulsory Bonus	Form	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt	en Lehrinhalte und	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement	6 Compulsory Bonus Yes 15 % Written exam	Form	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt	en Lehrinhalte und	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination	6 Compulsory Bonus Yes 15 % Written exam	Form	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt	en Lehrinhalte und	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination duration and scale	6 Compulsory Bonus Yes 15 % Written exam 180 min	Form Written elaboration	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt Studierenden auf die Klausur vorzu	en Lehrinhalte und	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	6 Compulsory Bonus Yes 15 % Written exam 180 min Civil- and Environme	Form Written elaboration	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt Studierenden auf die Klausur vorzu ualification: Compulsory	en Lehrinhalte und ubereiten.	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination duration and scale	6 Compulsory Bonus Yes 15 % Written exam 180 min Civil- and Environme Civil- and Environme	Form Written elaboration ental Engineering: Core C ental Engineering: Specia	Description Als Prüfungsvorleistung wird ein umfasst die bis dahin bekannt Studierenden auf die Klausur vorzu	len Lehrinhalte und ubereiten.	

Course L2758: Databases	
Тур	Integrated Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Kay Smarsly
Language	DE
Cycle	WiSe
Content	 Motivation and basic concepts Terminology and definitions Database design process Conceptual design Semantics of database models The Entity-Relationship Model Relationships in the ER model Other concepts in the ER model Other concepts in the ER model Conceptual modeling with UML Logical design The relational model Integrity constraints Anomalies and normalization ER mapping to the relational model Relational algebra Relational query languages Schema definition and modification SQL as a relational query language Modification options in SQL Database views Physical database design and implementation Concepts of database application development JDBC
	Data integration and data exchange in civil engineering
Literature	

Course L2759: Databases	
Тур	Recitation Section (small)
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Prof. Kay Smarsly
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L2468: Object-oriente	d Modelling
Тур	Integrated Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kay Smarsly
Language	DE
Cycle	WiSe
Content	 Fundamentals of engineering informatics Programming languages and programming paradigms Programming methodology Objects and classes Constructors Packages and imports Visibility and validity Methods, functions, and procedures Variables and constants UML notation Control structures Expressions and statements Recursion Exception handling Inputs and outputs Data streams Association, aggregation and composition Inheritance Abstract classes and methods Interfaces Data structures and algorithms (e.g. arrays) Generic programming
	Lists, queues, and sets Associative memory (particular emphasis on back tables and tree structures)
	Associative memory (particular emphasis on hash tables and tree structures) Further notes on algorithms
Literature	

Course L2469: Object-oriented Modelling	
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kay Smarsly
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Module M1629: Geoir	nformation Science				
Courses					
Title		Ty	ур	Hrs/wk	СР
ntroduction to Geoinformation Sci	ence (L2465)	Pr	oject-/problem-based Learning	3	3
Module Responsible	Prof. Peter Fröhle				
Admission Requirements	None				
Recommended Previous	Principles of analysis and linear alge	ebra			
Knowledge					
Educational Objectives	After taking part successfully, stude	nts have reached the following	learning results		
Professional Competence					
Knowledge	The students are able to define the	tasks and terms from the field	of application of geo informa	tion systems.	They can report t
	basics, the basic approaches and me	ethods of geo information syste	ms and are able to transfer th	ese to practic	al questions.
Skille	Students are able to apply the basic	mothods used in goo informat	ion systems to practical prob	lome Thoy ar	a able to apply the
SKIIIS	to simple applications of geograph	-		-	
	simple GIS project and present their	,	transfer them to other prob	ems. The stu	dents can process
		results			
Personal Competence					
Social Competence	The students can work together gro	ups cooperatively and productiv	vely.		
Autonomy	Students are able to organize the	ir work flow to prepare thems	elves before presentations a	and discussion	They can acqui
hatehenny	appropriate knowledge by making e				ii iiicy cuir acqui
	Independent Study Time 48, Study	Time in Lecture 42			
Credit points	3				
Course achievement	None				
Examination	Subject theoretical and practical wo	rk			
Examination duration and	Computer aided GIS-Application and	l written-theoretical part			
scale					
Assignment for the	General Engineering Science (Germa	an program, 7 semester): Speci	alisation Civil Engineering: Co	mpulsory	
Following Curricula	Civil- and Environmental Engineering	5 1	, , ,		
	Civil- and Environmental Engineering	g: Specialisation Water and Env	ironment: Compulsory		

Course L2465: Introduction t	o Geoinformation Science
Тур	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	 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 M1630: Sanita	ary Engineering II			
Courses				
Title		Тур	Hrs/wk	СР
Management of Wastewater Infrast	ructure (L2467)	Seminar	2	3
Drinking Water Treatment (L2466)		Seminar	2	3
Module Responsible	Prof. Mathias Ernst			
Admission Requirements	None			
Recommended Previous	Basic knowledge in the field of drinking water s	upply and waste water disposal.		
Knowledge				
Educational Objectives	After taking part successfully, students have re	ached the following learning results		
Professional Competence				
Personal Competence	The students can examplify their expert knowledge on drinking water, waste water treatment and the associated infrastructure systems. They are capable of reproducing the relevant empiricals 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. 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 filed 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.			
Autonomy	Students are in a position to work on a subje subject.	ect and to organize their work flow indep	endently. They can	also present on thi
Workload in Hours	Independent Study Time 124, Study Time in Lee	cture 56		
Credit points	6			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and	Written-theoretical part and modelling			
scale				
Assignment for the	General Engineering Science (German program	n, 7 semester): Specialisation Green Techn	ologies, Focus Water	and Environmenta
Following Curricula	Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specialisa	ation Water and Environment: Compulsory		
	Civil- and Environmental Engineering: Specialisa	ation Civil Engineering: Elective Compulsor	у	
	Civil- and Environmental Engineering: Specialis	ation Traffic and Mobility: Elective Compuls	ory	
	Green Technologies: Energy, Water, Climate: Sp	pecialisation Water Technologies: Elective	Compulsory	

Course L2467: Management	of Wastewater Infrastructure	
Тур	Seminar	
Hrs/wk	2	
CP	3	
Workload in Hours	pendent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Ralf Otterpohl	
Language	DE	
Cycle	SoSe	
Content	The seminar ""Infrastructure Management Wastewater"" develops the understanding of infrastructure systems in relation to wastewater systems, but also addresses other infrastructure systems.	
	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.	
	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.	
Literature	Gujer, W. (2007): Siedlungswasserwirtschaft, Springer, Berlin Heidelberg	
	Metcalf and Eddy (2003): Wastewater Engineering : Treatment and Reuse, Boston, McGraw-Hill	
	Henze, M. (1997): Wastewater Treatment : Biological and Chemical Processes, Berlin, Springer	
	Stein D., Stein R. (2014): Instandhaltung von Kanalisationen, Verlag Prof. DrIng. Stein & Partner GmbH	
	Wossog, G. (2016): Handbuch für den Rohrleitungsbau Band 1 und 2	
	Deutsche Vereinigung für Wasserwirtschaft, Abwasser und Abfall (2009): Abwasserableitung : Bemessungsgrundlagen, Regenwasserbewirtschaftung, Fremdwasser, Netzsanierung, Grundstücksentwässerung, Weimar, UnivVerl.	
	DWA Arbeitsblätter	

Course L2466: Drinking Water Treatment		
Тур	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	

Engineering				
Module M0612: Steel	Structures II			
-				
Courses				
Title		Тур	Hrs/wk	СР
Steel Structures II (L0301)		Lecture	2	3
Steel Structures II (L0302)		Recitation Section (large)	2	3
Module Responsible				
Admission Requirements				
Recommended Previous	Steel Structures I			
Knowledge				
Educational Objectives	After taking part successfully, students have reac	hed the following learning results		
Professional Competence				
Knowledge	After successful completition students can			
	 describe and explain the behaviour of bolte 	ed and welded connections		
	 design and check simple halls and building 			
	 calculate forces and stresses of simple structure 			
	• illustrate and dimension he main details (fr	amework, column base, load application	points)	
CL '''				
SKIIIS	Students are able to design simple structures and		-	
	failure. They can apply structural imperfections, c	alculate according to 2nd order theory an	id verity their result	.5.
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time in Lecto	ure 56		
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and	120 minutes			
scale				
Assignment for the	General Engineering Science (German program, 7	semester): Specialisation Civil Engineeri	ng: Elective Compu	lsory
Following Curricula	Civil- and Environmental Engineering: Specialisati	on Civil Engineering: Compulsory		
	Civil- and Environmental Engineering: Specialisati	on Traffic and Mobility: Elective Compulso	ory	
	Civil- and Environmental Engineering: Specialisati	on Water and Environment: Elective Com	pulsory	

Course L0301: Steel Structures II	
Тур	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	 Welded connections Simple constructions 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 Band 1 Tragwerksplanung, Grundlagen Band 2 Verbindungen und Konstruktionen

Course L0302: Steel Structur	Course L0302: Steel Structures II	
Тур	Recitation Section (large)	
Hrs/wk	2	
СР	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	

Medule M0005, Interes	lustion to Deilusus			
Module M0985: Introd	luction to Railways			
Courses				
Title		Tree	Hrs/wk	СР
Introduction to Railways (L1184)		Typ Lecture	2	4
Introduction to Railways (L1185)		Recitation Section (large)	1	2
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have r	eached the following learning results		
Professional Competence				
Knowledge	Students can			
	• give definitions for basic terms related	to railways		
	 explain specifics concerning the handling 	-		
	explain the required infrastructure	5		
	 describe the work at the track super str 	ructure		
Skills				
Personal Competence				
Social Competence	Students can			
	 work at tasks in groups and come to res 	sults together		
	 discuss contents in groups, summarize 	them and present them in front of others		
	 convey contents to other by processing 	them in writing		
Autonomy	Students can work out and understand conter	ts themselves during the lecture through litera	ture research	
Workload in Hours	Independent Study Time 138, Study Time in L	ecture 42		
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and	90 min			
scale				
Assignment for the	Civil- and Environmental Engineering: Speciali	sation Traffic and Mobility: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Special	sation Civil Engineering: Elective Compulsory		
	Civil- and Environmental Engineering: Speciali	sation Water and Environment: Elective Compu	lsory	
	Logistics and Mobility: Specialisation Traffic Pl	anning and Systems: Elective Compulsory		
	Engineering and Management - Major in Logis	tics and Mobility: Specialisation Traffic Planning	and Systems: Ele	ective Compulsory

Course L1184: Introduction t	o Railways
Тур	Lecture
Hrs/wk	2
CP	4
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28
Lecturer	André Schoppe
Language	DE
Cycle	SoSe
Content	Lecture:
	The module provides a basic knowledge of the field of railroad engineering. An overview of railroad operations, control and safety technology, railroad superstructure, structural engineering, project management as well as maintenance and design of infrastructure facilities is given. The aim of this module is to give students as much insight as possible into railroad infrastructure. The module is examined by means of a written exam at the end of the semester. Lecture Hall Exercise: In order to give the students practical examples, full-day practical excursions are carried out. New handling techniques and currently available hardware will be presented by visiting the marshalling yard "die Zugbildungsanlage Maschen (ZBA)". Furthermore, the training center for track construction and civil engineering as well as the operations center in Hanover will be visited, where facilities and tasks will be presented. Questionnaires will also be provided for practice purposes. In addition, study papers can be handed out and supervised as required.
Literature	Die maßgebliche Literatur wird in StudIP veröffentlicht. Weitere Hinweise werden in der Veranstaltung gegeben.

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

Module M1633: Plann	ing Law and Environmental	Law/ Sustainable Urban Develo	pment	
Courses				
Title		Тур	Hrs/wk	СР
Sustainable Urban Development (L	2474)	Lecture	2	3
Planning law and Environmental la	w (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				
Knowledge				
Skills				
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Tim	ne in Lecture 56		
Credit points	6			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and	Written-theoretical part and report			
scale				
Assignment for the	Civil- and Environmental Engineering: S	pecialisation Civil Engineering: Elective Compuls	sory	
Following Curricula	Civil- and Environmental Engineering: S	pecialisation Water and Environment: Elective C	Compulsory	
	Civil- and Environmental Engineering: S	pecialisation Traffic and Mobility: Elective Comp	oulsory	
	Logistics and Mobility: Specialisation Tra	affic Planning and Systems: Elective Compulsory	/	
	Engineering and Management - Major in	Logistics and Mobility: Specialisation Traffic Pla	anning and Systems: El	lective Compulsory

Course L2474: Sustainable U	ourse L2474: Sustainable Urban Development	
Тур	Lecture	
Hrs/wk	2	
СР	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	Course L2473: Planning law and Environmental law	
Тур	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 M1723: Buildi	ng Information Modeling				
Courses					
Title			Тур	Hrs/wk	СР
Building Information Modeling (L27	60)		Integrated Lecture	2	2
Building Information Modeling (L27	61)		Recitation Section (small)	2	4
Module Responsible	Prof. Kay Smarsly				
Admission Requirements	None				
Recommended Previous	None				
Knowledge					
Educational Objectives	After taking part successfully, students hav	e reached the followi	ng learning results		
Professional Competence					
	to present methodological knowledge to enable students to introduce, to design, to monitor, and to improve BIM processes in companies and public institutions. An in-depth understanding of the methods and technologies relevant to BIM is essential. Emphasis is placed on generally valid principles and techniques independent of specific software products and valid for several decades. The theoretical content taught in the lecture is complemented by practical exercises, in which state-of-the-art software tools will be used. Topics include computer-aided design and geometry modeling, digital modeling of buildings and infrastructure, BIM data exchange and cooperation (focusing on Industry Foundation Classes), process modeling, job descriptions and BIM applications, BIM tools, and advanced aspects. A central component of this module will be a project work.				
Skills					
Personal Competence					
Social Competence					
Autonomy					
	Independent Study Time 124, Study Time in	n Lecture 56			
Credit points					
Course achievement					
	Written elaboration				
Examination duration and scale	Description of a BIM model with 15-minute	oral presentation			
	Civil and Environmental Engineering: Cree	ialication Traffic and	Mobility, Elective Compulser	,	
-	Civil- and Environmental Engineering: Spec Civil- and Environmental Engineering: Spec			<i>y</i>	
ronowing curricula	Civil- and Environmental Engineering: Spec	-		lcon	
	Civii- and Environmental Engineering: Spec		invironment. Elective Compt	lisol y	

Course L2760: Building Inform	mation Modeling
Тур	Integrated Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kay Smarsly
Language	DE
Cycle	SoSe
Content	 Historical development Introduction and motivation Basics of geometry 2D geometry modeling 2½D geometry modeling 3D geometry modeling Digital modeling of buildings and infrastructure, object-oriented, semantic, and parametric modeling Data exchange, interoperability, and communication (with emphasis on Industry Foundation Classes) BIM data storage and data management Process modeling Job profiles and applications BIM tools Advanced aspects of BIM Seminar by external BIM experts and project presentations
Literature	

Course L2761: Building Infor	ourse L2761: Building Information Modeling		
Тур	Recitation Section (small)		
Hrs/wk	2		
CP	4		
Workload in Hours	Independent Study Time 92, Study Time in Lecture 28		
Lecturer	Prof. Kay Smarsly		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Courses				
Title		Тур	Hrs/wk	СР
Nature-oriented Hydraulic Engineer		Project-/problem-based Learning	2	2
Numerical modelling of soil water of	-	Project-/problem-based Learning	2	2
Numerical modelling of soil water d		Lecture	2	2
Module Responsible				
•	None			
Recommended Previous Knowledge	 Basic knowledge of analysis and differential equations hydromechanical and hydraulic engineering principles 			
	After taking part successfully, students have reached the fol	lowing learning results		
Professional Competence				
Knowledge	Students are able to define the basic tasks and terms of na		-	
	cam describe the basics concepts, the basic approaches	-	draulic engin	eering, groundwa
	hydrology and groundwater modelling and are able to apply	these to practical problems.		
Skille	The students are able to apply the methods and appro-	aches of nature-oriented hydraulic	engineering	and of groundwa
SKIIIS		o apply the methods and approaches of nature-oriented hydraulic engineering and of groundwater oblems. They can demonstrate to transfer and apply these to simple hydraulic engineering systems. In		
	addition, they are able to apply the approaches commonl			
	reason how to apply them as a basis for geo-hydrological q		-	
	methods to simple problems of groundwater movement and		ipply basic git	
	methods to simple problems of groundwater movement and	groundwater recharge.		
Personal Competence				
Social Competence	Students are able to help each other solving case studies	. The students are able to deploy t	heir gained k	nowledge in appl
	problems of the practical nature-based hydraulic engineerin	g. Additionaly, they will be able to a	lemonstrate to	o work cooperativ
	in teams consisting of engineers from different subject areas	5.		
Autonomy	The students will be able to independently extend their know	vledge 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	Written-theoretical part and modeling			
scale				
Assignment for the	General Engineering Science (German program, 7 semester): Specialisation Green Technologies	s, Focus Water	and Environmen
Following Curricula	Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specialisation Civil En	gineering: Elective Compulsory		
	Civil- and Environmental Engineering: Specialisation Traffic a			
	Civil- and Environmental Engineering: Specialisation Water a		v	

Course L2472: Nature-orient	ed Hydraulic Engineering
Тур	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	 Regime-theory and application for the development of environmental guiding priciples 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	

Course L2471: Numerical mo	urse L2471: Numerical modelling of soil water dynamics		
Тур	Project-/problem-based Learning		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Hannes Nevermann		
Language	EN		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Course L2470: Numerical modelling of soil water dynamics	
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Dr. Milad Aminzadeh
Language	EN
Cycle	SoSe
Content	 Hydrologic water bilance 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	Todd, K. (2005): Groundwater Hydrology Fetter, C. W. (2001): Applied Hydrogeology Hölting, B. & Coldewey, W. (2005): Hydrogeologie Charbeneau, R. J. (2000): Groundwater Hydraulics and pollutant Transport

Thesis	
Module M-001: Bachelor Thesis	
Typ Hrs/wk CP Professoren der TUHH	
According to General Regulations §21 (1):	
At least 126 ECTS credit points have to be achieved in study programme. The examinations board decides on exceptions.	
After taking part successfully, students have reached the following learning results	
After taking part successionly, students have reached the following rearing results	
 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. 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. 	
 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. 	
 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. 	
Independent Study Time 360, Study Time in Lecture 0	
12	
None	
Thesis	
According to General Regulations	
General Engineering Science (German program): Thesis: Compulsory	
General Engineering Science (German program, 7 semester): Thesis: Compulsory	
Civil- and Environmental Engineering: Thesis: Compulsory	
Bioprocess Engineering: Thesis: Compulsory	
Chemical and Bioprocess Engineering: Thesis: Compulsory Computer Science: Thesis: Compulsory	
Data Science: Thesis: Compulsory	
Digital Mechanical Engineering: Thesis: Compulsory	
Electrical Engineering: Thesis: Compulsory	
Engineering Science: Thesis: Compulsory General Engineering Science (English program): Thesis: Compulsory	
General Engineering Science (English program, 7 semester): Thesis: Compulsory	
Green Technologies: Energy, Water, Climate: Thesis: Compulsory	
Computer Science in Engineering: Thesis: Compulsory	
Integrated Building Technology: Thesis: Compulsory	
Logistics and Mobility: Thesis: Compulsory	
Logistics and Mobility: Thesis: Compulsory Mechanical Engineering: Thesis: Compulsory	
Mechanical Engineering: Thesis: Compulsory Mechatronics: Thesis: Compulsory Naval Architecture: Thesis: Compulsory	
Mechanical Engineering: Thesis: Compulsory Mechatronics: Thesis: Compulsory Naval Architecture: Thesis: Compulsory Technomathematics: Thesis: Compulsory	
Mechanical Engineering: Thesis: Compulsory Mechatronics: Thesis: Compulsory Naval Architecture: Thesis: Compulsory	