

#### **Module Manual**

Bachelor of Science (B.Sc.)

### Civil- and Environmental Engineering

Cohort: Winter Term 2023 Updated: 9th May 2025

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#### **Program description**

#### Content

#### Program structure

#### **Core Qualification**

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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 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 represent 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 <ul> <li>apply basic methods of the said scientific disciplines,</li> <li>auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specific-discipline,</li> <li>to handle simple questions in aforementioned scientific disciplines in a successful manner,</li> <li>justify their decisions on forms of organization and application in practical questions in contexts that go beyond</li> </ul>		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 contrant in the higher scientific and theoretical level of abstraction in the B.Sc.
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 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 represent 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 speci 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		This is also reflected in the different quality of soft skills, which relate to the different team positions and different group leader functions of Bachelor's and Master's graduates in their future working life.
<ul> <li>locate selected specialized areas with the relevant non-technical mother discipline,</li> <li>outline basic theories, categories, terminology, models, concepts or artistic techniques in the disciplines represented in learning area,</li> <li>different specialist disciplines relate to their own discipline and differentiate it as well as make connections,</li> <li>sketch the basic outlines of how scientific disciplines, paradigms, models, instruments, methods and forms of represent in the specialized sciences are subject to individual and socio-cultural interpretation and historicity,</li> <li>Can communicate in a foreign language in a manner appropriate to the subject.</li> </ul> Skills Professional Competence (Skills) In selected sub-areas students can <ul> <li>apply basic methods of the said scientific disciplines,</li> <li>auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specidiscipline, <ul> <li>to handle simple questions in aforementioned scientific disciplines in a sucsessful manner,</li> <li>justify their decisions on forms of organization and application in practical questions in contexts that go beyond</li> </ul></li></ul>		Specialized Competence (Knowledge)
<ul> <li>locate selected specialized areas with the relevant non-technical mother discipline,</li> <li>outline basic theories, categories, terminology, models, concepts or artistic techniques in the disciplines represented in learning area,</li> <li>different specialist disciplines relate to their own discipline and differentiate it as well as make connections,</li> <li>sketch the basic outlines of how scientific disciplines, paradigms, models, instruments, methods and forms of represent in the specialized sciences are subject to individual and socio-cultural interpretation and historicity,</li> <li>Can communicate in a foreign language in a manner appropriate to the subject.</li> </ul> Skills Professional Competence (Skills) In selected sub-areas students can <ul> <li>apply basic methods of the said scientific disciplines,</li> <li>auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specidiscipline, <ul> <li>to handle simple questions in aforementioned scientific disciplines in a sucsessful manner,</li> <li>justify their decisions on forms of organization and application in practical questions in contexts that go beyond</li> </ul></li></ul>		Students can
<ul> <li>In selected sub-areas students can</li> <li>apply basic methods of the said scientific disciplines,</li> <li>auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specific discipline,</li> <li>to handle simple questions in aforementioned scientific disciplines in a sucsessful manner,</li> <li>justify their decisions on forms of organization and application in practical questions in contexts that go beyond</li> </ul>		<ul> <li>locate selected specialized areas with the relevant non-technical mother discipline,</li> <li>outline basic theories, categories, terminology, models, concepts or artistic techniques in the disciplines represented in learning area,</li> <li>different specialist disciplines relate to their own discipline and differentiate it as well as make connections,</li> <li>sketch the basic outlines of how scientific disciplines, paradigms, models, instruments, methods and forms of representation in the specialized sciences are subject to individual and socio-cultural interpretation and historicity,</li> </ul>
<ul> <li>apply basic methods of the said scientific disciplines,</li> <li>auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specidiscipline,</li> <li>to handle simple questions in aforementioned scientific disciplines in a sucsessful manner,</li> <li>justify their decisions on forms of organization and application in practical questions in contexts that go beyond</li> </ul>	Skills	Professional Competence (Skills)
<ul> <li>apply basic methods of the said scientific disciplines,</li> <li>auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specidiscipline,</li> <li>to handle simple questions in aforementioned scientific disciplines in a sucsessful manner,</li> <li>justify their decisions on forms of organization and application in practical questions in contexts that go beyond</li> </ul>		In selected sub-areas students can
		<ul> <li>apply basic methods of the said scientific disciplines,</li> <li>auestion a specific technical phenomena, models, theories from the viewpoint of another, aforementioned specidiscipline,</li> <li>to handle simple questions in aforementioned scientific disciplines in a sucsessful manner,</li> </ul>

Social Competence	Personal Competences (Social Skills)	l
	Students will be able	
	to learn to collaborate in different manner,	
	<ul> <li>to present and analyze problems in the abovementioned fields in a partner or group situation in a manner appropriate to the addressees,</li> </ul>	
	<ul> <li>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),</li> </ul>	
	<ul> <li>to explain nontechnical items to auditorium with technical background knowledge.</li> </ul>	
Autonomy	Personal Competences (Self-reliance)	
	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	
	<ul> <li>to reflect and decide questions in front of a broad education background</li> </ul>	
	<ul> <li>to communicate a nontechnical item in a competent way in writen form or verbaly</li> </ul>	
	<ul> <li>to organize themselves as an entrepreneurial subject country (as far as this study-focus would be chosen)</li> </ul>	
Workload in Hours	Depends on choice of courses	1
Credit points	6	1

#### Courses

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

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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	15)	Lecture	2	2
Module Responsible	Prof. Frank Schmidt-Döhl			
Admission Requirements	None			
<b>Recommended Previous</b>	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				
Knowledge	The students are able to identify fund	lamental effects of action to materials and structures, to	o explain differen	types of mechani
-	behaviour, to describe the structure	e of building materials and the correlations betwee	n structure and	other properties.
		osion processes and to describe the most important i		
	materials and structures and their measurement in the field of protection against moisture, coldness, fire and noise.			
	materials and structures and their me		oluliess, file and	noise.
Skills	The students are able to work with the	students are able to work with the most important standardized methods and regularities in the field of moisture protection,		
	the German regulation for energy sav	ring, fire protection and noise protection in the case of a	a small building.	
Personal Competence				
Social Competence	The students are able to support each	n other to learn the very extensive specialist knowledge	<i>!</i>	
Autonomu	The students are able to make the tim	ains and the exercise store to leave the excisite (man		when sive field
Autonomy	The students are able to make the tin	ning and the operation steps to learn the specialist know	wiedge of a very e	extensive field.
Workload in Hours	Independent Study Time 96, Study Ti	me in Lecture 84		
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and	2 h written exam			
scale				
Assignment for the	General Engineering Science (German	n program, 7 semester): Specialisation Civil Engineering	J: Compulsory	
Following Curricula	Civil- and Environmental Engineering:	Core Qualification: Compulsory		
2	Integrated Building Technology: Core			
	Orientation Studies: Core Qualification			

Course L0217: Building Phys	Course L0217: Building Physics		
Тур	Lecture		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Frank Schmidt-Döhl		
Language	DE		
Cycle	WiSe		
Content	Heat transport, thermal bridges, balances of energy consumption, German regulation for energy saving, heat protection in		
	summer, moisture transport, condensation moisture, protection against mold, fire protection,		
	noise protection		
Literature	e 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 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 Physics		
Тур	Recitation Section (small)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Frank Schmidt-Döhl	
Language	DE	
Cycle	WiSe	
Content	t See interlocking course	
Literature	See interlocking course	

Course L0215: Principles of E	Building Materials	
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	Structure of building materials	
	Effects of action	
	Fundamentals of mechanical behaviour	
	Material testing	
	Principles of metals	
	Joining methods	
Literature	Wendehorst, R.: Baustoffkunde. ISBN 3-8351-0132-3	
	Scholz, W.:Baustoffkenntnis. ISBN 3-8041-4197-8	

Engineering				
Module M0687: Chem	nistry			
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			
<b>Recommended Previous</b>	none			
Knowledge				
Educational Objectives	After taking part successfully, students have r	reached the following learning results		
Professional Competence	2			
Knowledge	The students are able to name and to describ	e basic principles and applications of general c	hemistry (structur	re of matter, periodi
	table, chemical bonds), physical chemistry	, (aggregate states, separating processes,	thermodynamics,	kinetics), inorgani
	chemistry (acid/base, pH-value, salts, solubili	ity, redox, metals) and organic chemistry (alipl	hatic hydrocarbon	is, functional groups
	carbonyl compounds, aromates, reaction me	echanisms, natural products, synthetic polyme	rs). Furthermore	students are able t
	explain basic chemical terms.			
Skills	After successful completion of this module stu	udents are able to describe substance groups a	nd chemical comp	ounds. On this basi
	they are capable of explaining, choosing and	applying specific methods and various reaction	mechanisms.	
Personal Competence	2			
Social Competence	Students are able to take part in discussions of	on chemical issues and problems as a member	of an interdiscipli	inary team. They ca
	contribute to those discussion by their own sta	atements.		
Autonomy	After successful completion of this module s	tudents are able to solve chemical problems	independently by	defending propose
2	approaches with arguments. They can also do		, , ,	51 1
		i i i i i i i i i i i i i i i i i i i		
Workload in Hours	Independent Study Time 96, Study Time in Le	ecture 84		
Credit points		<u></u>		
Course achievement				
	Written exam			
Examination duration and	I 120 min			
scale				
Assignment for the	General Engineering Science (German program	m, 7 semester): Core Qualification: Compulsory		
		1 5		
Following Curricula	Civil- and Environmental Engineering: Core Qu	ualification: Compulsory		

Course L04	60: Chemistry I+II			
Тур	Lecture			
Hrs/wk	4			
-	4			
	Independent Study Time 64, Study Time in Lecture 56			
in Hours				
	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	Course 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
Mathematics I (L2970)		Lecture	4	4
Mathematics I (L2971)		Recitation Section (large)	2	2
Mathematics I (L2972)		Recitation Section (small)	2	2
Module Responsible	Prof. Anusch Taraz			
Admission Requirements	None			
<b>Recommended Previous</b>	School mathematics			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge				
	<ul> <li>Students can name the basic concepts in analy examples</li> </ul>	sis and linear algebra. They are abl	e to explain the	in using appropria
	examples.	these concepts. They are conching	of illustration th	aaa aannaatiana w
	<ul> <li>Students can discuss logical connections between the help of everyplace</li> </ul>	these concepts. They are capable	or illustrating th	ese connections w
	the help of examples.			
	<ul> <li>They know proof strategies and can reproduce the</li> </ul>			
CI-:!!-				
Skills	<ul> <li>Students can model problems in analysis and line</li> </ul>	ear algebra with the help of the conce	epts studied in th	nis course. Moreove
	they are capable of solving them by applying esta	blished methods.		
	<ul> <li>Students are able to discover and verify further lo</li> </ul>	gical connections between the conce	ots studied in the	e course.
	<ul> <li>For a given problem, the students can develop</li> </ul>	and execute a suitable approach, a	nd are able to c	ritically evaluate t
	results.			
Personal Competence				
Social Competence	Churchenster and a blacker wordt her webben in her men. The			
	<ul> <li>Students are able to work together in teams. They</li> <li>In doing so, they can communicate new concents</li> </ul>			
	<ul> <li>In doing so, they can communicate new concepts design examples to check and deepen the unders</li> </ul>		erating partners	. Moreover, they c
		tanding of their peers.		
Autonomy				
Autonomy	<ul> <li>Students are capable of checking their understar</li> </ul>	iding of complex concepts on their o	wn. They can sp	ecify open questio
	precisely and know where to get help in solving the	nem.		
	Students have developed sufficient persistence	to be able to work for longer period	s in a goal-orien	ted manner on ha
	problems.			
Workload in Hours Credit points	Independent Study Time 128, Study Time in Lecture 112			
Course achievement	Compulsory Bonus Form Descr	ption		
	Yes 10 % Excercises			
Examination	Written exam			
Examination duration and	120 min			
scale				
Assignment for the	General Engineering Science (German program, 7 seme	ster): Core Qualification: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Core Qualification	Compulsory		
	Bioprocess Engineering: Core Qualification: Compulsory			
	Chemical and Bioprocess Engineering: Core Qualification			
	Digital Mechanical Engineering: Core Qualification: Comp	bulsory		
	Electrical Engineering: Core Qualification: Compulsory	institut Course !		
	Green Technologies: Energy, Water, Climate: Core Quality			
	Computer Science in Engineering: Core Qualification: Co			
	Integrated Building Technology: Core Qualification: Com	pulsory		
	Logistics and Mobility: Core Qualification: Compulsory			
	Mechanical Engineering: Core Qualification: Compulsory			
	Mechatronics: Core Qualification: Compulsory			
	Orientation Studies: Core Qualification: Elective Compute	ory		
	Naval Architecture: Core Qualification: Compulsory			
	Process Engineering: Core Qualification: Compulsory	bility Coro Qualification Course		
	Engineering and Management - Major in Logistics and Me	obility: Core Qualification: Compulsory	1	

Course L2970: Mathematics	
	Lecture
Hrs/wk	4
CP	4
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56
Lecturer	Prof. Anusch Taraz
Language	DE
Cycle	WiSe
Content	Mathematical Foundations:
	sets, statements, induction, mappings, trigonometry
	Analysis: Foundations of differential calculus in one variable
	natural and real numbers
	convergence of sequences and series
	continuous and differentiable functions
	mean value theorems
	Taylor series
	• calculus
	error analysis
	fixpoint iteration
	Linear Algebra: Foundations of linear algebra in R <sup>n</sup>
	vectors: rules, linear combinations, inner and cross product, lines and planes
	systems of linear equations: Gauß elimination, linear mappings, matrix multiplication, inverse matrices, determinants
	orthogonal projection in R <sup>n</sup> , Gram-Schmidt-Orthonormalization
	1
Literature	• T. Arens u.a. : Mathematik, Springer Spektrum, Heidelberg 2015
	<ul> <li>W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994</li> </ul>
	<ul> <li>W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994</li> </ul>
	<ul> <li>G. Strang: Lineare Algebra, Springer-Verlag, 2003</li> </ul>
	<ul> <li>G. suang. Encare Algebra, springer-verlag, 2005</li> <li>G. und S. Teschl: Mathematik für Informatiker, Band 1, Springer-Verlag, 2013</li> </ul>

Course L2971: Mathematics	1
Тур	Recitation Section (large)
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Anusch Taraz, Dr. Dennis Clemens, Dr. Simon Campese
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Course L2972: Mathematics	l
Тур	Recitation Section (small)
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Anusch Taraz
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Courses				
Title		Тур	Hrs/wk	СР
Engineering Mechanics I (Statics) (		Lecture	2	3
Engineering Mechanics I (Statics) ( Engineering Mechanics I (Statics) (		Recitation Section (large) Recitation Section (small)	1 2	1 2
	Prof. Benedikt Kriegesmann	Rectation Section (Small)	L	L
Admission Requirements				
	Solid school knowledge in mathematics and physics.			
Knowledge				
-	After taking part successfully, students have reached the	following learning results		
Professional Competence				
-	The students can			
	<ul> <li>describe the axiomatic procedure used in mechanic</li> </ul>	cal contexts;		
	<ul> <li>explain important steps in model design;</li> </ul>			
	<ul> <li>present technical knowledge in stereostatics.</li> </ul>			
Skills	The students can			
	explain the important elements of mathematical /	mechanical analysis and model for	mation, and apply	y it to the contex
	their own problems;			
	<ul> <li>apply basic statical methods to engineering problem</li> </ul>	ms;		
	<ul> <li>estimate the reach and boundaries of statical methods</li> </ul>	nods and extend them to be applicab	le to wider proble	em sets.
Personal Competence	<ul> <li>estimate the reach and boundaries of statical meth</li> </ul>	nods and extend them to be applicab	ole to wider proble	em sets.
•			ole to wider proble	em sets.
Social Competence	The students can work in groups and support each other	to overcome difficulties.	·	
Social Competence		to overcome difficulties.	·	
Social Competence Autonomy	The students can work in groups and support each other	to overcome difficulties.	·	
Social Competence Autonomy	The students can work in groups and support each other s Students are capable of determining their own strengths Independent Study Time 110, Study Time in Lecture 70	to overcome difficulties.	·	
Social Competence Autonomy Workload in Hours	The students can work in groups and support each other of Students are capable of determining their own strengths Independent Study Time 110, Study Time in Lecture 70 6	to overcome difficulties.	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement	The students can work in groups and support each other of Students are capable of determining their own strengths Independent Study Time 110, Study Time in Lecture 70 6	to overcome difficulties.	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination	The students can work in groups and support each other of Students are capable of determining their own strengths Independent Study Time 110, Study Time in Lecture 70 6 None Written exam	to overcome difficulties.	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement	The students can work in groups and support each other of Students are capable of determining their own strengths Independent Study Time 110, Study Time in Lecture 70 6 None Written exam	to overcome difficulties.	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale	The students can work in groups and support each other for students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min	to overcome difficulties. and weaknesses and to organize the	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other for Students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale	The students can work in groups and support each other for Students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification:	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other for Students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification: Bioprocess Engineering: Core Qualification: Compulsory	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other for Students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification:	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other for Students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification: Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification:	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory Compulsory pulsory	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other for Students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification: Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification: Data Science: Specialisation II. Application: Elective Comp	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory Compulsory Julsory Jlsory	·	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other for Students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification: Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification: Data Science: Specialisation II. Application: Elective Compu Electrical Engineering: Core Qualification: Elective Compu	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory Compulsory Jlsory cation: Compulsory	ir time and learni	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other for Students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification: Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification: Data Science: Specialisation II. Application: Elective Compu Electrical Engineering: Core Qualification: Elective Compu Green Technologies: Energy, Water, Climate: Core Qualifi	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory Compulsory Jory Jory cation: Compulsory ematics & Engineering Science: Elect	ir time and learni	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other for Students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification: Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification: Data Science: Specialisation II. Application: Elective Compu Electrical Engineering: Core Qualification: Elective Compu Green Technologies: Energy, Water, Climate: Core Qualific Computer Science in Engineering: Specialisation II. Mathe	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory Compulsory Jory Jory cation: Compulsory ematics & Engineering Science: Elect	ir time and learni	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other for Students are capable of determining their own strengths of Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification: Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification: Data Science: Specialisation II. Application: Elective Compu Electrical Engineering: Core Qualification: Elective Compu Green Technologies: Energy, Water, Climate: Core Qualific Computer Science in Engineering: Specialisation II. Mathe Integrated Building Technology: Core Qualification: Comp	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory Compulsory Jory Jory cation: Compulsory ematics & Engineering Science: Elect	ir time and learni	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other of Students are capable of determining their own strengths in Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification: Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification: Data Science: Specialisation II. Application: Elective Compu Electrical Engineering: Core Qualification: Elective Compu Green Technologies: Energy, Water, Climate: Core Qualific Computer Science in Engineering: Specialisation II. Mathe Integrated Building Technology: Core Qualification: Compulsory Mechanical Engineering: Core Qualification: Compulsory Mechatronics: Core Qualification: Compulsory	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory compulsory ulsory ulsory cation: Compulsory ematics & Engineering Science: Elect pulsory	ir time and learni	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other of Students are capable of determining their own strengths in Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification: Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification: Data Science: Specialisation II. Application: Elective Compu Electrical Engineering: Core Qualification: Elective Compu Green Technologies: Energy, Water, Climate: Core Qualific Computer Science in Engineering: Specialisation II. Mathe Integrated Building Technology: Core Qualification: Compulsory	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory compulsory ulsory ulsory cation: Compulsory ematics & Engineering Science: Elect pulsory	ir time and learni	
Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	The students can work in groups and support each other of Students are capable of determining their own strengths in Independent Study Time 110, Study Time in Lecture 70 6 None Written exam 90 min General Engineering Science (German program, 7 semest Civil- and Environmental Engineering: Core Qualification: Bioprocess Engineering: Core Qualification: Compulsory Chemical and Bioprocess Engineering: Core Qualification: Data Science: Specialisation II. Application: Elective Compu Electrical Engineering: Core Qualification: Elective Compu Green Technologies: Energy, Water, Climate: Core Qualific Computer Science in Engineering: Specialisation II. Mathe Integrated Building Technology: Core Qualification: Compulsory Mechanical Engineering: Core Qualification: Compulsory Mechatronics: Core Qualification: Compulsory Orientation Studies: Core Qualification: Elective Compulsory	to overcome difficulties. and weaknesses and to organize the ter): Core Qualification: Compulsory Compulsory compulsory ulsory ulsory cation: Compulsory ematics & Engineering Science: Elect pulsory	ir time and learni	

Course L1001: Engineering M	lechanics I (Statics)
Тур	Lecture
Hrs/wk	2
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Benedikt Kriegesmann
Language	DE
Cycle	WiSe
Content	<ul> <li>Tasks in Mechanics</li> <li>Modelling and model elements</li> <li>Vector calculus for forces and torques</li> <li>Forces and equilibrium in space</li> <li>Constraints and reactions, characterization of constraint systems</li> <li>Planar and spatial truss structures</li> <li>Internal forces and moments for beams and frames</li> <li>Center of mass, volumn, area and line</li> <li>Computation of center of mass by intergals, joint bodies</li> <li>Friction (sliding and sticking)</li> <li>Friction of ropes</li> </ul>
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).

rse L1003: Engineering 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. Benedikt Kriegesmann
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 L1002: Engineering N	Course L1002: Engineering Mechanics I (Statics)	
Тур	Recitation Section (small)	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Benedikt Kriegesmann	
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).	

	j	atics				
Courses						
Гitle			Тур		Hrs/wk	СР
Databases (L2758)			Integ	grated Lecture	1	1
Databases (L2759)			Reci	tation Section (small)	1	1
Object-oriented Modelling (L2468)			Integ	grated Lecture	2	2
Object-oriented Modelling (L2469)			Reci	tation Section (small)	2	2
Module Responsible	Prof. Kay Smarsly					
Admission Requirements	None					
<b>Recommended Previous</b>	Students can descri	ibe and analyze existing	ng software programs in	the discipline based	on their essential	characteristics. The
Knowledge	students are able to	reproduce the element	ary basics and theoretical	concepts of engineering	ng informatics and	l to apply elementa
	solution algorithms to engineering problems. They are also able to define database principles and make simple queries to commo					
	database systems.					
Educational Objectives	After taking part suc	cessfully students have	e reached the following lea	arning results		
Professional Competence	, accir calling pare suc	,eeostany, seadents nav	e reaction and following los	arring results		
•	Eurodomontols of (i)	abject arianted modelin	ng and (ii) database desigi	will be precepted. Th	o students will be	able to develop ar
Kilowieuge						
	-	-	ems required in the area o			
			engineering informatics			
	functions, and procedures, UML notation (such as association, aggregation and composition), control structures, exception					
	handling, data strea	ams, inheritance, abstr	act classes and interface	s, data structures (e.	g. associative me	mory with particu
	emphasis on hash ta	ables and tree structure	es), algorithms and generi	c programming. Part (i	i) follows the data	abase design proce
	and primarily cover	rs conceptual design a	nd semantics of database	e models (with empha	sis on the Entity-	-Relationship Mode
	logical design (inclu	uding integrity constrain	nts, anomalies and norma	lization), relational al	gebra, relational o	query languages a
			sign and implementation,			
		and data exchange in ci	- ,			January 2011 - 2, 220 - 11
	us data integration a	and duta excitatinge in ci	vir engineering.			
Skills						
Skills Personal Competence						
Personal Competence						
Personal Competence Social Competence		Time 96, Study Time in l	Lecture 84			
Personal Competence Social Competence Autonomy	Independent Study T	Time 96, Study Time in l	Lecture 84			
Personal Competence Social Competence Autonomy Workload in Hours	Independent Study T 6 Compulsory Bonus	Form	Description			
Personal Competence Social Competence Autonomy Workload in Hours Credit points	Independent Study T		Description	istung wird ein schri	ftlicher Beleg and	gefertigt. Der Bel
Personal Competence Social Competence Autonomy Workload in Hours Credit points	Independent Study T 6 Compulsory Bonus	Form	Description Als Prüfungsvorle	istung wird ein schri dahin bekannten Le	-	
Personal Competence Social Competence Autonomy Workload in Hours Credit points	Independent Study T 6 Compulsory Bonus	Form	<b>Description</b> Als Prüfungsvorle umfasst die bis	-	ehrinhalte und d	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement	Independent Study T 6 Compulsory Bonus	Form	<b>Description</b> Als Prüfungsvorle umfasst die bis	dahin bekannten Le	ehrinhalte und d	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement	Independent Study T 6 Compulsory Bonus Yes 15 % Written exam	Form	<b>Description</b> Als Prüfungsvorle umfasst die bis	dahin bekannten Le	ehrinhalte und d	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination	Independent Study T 6 Compulsory Bonus Yes 15 % Written exam	Form	<b>Description</b> Als Prüfungsvorle umfasst die bis	dahin bekannten Le	ehrinhalte und d	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination duration and scale	Independent Study T 6 Compulsory Bonus Yes 15 % Written exam 180 min	Form Written elaboration	Description Als Prüfungsvorle umfasst die bis Studierenden auf	dahin bekannten Le	ehrinhalte und d	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination Examination duration and scale Assignment for the	Independent Study T 6 Compulsory Bonus Yes 15 % Written exam 180 min Civil- and Environme	Form Written elaboration	Description Als Prüfungsvorle umfasst die bis Studierenden auf Qualification: Compulsory	dahin bekannten Le die Klausur vorzubereit	ehrinhalte und d	
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination duration and scale	Independent Study T 6 Compulsory Bonus Yes 15 % Written exam 180 min Civil- and Environme Civil- and Environme	Form Written elaboration ental Engineering: Core ental Engineering: Speci	Description Als Prüfungsvorle umfasst die bis Studierenden auf	dahin bekannten Le die Klausur vorzubereit	ehrinhalte und d	

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	<ul> <li>Motivation and basic concepts</li> <li>Terminology and definitions</li> <li>Database design process</li> <li>Conceptual design <ul> <li>Semantics of database models</li> <li>The Entity-Relationship Model</li> <li>Relationships in the ER model</li> <li>Other concepts in the ER model</li> <li>Conceptual modeling with UML</li> </ul> </li> <li>Logical design <ul> <li>The relational model</li> <li>Integrity constraints</li> <li>Anomalies and normalization</li> <li>ER mapping to the relational model</li> <li>Relational query languages</li> <li>Schema definition and modification</li> <li>SQL as a relational query language</li> <li>Modification options in SQL</li> <li>Database views</li> </ul> </li> <li>Physical database design and implementation</li> <li>Concepts of database application development</li> <li>JDBC</li> <li>Data integration and data exchange in civil engineering</li> </ul>
	· · · · · · · · · · · · · · · · · · ·
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

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	<ul> <li>Fundamentals of engineering informatics</li> <li>Programming languages and programming paradigms</li> <li>Programming methodology</li> <li>Objects and classes</li> <li>Constructors</li> <li>Packages and imports</li> <li>Visibility and validity</li> <li>Methods, functions, and procedures</li> <li>Variables and constants</li> <li>UML notation</li> <li>Control structures</li> <li>Expressions and statements</li> <li>Recursion</li> <li>Exception handling</li> <li>Inputs and outputs</li> <li>Data streams</li> <li>Abstract classes and methods</li> <li>Interfaces</li> <li>Data structures and algorithms (e.g. arrays)</li> </ul>
	Generic programming
	Lists, queues, and sets
	<ul> <li>Associative memory (particular emphasis on hash tables and tree structures)</li> </ul>
	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 M0660: Const	ruction Industry and Const	ruction Management		
Module Modol. Const	nuction mutative 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			
<b>Recommended Previous</b>	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		
	<ul> <li>understand basic knowledge of c</li> </ul>	-		
	<ul> <li>choose appropriate methodes of construction project management to solve problems,</li> </ul>			
	<ul> <li>capture basic structures and ant</li> </ul>	agonisms of European enviromental legislation,		
	<ul> <li>locate and apply relevant enviro</li> </ul>	mental regulations		
	<ul> <li>implement any environmental reg</li> </ul>	gulation to the realisation of an construction project an	d to capture the	signifiacance for th
	civil engineer			
	<ul> <li>recognize basic structures of ger</li> </ul>	neral civil and construction law as well as standards for	construction wo	rks
	<ul> <li>capture the content of contracts</li> </ul>	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: 0	Core Qualification: Compulsory		
Following Curricula				

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	<ul> <li>Project development</li> <li>Project management</li> <li>Announcement</li> <li>Order acquisition</li> <li>Project execution</li> <li>Project supervision</li> </ul>
Literature	<ul> <li>Vorlesungsskript, s. www.tuhh.de/gbt</li> <li>Baugeräteliste BGL</li> <li>Honorarordnung für Architekten und Ingenieure HOAI</li> <li>Verdingungsordnung im Bauwesen VOB mit Kommentaren</li> </ul>

Course L0397: Construction	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	ig Contracts
Тур	Lecture
Hrs/wk	1
СР	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Dr. Daniel Waterstraat
Language	DE
Cycle	SoSe
Content	<ul> <li>Detecting the legal foundations and connections of construction law</li> <li>Awareness of legal "Control points" in the construction contract and the construction process</li> <li>Construction contract law according to the BGB and VOB</li> <li>public procurement according to national and EU laws</li> <li>Engineers law</li> </ul>
Literature	<ul> <li>Axel Maser, Baurecht nach BGB und VOB/B Grundlagenwissen für Architekten und Ingenieure, Id Verlag 1., Auflage 2005, 28,00 €</li> <li>Schmeel ATB Baurecht, Auflage 2002, 34,80 €</li> <li>Werner / Pastor, Der Bauprozess 11. Auflage 2005, 149,00 €</li> </ul>

Course L0346: Environmenta	ıl Law
Тур	Lecture
Hrs/wk	1
CP	1
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14
Lecturer	Daniel Welss
Language	DE
Cycle	SoSe
Content	The lecture focusses on:
	<ul> <li>Structure of Environmental Legislation in Europe and Germany</li> <li>Important international, European and German laws/legal regulations (Water Framework Directive, IED, etc.)</li> <li>Interactions between Environmental Laws and Technical Standards</li> </ul>
Literature	<ul> <li>Erbguth, Wilfried; Schlacke, Sabine, Umweltrecht, 6. Auflage 2016</li> <li>Gesetzessammlung Umweltrecht, 26. Auflage 2016 (Beck Texte im dtv)</li> </ul>

Module M1627: Water	r and En	vironm	ent				
Courses							
Title					Тур	Hrs/wk	СР
Project on Water, Environment, Tra	ffic (L2462)				Project-/problem-based Learning	2	3
Water in the Environment (L2461)					Lecture	2	3
Module Responsible	Prof. Mathi	as Ernst					
Admission Requirements							
<b>Recommended Previous</b>	Basic know	ledge of ch	iemistry				
Knowledge							
Educational Objectives	After taking	g part succ	essfully, students ha	ve reached the followi	ng learning results		
Professional Competence							
Knowledge	Students can define generic material interactions between the environmental media. The can demonstrate their knowledge about						
				erials. They are capa	able of explaining the natural	condition o	f waters and othe
	environmental media.						
Skills					f civil engineering independent		resent their finding
	using accredited academic media (e.g. posters) and can give a short summary including scientific references.						
Personal Competence							
Social Competence	Students ca	an fulfil a c	omplex environment	-related assignment ir	the field of civil engineering by	working in a t	eam.
,	Individual students prepare aspects of the given group work independently.						
Workload in Hours		nt Study Tii	me 124, Study Time	in Lecture 56			
Credit points							
Course achievement	Compulsory		Form	Description	e de site as it Dail e su testi a a		
Formation 1	Yes	None	Presentation	ream-Projekt	tarbeit mit Präsentation		
Examination		am					
Examination duration and	60 min						
scale	C				na sieliestien Course Tech I. I.	<b>\ \ \</b>	and Frederica -
5		5 5		ogram, / semester): S	pecialisation Green Technologies	s, Focus Wate	r and Environmenta
Following Curricula	5		1 3	e Qualification: Compu	loon		
			• •			loon	
	Green recr	mologies: E	nergy, water, Clima	ite: specialisation Wat	er Technologies: Elective Compu	isory	

Course L2462: Project on Wa	ter, 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
	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	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	<ul> <li>Basics of global/regional Water Cycle</li> <li>quality of water</li> <li>natural/anthropogenic water ingredients</li> <li>Basics water science</li> <li>water legislation (EU/D)</li> </ul>
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

Module M1803: Engin	eering Mechanics II (Elastostatics)			
Courses				
Title		Тур	Hrs/wk	СР
Engineering Mechanics II (Elastosta	itics) (L0493)	Lecture	2	2
Engineering Mechanics II (Elastosta	tics) (L1691)	Recitation Section (large)	2	2
Engineering Mechanics II (Elastosta	tics) (L0494)	Recitation Section (small)	2	2
Module Responsible	Prof. Christian Cyron			
Admission Requirements	None			
<b>Recommended Previous</b>	Engineering Mechanics I, Mathematics I (basic know	ledge of rigid body mechanics suc	ch as balance of	linear and angu
Knowledge	momentum, basic knowledge of linear algebra like ve	ctor-matrix calculus, basic knowledg	e of analysis suc	h as differential a
	integral calculus)			
Educational Objectives	After taking part successfully, students have reached th	e following learning results		
Professional Competence				
	Having accomplished this module, the students kn	ow and understand the basic con	cepts of continu	ium mechanics a
	elastostatics, in particular stress, strain, constitutive stability of structures.	laws, stretching, bending, torsion,	failure analysis, e	energy methods a
Skills	Having accomplished this module, the students are able to - apply the fundamental concepts of mathematical and mechanical modeling and analysis to problems of their choice - apply the basic methods of elastostatics to problems of engineering, in particular in the design of mechanical structures - to educate themselves about more advanced aspects of elastostatics			
Personal Competence				
Social Competence	Ability to communicate complex problems in elastosta communicate these solutions.	tics, to work out solution to these p	problems togethe	r with others, and
Autonomy	Self-discipline and endurance in tackling independent knowledge.	y complex challenges in elastostation	cs; ability to lear	n also very abstra
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and	90 min			
scale				
Assignment for the	General Engineering Science (German program, 7 seme	ster): Core Qualification: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Core Qualification			
3	Bioprocess Engineering: Core Qualification: Compulsory			
	Chemical and Bioprocess Engineering: Core Qualification	n: Compulsory		
	Electrical Engineering: Core Qualification: Elective Com			
	Green Technologies: Energy, Water, Climate: Core Qual	•		
	Integrated Building Technology: Core Qualification: Corr			
	Mechanical Engineering: Core Qualification: Compulsory			
	Mechatronics: Core Qualification: Compulsory			
	Orientation Studies: Core Qualification: Elective Comput	sory		
	Naval Architecture: Core Qualification: Compulsory	,		
	Technomathematics: Specialisation III. Engineering Scie	nce: Elective Compulsory		
	Process Engineering: Core Qualification: Compulsory			
	Engineering and Management - Major in Logistics and M	ability Core Qualification Compulse		

Course L0493: Engineering M	Aechanics II (Elastostatics)
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
	The lecture Engineering Mechanics II introduces the fundamental concepts of stress and strain and explains how these can be used to characterize and compute elastic deformations of mechanical bodies under loading. The focus of the lecture lies on: basis of continuum mechanics: stress, strain, constitutive laws truss torsion bar beam theory: bending, moment of inertia of area, transverse shear energy methods: Maxwell-Betti reciprocal work theorem, Castigliano's second theorem, theorem of Menabrea strength of materials: maximum principle stress criterion, yield criteria according to Tresca and von Mises stability of mechanical structures: Euler buckling strut
Literature	<ul> <li>Gross, D., Hauger, W., Schröder, J., Wall, W.A.: Technische Mechanik 1, Springer</li> <li>Gross, D., Hauger, W., Schröder, J., Wall, W.A.: Technische Mechanik 2 Elastostatik, Springer</li> </ul>

Course L1691: Engineering M	ourse L1691: Engineering Mechanics II (Elastostatics)		
Тур	Recitation Section (large)		
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 L0494: Engineering Mechanics II (Elastostatics)				
Тур	itation Section (small)			
Hrs/wk	2			
СР	2			
Workload in Hours	ependent Study Time 32, Study Time in Lecture 28			
Lecturer	nf. Christian Cyron			
Language				
Cycle	Se			
Content	ee interlocking course			
Literature	See interlocking course			

Module M0590: Buildi	ng Materials ar	nd Building (	Chemistry			
Courses						
Title				Тур	Hrs/wk	СР
Building Materials and Building Che	mistry (L0248)			Lecture	4	4
Building Materials and Building Che	mistry (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	have reached the follow	ing learning results		
Professional Competence						
Knowledge	The students are at	ole to explain th	e most important con	nponents, the manufacture	, the structure, t	he most important
	characteristics of the relevant building mate		viour and the corrosion	behaviour, the material tes	sting and the field	s of utilization of all
Skille	The students are abl	a to access the i	sability of building ma	terials for different applica	tions and to selec	t building materials
JKIIIS				students are able to prepare		
		-	-	the connections between th		
			ls and mixtures to avoid			
Personal Competence						
Social Competence	The students are able	to support each	other to learn the very	extensive specialist knowled	lge in learning grou	ups and to carry out
	exercises in small gro	ups in the lab.				
Autonomy	The students are able	to make the timin	g and the operation ste	ps to learn the specialist kno	wledge of a very e	xtensive field.
Workload in Hours	Independent Study Tir	me 110, Study Tim	ne in Lecture 70			
Credit points	6					
Course achievement	Compulsory Bonus	Form	Description			
	No 10 %	Presentation				
Examination						
Examination duration and scale	2 h written exam					
	General Engineering	cience (German n	rogram 7 semester). Sr	pecialisation Civil Engineering	a. Compulsory	
-			ore Qualification: Compu	-	g. compaisory	
i onowing curricula			ualification: Compulsory			
	Orientation Studies: C					

ourse 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			
	enning, O.; Knöfel, D.: Baustoffchemie. ISBN 3-345-00799-1			
	Knoblauch, H.; Schneider, U.: Bauchemie. ISBN 3-8041-5174-4			

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

Module M0851: Math				
	ematics II			
Courses				
Title		Тур	Hrs/wk	СР
Mathematics II (L2976)		Lecture	4	4
fathematics II (L2977)		Recitation Section (large)	2	2
Mathematics II (L2978)		Recitation Section (small)	2	2
	Dref Anuash Taran		-	-
Module Responsible				
Admission Requirements	None			
<b>Recommended Previous</b>	Mathematics I			
Knowledge				
Educational Objectives	After taking part successfully, students have	ve reached the following learning results		
Professional Competence				
Knowledge				
<i>Skills</i> <b>Personal Competence</b> <i>Social Competence</i>	<ul> <li>examples.</li> <li>Students can discuss logical connect the help of examples.</li> <li>They know proof strategies and can</li> <li>Students can model problems in an they are capable of solving them by</li> <li>Students are able to discover and voice.</li> <li>For a given problem, the students results.</li> </ul>	alysis and linear algebra with the help of the co	le of illustrating th ncepts studied in th cepts studied in the and are able to c	ese connections w his course. Moreov e course. ritically evaluate t
Autonomy	<ul> <li>design examples to check and deep</li> <li>Students are capable of checking the precisely and know where to get he</li> </ul>	new concepts according to the needs of their co ben the understanding of their peers. heir understanding of complex concepts on their lp in solving them. t persistence to be able to work for longer peri	own. They can sp	ecify open questic
Workload in Hours	Independent Study Time 128, Study Time	in Lecture 112		
Workload in Hours Credit points		in Lecture 112		
	8	in Lecture 112 Description		
Credit points	8			
Credit points Course achievement	8 Compulsory Bonus Form			
Credit points Course achievement	8 Compulsory Bonus Form Yes 10 % Excercises Written exam			
Credit points Course achievement Examination	8 Compulsory Bonus Form Yes 10 % Excercises Written exam 120 min			
Credit points Course achievement Examination Examination duration and scale	8 Compulsory Bonus Form Yes 10 % Excercises Written exam 120 min	Description		
Credit points Course achievement Examination Examination duration and scale Assignment for the	8 Compulsory Bonus Form Yes 10 % Excercises Written exam 120 min General Engineering Science (German prog	Description gram, 7 semester): Core Qualification: Compulsor	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8 Compulsory Bonus Form Yes 10 % Excercises Written exam 120 min General Engineering Science (German prop Civil- and Environmental Engineering: Core	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8 Compulsory Bonus Form Yes 10 % Excercises Written exam 120 min General Engineering Science (German prop Civil- and Environmental Engineering: Core Bioprocess Engineering: Core Qualification	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory h: Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8 Compulsory Bonus Form Yes 10 % Excercises Written exam 120 min General Engineering Science (German prop Civil- and Environmental Engineering: Core Bioprocess Engineering: Core Qualification Chemical and Bioprocess Engineering: Cor	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory h: Compulsory re Qualification: Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8 Compulsory Bonus Form Yes 10 % Excercises Written exam 120 min General Engineering Science (German prop Civil- and Environmental Engineering: Core Bioprocess Engineering: Core Qualification	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory h: Compulsory re Qualification: Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8 Compulsory Bonus Form Yes 10 % Excercises Written exam 120 min General Engineering Science (German prop Civil- and Environmental Engineering: Core Bioprocess Engineering: Core Qualification Chemical and Bioprocess Engineering: Cor	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory e Qualification: Compulsory ification: Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8         Compulsory Bonus       Form         Yes       10 %       Excercises         Written exam       120 min         General Engineering Science (German proportion)       General Engineering: Core Gualification         Civil- and Environmental Engineering: Core Bioprocess Engineering: Core Qualification       Chemical and Bioprocess Engineering: Core Digital Mechanical Engineering: Core Qualification	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory e Qualification: Compulsory ification: Compulsory Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8         Compulsory Bonus       Form         Yes       10 %       Excercises         Written exam       120 min         General Engineering Science (German proposition)       General Engineering: Core Qualification         Civil- and Environmental Engineering: Core Bioprocess Engineering: Core Qualification       Chemical and Bioprocess Engineering: Core Qualification         Chemical and Bioprocess Engineering: Core Qualification       Chemical Engineering: Core Qualification	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory re Qualification: Compulsory ification: Compulsory Compulsory te: Core Qualification: Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8           Compulsory         Bonus         Form           Yes         10 %         Excercises           Written exam         120 min           General Engineering Science (German prog.         Civil- and Environmental Engineering: Core           Bioprocess Engineering: Core Qualification         Chemical and Bioprocess Engineering: Core           Digital Mechanical Engineering: Core Qualification:         Green Technologies: Energy, Water, Clima           Computer Science in Engineering: Core Qualification:         Green Technologies: Energy, Water, Clima	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory re Qualification: Compulsory ification: Compulsory Compulsory te: Core Qualification: Compulsory ualification: Compulsory	у У	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8           Compulsory         Bonus         Form           Yes         10 %         Excercises           Written exam         120 min	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory re Qualification: Compulsory ification: Compulsory Compulsory te: Core Qualification: Compulsory ualification: Compulsory lification: Compulsory	y	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8           Compulsory         Bonus         Form           Yes         10 %         Excercises           Written exam         120 min         120 min           General Engineering Science (German proportion)         General Engineering: Core Qualification           Chemical and Environmental Engineering: Core Bioprocess Engineering: Core Qualification         Chemical and Bioprocess Engineering: Core Qualification:           Green Technologies: Energy, Water, Clima         Computer Science in Engineering: Core Qualification:           Gregated Building Technology: Core Qualification:         Core Qualification:	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory re Qualification: Compulsory ification: Compulsory Compulsory te: Core Qualification: Compulsory ualification: Compulsory lification: Compulsory Compulsory Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8           Compulsory         Bonus         Form           Yes         10 %         Excercises           Written exam         120 min           General Engineering Science (German programment)         Core Qualification           Given and Environmental Engineering: Core Bioprocess Engineering: Core Qualification         Chemical and Bioprocess Engineering: Core Qualification: Chemical and Bioprocess Engineering: Core Qualification: Green Technologies: Energy, Water, Clima           Gomputer Science in Engineering: Core Qualification: Guestics and Mobility: Core Qualification: Gmechanical Engineering: Core Qualification: Gmec	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory re Qualification: Compulsory ification: Compulsory Compulsory te: Core Qualification: Compulsory ualification: Compulsory lification: Compulsory Compulsory n: Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8           Compulsory         Bonus         Form           Yes         10 %         Excercises           Written exam         120 min           General Engineering Science (German programment)         Core Qualification           Gioprocess Engineering: Core Qualification         Chemical and Bioprocess Engineering: Core Qualification:           Chemical and Bioprocess Engineering: Core Qualification:         Core Qualification:           Green Technologies: Energy, Water, Clima         Computer Science in Engineering: Core Quali           Logistics and Mobility: Core Qualification:         Core Qualification:           Mechanical Engineering: Core Qualification:         Mechanical Engineering: Core Qualification:	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory re Qualification: Compulsory ification: Compulsory Compulsory te: Core Qualification: Compulsory ualification: Compulsory lification: Compulsory compulsory n: Compulsory n: Compulsory n: Compulsory n: Compulsory n: Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8           Compulsory         Bonus         Form           Yes         10 %         Excercises           Written exam         120 min           General Engineering Science (German programment)         Core Qualification           Given and Environmental Engineering: Core Bioprocess Engineering: Core Qualification         Chemical and Bioprocess Engineering: Core Qualification: Chemical and Bioprocess Engineering: Core Qualification: Green Technologies: Energy, Water, Clima           Gomputer Science in Engineering: Core Qualification: Guestics and Mobility: Core Qualification: Gmechanical Engineering: Core Qualification: Gmec	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory re Qualification: Compulsory ification: Compulsory Compulsory te: Core Qualification: Compulsory ualification: Compulsory lification: Compulsory compulsory n: Compulsory n: Compulsory n: Compulsory n: Compulsory n: Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8           Compulsory         Bonus         Form           Yes         10 %         Excercises           Written exam         120 min           General Engineering Science (German programment)         Core Qualification           Gioprocess Engineering: Core Qualification         Chemical and Bioprocess Engineering: Core Qualification:           Chemical and Bioprocess Engineering: Core Qualification:         Core Qualification:           Green Technologies: Energy, Water, Clima         Computer Science in Engineering: Core Quali           Logistics and Mobility: Core Qualification:         Core Qualification:           Mechanical Engineering: Core Qualification:         Mechanical Engineering: Core Qualification:	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory re Qualification: Compulsory ification: Compulsory Compulsory te: Core Qualification: Compulsory ualification: Compulsory lification: Compulsory compulsory n: Compulsory n: Compulsory n: Compulsory cory ective Compulsory	у	
Credit points Course achievement Examination Examination duration and scale Assignment for the	8           Compulsory         Bonus         Form           Yes         10 %         Excercises           Written exam         120 min         120 min           General Engineering Science (German programmental Engineering: Core Qualification Chemical and Bioprocess Engineering: Core Qualification Chemical and Bioprocess Engineering: Core Qualification: Core Digital Mechanical Engineering: Core Qualification: Green Technologies: Energy, Water, Clima Computer Science in Engineering: Core Qual Integrated Building Technology: Core Qual Logistics and Mobility: Core Qualification: Compuls Orientation Studies: Core Qualification: Compuls Orientation Studies: Core Qualification: Electrication: Studies: Core Qualification: Electrication	Description gram, 7 semester): Core Qualification: Compulsor e Qualification: Compulsory a: Compulsory te Qualification: Compulsory ification: Compulsory Compulsory te: Core Qualification: Compulsory ualification: Compulsory lification: Compulsory compulsory a: Compulsory b: Com	у	

Course L2976: Mathematics	11
Тур	Lecture
Hrs/wk	4
СР	4
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56
Lecturer	Prof. Anusch Taraz
Language	DE
Cycle	SoSe
Content	Analysis:
literature	<ul> <li>power series and elementary functions</li> <li>interpolation</li> <li>integration (proper integrals, fundamental theorem, integration rules, improper integrals, parameter dependent integrals</li> <li>applications of integration (volume and surface of bodies of revolution, lines and arc length, line integrals</li> <li>numerical quadrature</li> <li>periodic functions</li> </ul> Linear Algebra: <ul> <li>general vector spaces: subspaces, Euclidean vector spaces</li> <li>linear mappings: basis transformation, orthogonal projection, orthogonal matrices, householder matrices</li> <li>linear regression: normal equations, linear discrete approximation</li> <li>eigenvalues: diagonalising matrices, normal matrices, symmetric and Hermite matrices</li> <li>system of linear differential equations</li> <li>matrix factorizations: LR-decomposition, QR-decomposition, Schur decomposition, Jordan normal form, singular value decomposition</li> </ul>
Literature	<ul> <li>T. Arens u.a. : Mathematik, Spektrum Akademischer Verlag, Heidelberg 2009</li> <li>W. Mackens, H. Voß: Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994</li> <li>W. Mackens, H. Voß: Aufgaben und Lösungen zur Mathematik I für Studierende der Ingenieurwissenschaften, HECO-Verlag, Alsdorf 1994</li> <li>G. Strang: Lineare Algebra, Springer-Verlag, 2003</li> <li>G. und S. Teschl: Mathematik für Informatiker, Band 1, Springer-Verlag, 2013</li> </ul>

Course L2977: Mathematics II			
Тур	Recitation Section (large)		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Anusch Taraz		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Course L2978: Mathematics II			
Тур	Typ Recitation Section (small)		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Anusch Taraz		
Language	DE		
Cycle	SoSe		
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)			Recitation Section (large)	3	3
Module Responsible	Prof. Bastian Oesterl	e			
Admission Requirements	None				
<b>Recommended Previous</b>	Mechanics I, Mathem	natics I			
Knowledge					
Educational Objectives	After taking part suc	cessfully, students have re	ached the following learning results		
Professional Competence					
Knowledge	After successfully co	mpleting this module, stud	ents can express the basic aspects of linear	frame analysis of s	statically determinat
	and indeterminate s	ystems.			
Skills	After successful com	noletion of this module the	e students are able to distinguish between s	statically determina	te and indeterminate
			riables and to construct influence lines of	-	
	frame and truss stru	-		,	
Personal Competence					
Social Competence	Students can				
		subject-specific and interd			
		own work results in front of scientific development of co			
			professional constructive criticism		
	• Furthermore,	they can give and accept p			
Autonomy	The students are ab	le work in-term homeworl	assignments. Due to the in-term feedbac	k, they are enable	d to self-assess thei
	learning progress du	ring the lecture period, alr	eady.		
Workload in Hours	Independent Study T	Time 110, Study Time in Le	cture 70		
Credit points	6	110, study mile in Le			
Course achievement	Compulsory Bonus	Form	Description		
	No 10%	Written elaboration	Hausübungen mit Testat, betreut durch	Studentische Tuto	ren (Tutorium)
Examination	Written exam				
Examination duration and	90 minutes				
scale					
Assignment for the	General Engineering	Science (German program	, 7 semester): Specialisation Civil Engineeri	ng: Compulsory	
Following Curricula	Civil- and Environme	ental Engineering: Core Qua	alification: Compulsory		
	Logistics and Mobilit	y: Specialisation Traffic Pla	nning and Systems: Elective Compulsory		
	Technomathematics	: Specialisation III. Enginee	ring Science: Elective Compulsory		
	Engineering and Mar	nagement - Major in Logisti	cs and Mobility: Specialisation II. Traffic Pla	nning and Systems:	Elective Compulsory

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

Course L0667: Structural Analysis I			
Тур	ation Section (large)		
Hrs/wk	3		
CP	3		
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42		
Lecturer	Bastian Oesterle		
Language	DE		
Cycle	WiSe		
Content	e interlocking course		
Literature	See interlocking course		

9						
Module M0706: Geote	echnics 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	Prof. Jürgen Grabe					
Admission Requirements	None					
<b>Recommended Previous</b>	Modules :					
Knowledge	Mechanics I-II					
	• Mechanics Fil					
Educational Objectives	After taking part successfully, students	s have reached the following learning results				
Professional Competence						
Knowledge	The students know the basics of soil m	nechanics as the structure and characteristics of soil,	stress distribution	due to weight, wate		
	or structures, consolidation and settler	ment calculations, as well as failure of the soil due to g	ground- or slope fa	ilure.		
Skills	After the successful completion of the module the students should be able to describe the mechanical properties and to evaluate					
	them with the help of geotechnical s	tandard tests. They can calculate stresses and defo	rmation in the so	oils due to weight o		
	influence of structures. They are are al	ble to prove the usability (settlements) for shallow fou	ndations.			
Personal Competence						
Social Competence						
Autonomy						
Workload in Hours	Independent Study Time 96, Study Tim	ne in Lecture 84				
Credit points						
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	program, 7 semester): Specialisation Civil Engineering	g: Compulsory			
Following Curricula	Civil- and Environmental Engineering:	Core Qualification: Compulsory				
	Logistics and Mobility: Specialisation T	raffic Planning and Systems: Elective Compulsory				
	Technomathematics: Specialisation III.	Engineering Science: Elective Compulsory				
	Engineering and Management - Major i	in Logistics and Mobility: Specialisation II. Traffic Planr	ing and Systems:	Elective Compulsory		

Course L0550: Soil Mechanics		
Тур	Lecture	
Hrs/wk		
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Jürgen Grabe	
Language	DE	
Cycle	WiSe	
Content		
	Structure of the soil	
	Ground surveying	
	Compstition and properties of the soil	
	Groundwater     One-dimensional compression	
	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	

Course 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	
Content	See interlocking course	
Literature	See interlocking course	

Course L1493: Soil Mechanics		
Тур	Recitation Section (small)	
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	
Content	See interlocking course	
Literature	See interlocking course	

Module M1082: Mathe	ematics III - Differential Equations I			
Courses				
Title Differential Equations 1 (Ordinary Differential Equations) (L1031) Differential Equations 1 (Ordinary Differential Equations) (L1032) Differential Equations 1 (Ordinary Differential Equations) (L1033)		<b>Typ</b> Lecture Recitation Section (small) Recitation Section (large)	Hrs/wk 2 1 1	<b>CP</b> 2 1
Module Responsible	Dozenten des Fachbereiches Mathematik der UHH			
Admission Requirements	None			
<b>Recommended Previous</b>	Mathematics I and II			
Knowledge				
Educational Objectives	After taking part successfully, students have reached th	e following learning results		
Professional Competence Knowledge	<ul> <li>Students can name the basic concepts in Mathen</li> <li>Students can discuss logical connections betwee the help of examples</li> <li>They know proof strategies and can reproduce the</li> </ul>	n these concepts. They are capab		
Skills	<ul> <li>Students can model problems in Mathematics III with the help of the concepts studied in this course. Moreover, they are capable of solving them by applying established methods</li> <li>Students are able to discover and verify further logical connections between the concepts studied in the course.</li> <li>For a given problem, the students can develop and execute a suitable approach, and are able to critically evaluate the results.</li> </ul>			
Personal Competence Social Competence	<ul> <li>Students are able to work together in teams. The</li> <li>In doing so, they can communicate new concept design examples to check and deepen the understanding to check and the understanding to check</li></ul>	s according to the needs of their c		
Autonomy	<ul> <li>Students are capable of checking their understa precisely and know where to get help in solving t</li> <li>Students have developed sufficient persistence problems.</li> </ul>	hem.		
Workload in Hours	Independent Study Time 64, Study Time in Lecture 56			
Credit points	4			
Course achievement				
Examination				
Examination duration and	60 min			
scale Assignment for the Following Curricula	Civil- and Environmental Engineering: Core Qualification	: Compulsory		

Course L1031: Differential Equations 1 (Ordinary Differential Equations)		
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 the theory and numerical treatment of ordinary differential equations	
	<ul> <li>Introduction and elementary methods</li> <li>Exsitence and uniqueness of initial value problems</li> <li>Linear differential equations</li> <li>Stability and qualitative behaviour of the solution</li> <li>Boundary value problems and basic concepts of calculus of variations</li> <li>Eigenvalue problems</li> <li>Numerical methods for the integration of initial and boundary value problems</li> <li>Classification of partial differential equations</li> </ul>	
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 M2037: Struct	ıral Design				
	-				
Courses					
itle		Тур		rs/wk	CP
asics of Structural Design (L0205)		Lecture	2		1
asics in Structural Design (L0209)		Project-/problem-bas			4 1
asics in Structural Design (L0208)		Recitation Section (la	arge) I		T
Module Responsible					
Admission Requirements	lone				
Recommended Previous	Contents of module "Principles of Building I	aterials and Building Physics"			
Knowledge					
	fter taking part successfully, students hav	e reached the following learning results			
Professional Competence					
Knowledge	fter attending the "Building Construction"	nodule students are able			
	<ul> <li>to define the basics of building regul</li> </ul>	tions law			
	<ul> <li>to explain load effects and associate</li> </ul>				
	<ul> <li>to describe overriding conventions o</li> </ul>				
	<ul> <li>to specify typical building componen</li> </ul>				
		- bilities of load bearing behaviour and ris	ks due to lack o	f stability	
	<ul> <li>to explain the main objective of fire of</li> </ul>			, stasticy	
Skills	fter the successful completion of the "Buil		be able		
Skiis		ing construction module, stadents with	be uble		
	<ul> <li>to apply industry-specific drawing co</li> </ul>	iventions			
	carry out preliminary dimensioning of	basic building components			
	<ul> <li>develop stability and foundation con</li> </ul>	epts			
	<ul> <li>and to design and construct standard</li> </ul>	cross-sections due to structural aspects			
Personal Competence					
-	fter attending the course students are abl				
	····· ································				
	<ul> <li>to work in a team and to persent the</li> </ul>	results of the team work			
	<ul> <li>to use the feedback from other stude</li> </ul>	nts to improve the own results			
	<ul> <li>to give a feedback to other students</li> </ul>	n a constructive manner			
Autonomy	fter attending the course students are abl	2			
	<ul> <li>to control and improve their knowled</li> </ul>	ge with the help of weeekly presentation	s (lecture room)	and tests (	
		irts, to deduce the needed knowledge an			
					none steps
Workload in Hours	adapandant Study Tima 110 Study Time :	Locturo 70			
	ndependent Study Time 110, Study Time i	Lecture /U			
Credit points		Description			
Course achievement	es 20 % Subject theoretica		Nohngehäudes	Abashe	von Hausarboit
	practical work	Betreuung durch Tutoren.	moningebaudes.	Augabe	
Examination	Vritten exam	bereating durch ratoren.			
Examination duration and	0 min				
scale					
Assignment for the	General Engineering Science (German prog	am, 7 semester): Specialisation Civil Eng	gineering: Comp	ulsory	
Following Curricula	Civil- and Environmental Engineering: Core	Qualification: Compulsory			

Course L0205: Basics of Stru	ictural Design
Тур	
CP	
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Sebastian Rybczynski
Language	DE
Cycle	WiSe
Content	
	Basics of building regulation laws
	Foundation of buildings
	Sealing of basements
	• facades
	Ceilings
	Roofs
	Windows, doors and post-and-beam constructions
	Staircases
	Basics of strucural engineering design
	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
	Wiesbuden. Wewey Freubrici Venag, 2000
	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
	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
	Wandahawat Dainhawd (Mokeell O. W., Dauwaashaar II.)
	Wendehorst, Reinhard (Wetzell, O. W.,; Baumgartner, H.,)
	Wendehorst Bautechnische Zahlentafeln
	ISBN: 978-3-8351-0055-8
	Stuttgart/Berlin: Teubner/Beuth, 2018

Course L0209: Basics in Stru	ctural 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	
	<ul> <li>Constructing a small individuell building in groups of 4 persons</li> <li>Analysing the informations and the contents of development plans and building regulation laws</li> <li>Design of building components and approving of the funcionality (sealing, facades, roofs)</li> <li>Design and approve of the funcionality of the component interconnections</li> <li>Proofing and assessing of moisture behaviour, energy comsumption, acoustic protection and fire control</li> <li>Assessing the building stability</li> <li>Basics of building services</li> </ul>
	<ul> <li>Each week the results of different work steps are presented in oral and written form</li> </ul>
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 L0208: Basics in Structural 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 funcionality (sealing, facades, roofs)			
	Design and approve of the funcionality of the component interconnections			
	<ul> <li>Proofing and assessing of moisture behaviour, energy comsumption, acoustic protection and fire control</li> </ul>			
	Assessing the building stability			
	Basics of building services     Teach week the results of different week store are presented in eval and written form			
	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 Frank (Kishar Jahannaa)			
	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,			
	Gebaude, Raume, Einrichtungen, Gerate mit dem Menschen als Mals und Ziel ; Handbuch für den Baufachmann, Baunerrn, Lehrenden und Lernenden			
	ISBN: 978-3-8348-0732-8 (GB.)			
	Wiesbaden : Vieweg + Teubner, 2009			

Module M2047: Hydro	omechanics and	l Hydrology				
Co						
Courses						
Title			Тур	Hrs/wk	СР	
Hydrology (L0909)			Lecture	1	1	
Hydrology (L0956)			Project-/problem-based Lea	5	2	
Hydromechanics (L0615) Hydromechanics (L0616)	Lecture 2 2 Project-/problem-based Learning 1 1					
	Duck Datas Fuild		Toject-problem-based Lea	ining 1	1	
Module Responsible						
Admission Requirements						
Recommended Previous		111				
Knowledge	Mechanics I und II					
Educational Objectives	After taking part succ	essfully, students have	eached the following learning results			
Professional Competence						
knowledge	They are able to deriv and quantify the rele	ve the basic formulation evant processes of the	ms of hydromechanics, hydrology groundwa s of i) hydrostatics, ii) kinematics of flows an hydrological water cycle. Besides, the stud reservoir / storage models as well as the c	nd iii) conservation ents can describe	laws and to describ the main aspects of	
Skills	The students are able to apply the fundamental formulations of hydromechanics to basic practical problems. Furthermore, they are able to run, explain and document basic hydraulic experiments.					
		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.					
Personal Competence						
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 groups.					
Autonomy	Students are capable of organising their individual work flow to contribute to the conduct of experiments and to present discipline- specific knowledge. They can provide each other with feedback and suggestions on their results. They are capable of reflecting their study techniques and learning strategy on an individual basis.					
Workload in Hours	Independent Study Ti	me 110, Study Time in L	ecture 70			
Credit points	6					
Course achievement	Compulsory Bonus	Form	Description			
	Yes None	Excercises	Übungsaufgaben Hydrologie			
	Yes None	Group discussion	Erstellung eine Posters zu einer T	hematik aus dem	Themengebiet de	
			Hydrologie in Gruppen und Präsentation	า		
Examination	Written exam					
Examination duration and	150 minutes					
scale						
Assignment for the	General Engineering S	Science (German progra	n, 7 semester): Specialisation Civil Engineeri	ng: Compulsory		
Following Curricula	Civil- and Environmen	tal Engineering: Core Q	alification: Compulsory			
	Logistics and Mobility	: Specialisation Traffic P	anning and Systems: Elective Compulsory			
	Engineering and Mana	agement - Major in Logis	tics and Mobility: Specialisation II. Traffic Plar	ning and Systems	Elective Compulsor	

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
	Introduction to basics of hydrology and groundwater hydrology: <ul> <li>Hydrological cycle</li> <li>Data acquisition in hydrology</li> <li>Data analyses and statistical assessment</li> <li>Statistics of extremes</li> <li>Regionalization methods for hydrological values</li> <li>rainfall-run-off modelling on the basis of a unit hydrograph concept</li> </ul>
Literature	Maniak, U. (2017). Hydrologie und Wasserwirtschaft: Eine Einführung für Ingenieure. Springer Vieweg. Skript "Hydrologie und Gewässerkunde"

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Course L0956: Hydrology					
Тур	Project-/problem-based Learning				
Hrs/wk	1				
СР	2				
Workload in Hours	ndependent Study Time 46, Study Time in Lecture 14				
Lecturer	Prof. Peter Fröhle				
Language	DE				
Cycle	WiSe				
	Introduction to basics of Hydrology: <ul> <li>Hydrological cycle</li> <li>Data acquisition</li> <li>Data analyses and statistical assessment</li> <li>Statistics of extremes</li> <li>Regionalization methods for hydrological values</li> </ul> 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
literature	<ul> <li>Characteristics of fluids</li> <li>Hydrostatics</li> <li>Kinematics of flows, laminar and turbulent flows</li> <li>Conservation laws         <ul> <li>Conservation of mass</li> <li>Conservation of Energy</li> <li>Momentum Equation</li> </ul> </li> <li>Application of conservation laws to flow conditions</li> </ul>
Literature	Skript zur Vorlesung Hydromechanik/Hydraulik, Kapitel 1-2 Truckenbrodt, E.: Lehrbuch der angewandten Fluidmechanik, Springer Verlag, Berlin, 1998. Truckenbrodt, E.: Grundlagen und elementare Strömungsvorgänge dichtebeständiger Fluide / Fluidmechanik, Springer Verlag, Berlin, 1996.

Course L0616: Hydromechan	ourse L0616: Hydromechanics				
Тур	roject-/problem-based Learning				
Hrs/wk					
CP					
Workload in Hours	ndependent Study Time 16, Study Time in Lecture 14				
Lecturer	rof. Peter Fröhle				
Language	DE				
Cycle	WiSe				
Content	See interlocking course				
Literature	See interlocking course				

Module M0613: Reinf	orced Concrete Structures I				
Courses					
Title		Тур		Hrs/wk	СР
Project Seminar Concrete I (L0896)		Semina	r	1	1
Reinforced Concrete Design I (L030		Lecture	1	2	3
Reinforced Concrete Design I (L030	)5)	Recitat	ion Section (large)	2	2
Module Responsible	NN				
Admission Requirements	None				
<b>Recommended Previous</b>	Basic knowledge in structural analysis and	building materials.			
Knowledge	Modules: Structural Analysis I, Mechanics I	+11			
Educational Objectives	After taking part successfully, students hav	e reached the following learn	ing results		
Professional Competence					
Knowledge	The students can outline the history of con combinations and safety concepts. They ar behaviour of the materials and of structura	e able to draft and dimensio			
Skills	The students are able to apply basic procedures of the conception and dimensioning to practical cases. They are capable to drai simple concrete structures and to design them for bending and bending with axial force, and to plan their detailing an execution. Moreover, they can make design and construction sketches and draw up technical descriptions.				
Personal Competence					
Social Competence	Students will be able to produce results of h	nigh quality in working group	5.		
Autonomy	The students are able to carry out simple to	asks in the conception and di	mensioning of structu	ures and to critica	lly reflect the resu
Workload in Hours	Independent Study Time 110, Study Time in	n Lecture 70			
Credit points	6				
Course achievement	CompulsoryBonusFormNoNoneExcercises	Description			
Examination	Written exam				
Examination duration and	120 minutes				
scale					
Assignment for the	General Engineering Science (German prog	ram, 7 semester): Specialisat	ion Civil Engineering	: Compulsory	
Following Curricula	Civil- and Environmental Engineering: Core	Qualification: Compulsory			
Course L0896: Project Semin	ar Concrete I				
Typ	Seminar				
Hrs/wk	1				

Hrs/wk	1			
CP				
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14			
Lecturer	NN			
Language	)E			
Cycle	ioSe			
Content	n 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
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	NN
Language	DE
Cycle	SoSe
Content	The following subjects/contents are treated:
	<ul> <li>history of concrete construction</li> <li>building materials: mechanical and physical-chemical properties of concrete, steel, GFRP, CFRP</li> <li>Introduction in safety concepts, ultimate limit states and safety coefficients</li> <li>actions on structures</li> <li>design of linear concrete members with arbitrary cross section for tension and bending with/without axial force</li> <li>design of slender columns</li> </ul>
Literature	<ul> <li>Download der Unterlagen zur Vorlesung über Stud.IP!</li> <li>Zilch K., Zehetmaier G.: Bemessung im konstruktiven Betonbau. Springer Verlag, 2010</li> <li>König G., Tue N.: Grundlagen des Stahlbetonbaus, 3. Auflage, Teubner-Verlag, 2008</li> <li>Deutscher Beton- und Bautechnikverein E.V.: Beispiele zur Bemessung von Betontragwerken nach Eurocode 2. Band 1: Hochbau, Bauverlag GmbH, Wiesbaden 2011</li> <li>Fingerlos F., Hegger J., Zilch K.: Eurocode 2 für Deutschland. Berlin 2016</li> <li>Dahms KH.: Rohbauzeichnungen, Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997</li> <li>Grasser E., Thielen G.: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken. Deutscher Ausschuss für Stahlbeton, Heft 240, Verlag Ernst &amp; Sohn, Berlin 1978</li> </ul>

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

	tural Analysis				
Courses					
Title			Тур	Hrs/wk	СР
Structural Analysis II (L0673)			Lecture	2	3
Structural Analysis II (L0674)	1		Recitation Section (large)	3	3
Module Responsible	Prof. Bastian Oesterl	le			
Admission Requirements	None				
Recommended Previous	Mechanics I/II				
Knowledge	Mathematics I				
	Differential Ec	quations I			
	<ul> <li>Structural Ana</li> </ul>	alysis I			
Educational Objectives	After taking part suc	cessfully, students have	reached the following learning results		
Professional Competence					
Knowledge			e, students can express the basic aspect	ts of linear frame a	analysis of statica
	indeterminate system	ms.			
Skills	After successful con	npletion of this module,	the students are able to analyze state var	iables and to constru	uct influence lines
Skills		npletion of this module, te plane and spatial frame		iables and to constru	uct influence lines
Skills				iables and to constru	uct influence lines
Skills				iables and to constru	uct influence lines
Skills				iables and to constru	uct influence lines
				iables and to constru	uct influence lines
Personal Competence	statically inderminat			iables and to constru	uct influence lines
	statically inderminat	e plane and spatial frame	e and truss structures.	iables and to constru	uct influence lines
Personal Competence	statically inderminat Students can • participate in	subject-specific and inter	e and truss structures. disciplinary discussions,	iables and to constru	uct influence lines
Personal Competence	statically inderminat Students can • participate in • defend their c	subject-specific and inter	e and truss structures. disciplinary discussions, of others	iables and to constru	uct influence lines
Personal Competence	statically inderminat Students can • participate in • defend their o • promote the s	subject-specific and inter wn work results in front of scientific development of	e and truss structures. disciplinary discussions, of others colleagues	iables and to constru	uct influence lines
Personal Competence	statically inderminat Students can • participate in • defend their o • promote the s	subject-specific and inter wn work results in front of scientific development of	e and truss structures. disciplinary discussions, of others	iables and to constru	uct influence lines
<b>Personal Competence</b> Social Competence	statically inderminat Students can • participate in • defend their o • promote the s • Furthermore,	subject-specific and inter swn work results in front of scientific development of they can give and accept	e and truss structures. disciplinary discussions, of others colleagues		
<b>Personal Competence</b> Social Competence	statically inderminat Students can • participate in • defend their o • promote the s • Furthermore, The students are ab	subject-specific and inter swn work results in front of scientific development of they can give and accept	e and truss structures. disciplinary discussions, of others colleagues professional constructive criticism work assignments. Due to the in-term feedb		
<b>Personal Competence</b> Social Competence	statically inderminat Students can • participate in • defend their o • promote the s • Furthermore, The students are ab	subject-specific and inter ywn work results in front of scientific development of they can give and accept le to work in-term homew	e and truss structures. disciplinary discussions, of others colleagues professional constructive criticism work assignments. Due to the in-term feedb		
<b>Personal Competence</b> Social Competence Autonomy	statically inderminat Students can • participate in • defend their c • promote the s • Furthermore, The students are ab learning progress du	subject-specific and inter with work results in front of scientific development of they can give and accept le to work in-term homev ring the lecture period, a	e and truss structures. disciplinary discussions, of others colleagues professional constructive criticism work assignments. Due to the in-term feedb lready.		
Personal Competence Social Competence Autonomy Workload in Hours	statically inderminat Students can • participate in • defend their c • promote the s • Furthermore, The students are ab learning progress du Independent Study T	subject-specific and inter ywn work results in front of scientific development of they can give and accept le to work in-term homew	e and truss structures. disciplinary discussions, of others colleagues professional constructive criticism work assignments. Due to the in-term feedb lready.		
<b>Personal Competence</b> Social Competence Autonomy	statically inderminat Students can • participate in • defend their c • promote the s • Furthermore, The students are ab learning progress du Independent Study T 6	subject-specific and inter swn work results in front of scientific development of they can give and accept le to work in-term homev uring the lecture period, a Fime 110, Study Time in L	e and truss structures. disciplinary discussions, of others colleagues professional constructive criticism work assignments. Due to the in-term feedb lready.		
Personal Competence Social Competence Autonomy Workload in Hours	statically inderminat Students can • participate in • defend their o • promote the s • Furthermore, The students are ab learning progress du Independent Study T 6 <b>Compulsory Bonus</b>	subject-specific and inter own work results in front of scientific development of they can give and accept le to work in-term homew ring the lecture period, a Fine 110, Study Time in L	disciplinary discussions, of others colleagues professional constructive criticism work assignments. Due to the in-term feedb lready. 	ack, they are enable	ed to self-assess the
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement	Statically inderminat Students can • participate in • defend their o • promote the s • Furthermore, The students are ab learning progress du Independent Study T 6 Compulsory Bonus No 10 %	subject-specific and inter swn work results in front of scientific development of they can give and accept le to work in-term homev uring the lecture period, a Fime 110, Study Time in L	e and truss structures. disciplinary discussions, of others colleagues professional constructive criticism work assignments. Due to the in-term feedb lready.	ack, they are enable	ed to self-assess the
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination	Statically inderminat Students can • participate in • defend their o • promote the s • Furthermore, The students are ab learning progress du Independent Study T 6 Compulsory Bonus No 10 % Written exam	subject-specific and inter own work results in front of scientific development of they can give and accept le to work in-term homew ring the lecture period, a Fine 110, Study Time in L	disciplinary discussions, of others colleagues professional constructive criticism work assignments. Due to the in-term feedb lready. 	ack, they are enable	ed to self-assess the
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination	Statically inderminat Students can • participate in • defend their o • promote the s • Furthermore, The students are ab learning progress du Independent Study T 6 Compulsory Bonus No 10 % Written exam	subject-specific and inter own work results in front of scientific development of they can give and accept le to work in-term homew ring the lecture period, a Fine 110, Study Time in L	disciplinary discussions, of others colleagues professional constructive criticism work assignments. Due to the in-term feedb lready. 	ack, they are enable	ed to self-assess the
Personal Competence Social Competence Autonomy Workload in Hours Credit points Course achievement Examination	statically inderminat Students can • participate in • defend their o • promote the s • Furthermore, The students are ab learning progress du Independent Study T 6 Compulsory Bonus No 10 % Written exam 90 minutes	subject-specific and inter with work results in front of scientific development of they can give and accept le to work in-term homew ring the lecture period, a Form Written elaboration	disciplinary discussions, of others colleagues professional constructive criticism work assignments. Due to the in-term feedb lready. 	back, they are enable	ed to self-assess the

Course L0673: Structural Ana	alysis II
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	SoSe
Content	<ul> <li>Analysis of statically indeterminant structures, force method</li> <li>displacement method</li> <li>computational methods, direct stiffness method</li> <li>introduction to the finite element method</li> <li>elastically supported structures</li> <li>Pre-stressed systems</li> </ul>
Literature	<ul> <li>Vorlesungsmanuskript</li> <li>Bletzinger et al.: Aufgabensammlung zur Baustatik: Übungsaufgaben zur Berechnung ebener Stabtragwerke. Hanser.</li> <li>Dinkler: Grundlagen der Baustatik. Springer.</li> <li>Marti: Baustatik. Ernst und Sohn.</li> </ul>

Course L0674: Structural Analysis II				
Тур	Recitation Section (large)			
Hrs/wk				
CP				
Workload in Hours	ndependent Study Time 48, Study Time in Lecture 42			
Lecturer	Prof. Bastian Oesterle			
Language	DE			
Cycle	SoSe			
Content	See interlocking course			
Literature	See interlocking course			

Module M0686: Sanita	ary Engineering I			
Courses				
<b>Title</b> Wastewater Disposal (L0276) Wastewater Disposal (L0278)		<b>Typ</b> Lecture Recitation Section (large)	Hrs/wk 2 1	<b>CP</b> 2
Drinking Water Supply (L0306) Drinking Water Supply (L0308)		Lecture Recitation Section (large)	2	1 2
Module Responsible	Prof. Ralf Otterpohl			
Admission Requirements	None			
Recommended Previous Knowledge	<ul> <li>Basic knowledge on Chemistry and Biole</li> <li>Hydraulics of pipe systems and open ch</li> <li>Basic knowledge on water management</li> <li>Basic knowledge on Environmental Legi</li> </ul>	annels : water quantity and water quality		
Educational Objectives	After taking part successfully, students have re	eached the following learning results		
Professional Competence				
Knowledge	The students can examplify their expert knowledge on urban water infrastructures. They can present the derivation and detail explanation of important standards for the design of drinking water supply and wastewater disposal systems in Germany and the are capable of reproducing the relevant empiricals assumptions and scientific simplifications. The students are able to present a discuss sanitary engineering processes and the technologies used for drinking and wastewater treatment. They can also ass existing problems in the field of sanitary engineering by considering legal, risk and saftey aspects. Furthermore, they know how draft the features and effectiveness of important technologies of the future such as high- and low-pressure membrane filtrat systems and techniques for the removal of trace pollutants.		in Germany and the e able to present au They can also asse re, they know how	
Skills	The students are able to apply the relevant si independently. Their expertise comprises expe associated treatment facilities. Besides the ac problems in the filed of drinking water and v improve the existing water related infrastructu	ert skills to design drinking water supply and u quirement of technical skills the students are vastewater treatment. The students are also	urban drainage sy able to address a	vstems as well as the study of the solve biochemic
Personal Competence Social Competence	Social skills are not targeted in this module.			
Autonomy	Students are able to form concepts on their appropriate knowledge when being given sor follow-up of the exercises).			,
Workload in Hours	Independent Study Time 96, Study Time in Leo	ture 84		
Credit points	6			
Course achievement	None			
Examination	Written exam			
Examination duration and	120 min			
scale				
Assignment for the Following Curricula	General Engineering Science (German progran Civil- and Environmental Engineering: Core Qu		gies: Compulsory	
	Green Technologies: Energy, Water, Climate: C	Core Qualification: Compulsory		

ourse L0276: Wastewater D	Visposal
	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Ralf Otterpohl
Language	DE
Cycle	SoSe
Content	This lecture focusses on urban drainage and wastewater treatment.
	Urban Drainage
	<ul> <li>Design of urban drainage systems (combined and separate sewer systems)</li> </ul>
	Special structures
	Rainwater management
	Wastewater treatement
	<ul> <li>Mechanical treatment (Screens, Grit chamber, Preliminary Sedimentation, Secondary Settlement Tanks, Membra Filtration)</li> </ul>
	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.
	<ul> <li>Taschenbuch der Stadtentwässerung : mit 10 Tafeln und 67 Tabellen, Imhoff, K., &amp; . (2009). (31., verbesserte Aufl München: Oldenbourg Industrieverl.</li> <li>Abwasser : Technik und Kontrolle. Neitzel, Volkmar, and Weinheim [u.a.]: Wiley-VCH, 1998.</li> </ul>
	• Kommunale Kläranlagen : Bemessung, Erweiterung, Optimierung, Betrieb und Kosten, (2009). Günthert, F. Wolfgang: völlig neu bearb. Aufl.). Renningen: expert-Verl.
	<ul> <li>Water and wastewater technology Hammer, M. J. 1., &amp; . (2012). (7. ed., internat. ed.). Boston [u.a.]: Pearson Educat International.</li> </ul>
	<ul> <li>Water and wastewater engineering : design principles and practice: Davis, M. L. 1. (2011). New York, NY: McGraw-Hill.</li> <li>Biological wastewater treatment: (2011). C. P. Leslie Grady, Jr. (3. ed.). London, Boca Raton, Fla. [u.a.]: IWA Publ.</li> </ul>

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
CP	1
Workload in Hours	Independent Study Time 2, Study Time in Lecture 28
Lecturer	Dr. Klaus Johannsen, Prof. Mathias Ernst
Language	DE
Cycle	SoSe
Content	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	

Linginieerinig				
Module M0611: Steel	Structures I			
Courses				
Title		Тур	Hrs/wk	СР
Steel Structures I (L0299)		Lecture	2	3
Steel Structures I (L0300)		Recitation Section (large)	2	3
Module Responsible				
Admission Requirements	None			
Recommended Previous	<ul> <li>Structural analysis I, Structural analysis II</li> </ul>			
Knowledge	Mechanics I, Mechanics II			
	<ul> <li>Building Materials and Building Chemistry</li> </ul>			
	<ul> <li>Principles of Building Materials and Building Phys</li> </ul>	ics		
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge	After passing this module students are able to			
	<ul> <li>give a summary of the security concept</li> </ul>			
	<ul> <li>explain the priciples of the design process</li> </ul>			
	<ul> <li>describe and illustrate the bhaviour of memers in</li> </ul>	tension, compression and bending		
		·,		
Skills	Students can rate and apply the material steel appropia	tely with respect to its properties and	usage.	
	They can use the security concept with respect to loads	, forces and resistances.		
	They can check the ultimate limit state and the service	ability of simple members in tension, c	ompression and	bending.
Personal Competence				
Social Competence	After participation of an optional course (building of a	simple truss) they are able to organiz	e themselves in	groups. They will be
	successful in guided building a truss with bolted connec	tions according to design drawings.		
Autonomy	The students develop the ability to design simple stru	uctures. Based on this knowledge, the	e students are p	repared to dive into
	special topics of steel structures design.			
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 seme	ester): Specialisation Civil Engineering:	Compulsory	
Following Curricula	Civil- and Environmental Engineering: Core Qualification	n: 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	<ul> <li>Introduction to steel constructions</li> <li>Materials</li> <li>Design and security model</li> <li>Tension rods</li> <li>Beams (elsatic and plastic design</li> <li>Column design</li> <li>Bolted connections</li> </ul>
Literature	<ul> <li>Petersen, C.: Stahlbau, 4. Auflage 2013, Springer-Vieweg Verlag</li> <li>Wagenknecht, G.: Stahlbau-Praxis nach Eurocode 3, Bauwerk-Verlag 2011</li> <li>Band 1 Tragwerksplanung, Grundlagen</li> <li>Band 2 Verbindungen und Konstruktionen</li> </ul>

Course 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			
<b>Recommended Previous</b>	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 results 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
	<ul> <li>Introduction and hydrological cycle</li> <li>River engineering <ul> <li>Regime theory of natural rivers</li> <li>Sediment transport</li> <li>Regulation of rivers</li> <li>Bank protection / protection of river bed</li> <li>Tidal rivers</li> </ul> </li> <li>Flood protection <ul> <li>Dikes</li> <li>Flood contraol basins</li> </ul> </li> <li>Hydraulic power</li> <li>Inland waterways engineering <ul> <li>waterways</li> <li>Locks and ship lifts</li> <li>Fish passages</li> </ul> </li> <li>Nature-oriented hydraulic engineering</li> </ul>
Literature	Strobl, T. & Zunic, F: Wasserbau, Springer 2006
	Patt, H. & Gonsowski, P: Wasserbau, Springer 2011

Course L0960: Hydraulic Eng	urse 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		

Courses				
Title		Тур	Hrs/wk	СР
Applied Structural Dynamics (L079)		Lecture	2	2
	al Engineering (dual) - 7 CP (L3477)	Lecture	0	7
	al Engineering (dual) - 9 CP (L3478)		0	9
Soil Laboratory Course (L0499)		Practical Course	1	2
Introduction in Statitics with R (L02	86)	Lecture	1	1
Introduction in Statitics with R (L07		Recitation Section (large)	1	1
Excursion construction projects (L1		Project Seminar	2	2
Principles of Geomatics (L0470)		Lecture	2	2
Principles of Geomatics (L0471)		Recitation Section (small)	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
Water and Energy (L3253)		Integrated Lecture	2	2
Module Responsible	Prof. Bastian Oesterle			
Admission Requirements	None			
Recommended Previous	none			
Knowledge				
Educational Objectives	After taking part successfully, students have	reached the following learning results		
Professional Competence				
Knowledge	The students are at home doing with typical a	applications of the study programme.		
Skills	The students are able to use the methods that	at are provided during the lectures for practical of	questions. They a	re able to work in t
	learnt methods into new forms of application	independently".		
Personal Competence				
Social Competence		re able to perform tasks or to conduct a proje	ect in teams. If s	o, they can prese
	discuss and document results accordingly.			
Autonomy	According to the course chosen individual stu	idents can plan and document tasks and work fl	ow for thomsolvo	or for the team
Autonomy			ow for themselves	s of for the team.
	Depends on choice of courses			
Workload in Hours	Depends on choice of courses			
Workload in Hours Credit points	•			
Credit points	•	ualification: Compulsory		

Course L0791: Applied Struct		
	Lecture	
Hrs/wk		
СР		
	Independent Study Time 32, Study Time in Lecture 28	
Examination Form		
Examination duration and	15 min	
scale	De Vier Hellerende ff	
	Dr. Kira Holtzendorff	
Language		
Cycle		
	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 L3477: Applications i	n Civil + Environmental Engineering (dual) - 7 CP
Тур	
Hrs/wk	0
СР	7
Workload in Hours	Independent Study Time 210, Study Time in Lecture 0
Examination Form	Schriftliche Ausarbeitung
Examination duration and	Studienbegleitende und semesterübergreifende Dokumentation: Die Leistungspunkte für das Modul werden durch die Anfertigung
scale	eines digitalen Lern- und Entwicklungsberichtes (E-Portfolio) erworben. Dabei handelt es sich um eine Dokumentation und
	Reflexion der individuellen Lernerfahrungen und Kompetenzentwicklungen im Bereich der Theorie-Praxis-Verzahnung und der
	Berufspraxis. Zusätzlich erbringt das Kooperationsunternehmen gegenüber der Koordinierungsstelle dual@TUHH den Nachweis,
	dass die bzw. der dual Studierende die Praxisphase absolviert hat.
Lecturer	Dr. Henning Haschke, Heiko Sieben
Language	DE/EN
Cycle	WiSe/SoSe
Content	
Literature	

Course L3478: Applications i	n Civil + Environmental Engineering (dual) - 9 CP
Тур	
Hrs/wk	0
СР	9
Workload in Hours	Independent Study Time 270, Study Time in Lecture 0
Examination Form	Schriftliche Ausarbeitung
Examination duration and	Studienbegleitende und semesterübergreifende Dokumentation: Die Leistungspunkte für das Modul werden durch die Anfertigung
scale	eines digitalen Lern- und Entwicklungsberichtes (E-Portfolio) erworben. Dabei handelt es sich um eine Dokumentation und
	Reflexion der individuellen Lernerfahrungen und Kompetenzentwicklungen im Bereich der Theorie-Praxis-Verzahnung und der
	Berufspraxis. Zusätzlich erbringt das Kooperationsunternehmen gegenüber der Koordinierungsstelle dual@TUHH den Nachweis,
	dass die bzw. der dual Studierende die Praxisphase absolviert hat.
Lecturer	Dr. Henning Haschke, Heiko Sieben
Language	DE/EN
Cycle	WiSe/SoSe
Content	
Literature	

Course L0499: Soil Laborator	y 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
Examination duration and	Die gesamte Arbeitszeit im Praktikum plus anschließender Bericht = 90 Stunden Arbeitszeit (Das Erstellen der Ausarbeitung =
scale	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 L0776: Introduction in Statitics with R	
Тур	Recitation Section (large)
Hrs/wk	1
СР	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
CP	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	<ul> <li>Overview of geomatics in general</li> <li>Units of measurements</li> <li>Generating of topographical maps</li> <li>Basic surveying instruments and handling</li> <li>Geodetic surveying lines and verification of measurements</li> <li>Methods of horizontal survey</li> <li>Components of geodetic surveying instruments</li> <li>Height determination</li> <li>Setting out points</li> <li>Topographical survey</li> <li>Directions and angles</li> <li>Determination of coordinates</li> <li>Traversing</li> <li>Basics on surveying and positioning with GNSS</li> </ul>	
Literature	Andree, P.: Grundlagen der Geomatik (Skript)	
	Resnik, B. / Bill, R.: Vermessungskunde für den Planungs- Bau- und Umweltbereich, Wichmann-verlag	
	Witte, B. / Sparla, P.: Vermessungskunde und Grundlagen der Statistik für das Bauwesen, Wichmann-Verlag	
	Gruber, F.J. / Joeckel, R.: Formelsammlung für das Vermessungswesen, Vieweg + Teubner-Verlag	

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 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	
	chemical analysis methods of drinking water. This includes sampling, photometric measurement, complexometric titration as well	
	as acid/base titration. The experiments are strongly related to the processes in drinking water treatment and water distribution (e.	
	g. removal of iron and manganese, softening and conditioning). Instrumental analytics is not subject of this practical course.	
	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	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	Fachtheoretisch-fachpraktische Arbeit	
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	Fachtheoretisch-fachpraktische Arbeit
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	of Civil- and Environmental Engineering 3LP
Тур	
Hrs/wk	3
СР	3
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Examination Form	Fachtheoretisch-fachpraktische Arbeit
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
	Lecture
Hrs/wk	
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	<ul> <li>Introduction</li> <li>fire in residential and office buildings</li> <li>town planning: location of residential, office and industry areas, location of fire stations</li> <li>design of roads an water pipes</li> <li>explosions</li> </ul>
Literature	• Schneider U. : Ingenieurmethoden im baulichen Brandschutz. Expert Verlag, 2. Aufl., 2002

Course 12252: Woton and En	
Course L3253: Water and En	ergy
Тур	Integrated 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	10 - 15 Seiten
scale	
Lecturer	Prof. Mathias Ernst
Language	DE
Cycle	SoSe
Content	Water and energy are connected and interlinked in many ways. Water is indispensable for many energy generation technologies (fossil fuels, biomass, hydropower, geothermal energy, etc.) and can be utilized as energy storage (pumped storage, heat, H2, etc.). In turn, energy is needed in all areas of water supply and wastewater disposal. Climate change and the energy transition pose new questions and challenges for the historical interlinking of water and energy. Exemplary contents of the course are (i) Effects of climate change on the medium of water (quantity, quality, availability) and on the German energy supply; (ii)
	Transformation of the water and energy industry with a view to renewable energies; (iii) Energy efficiency in the water industry; (vi) Water supply vs. production of green hydrogen; (v) Water demand and agricultural production (biomass); (vi) Water-energy nexus. The course content is covered in an integrated form as a lecture and in the form of student contributions.
Literature	

### 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			
<b>Recommended Previous</b>	Modules:			
Knowledge				
	Mechanics I-II			
	Geotechnics I			
Educational Objectives	After taking part successfully, students ha	ave reached the following learning results		
Professional Competence				
Knowledge	The students know the basic principles an	nd methods which are required to verificate the stab	ility of geotechni	cal structures.
Skills	After successful completion of the module	e the students are able to:		
	<ul> <li>verificate the stability and usability</li> </ul>			
	<ul> <li>know individual methods of ground improvement and apply them in their range of application,</li> </ul>			
	<ul> <li>design retaining walls.</li> </ul>			
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 96, Study Time i	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 pro	ogram, 7 semester): Specialisation Civil Engineering:	Elective Compu	lsory
Following Curricula	Civil- and Environmental Engineering: Spe	ecialisation Civil Engineering: Compulsory		
-	Civil- and Environmental Engineering: Spe	ecialisation Traffic and Mobility: Elective Compulsory		
	Civil- and Environmental Engineering. Spe	ecialisation Water and Environment: Elective Compu	ISOLA	

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	SoSe
Content	<ul> <li>Shallow foundations</li> <li>Pile foundations</li> <li>Ground improvement</li> <li>Retaining walls</li> <li>Underpinning</li> <li>Groundwater Conservation</li> <li>Cut-off Walls</li> </ul>
Literature	<ul> <li>Vorlesung/Übung s. www.tu-harburg.de/gbt</li> <li>Grabe, J. (2004): Bodenmechanik und Grundbau</li> <li>Kolymbas, D. (1998): Geotechnik - Bodenmechanik und Grundbau</li> <li>Grundbau-Taschenbuch, neueste Auflage</li> </ul>

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	SoSe
Content	See interlocking course
Literature	See interlocking course
	· · · · · · · · · · · · · · · · · · ·

Course L1494: Foundation E	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	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Engineering" Module M0983: Mobil	ty Concents					
	ty concepts					
Courses						
Title			Тур		Hrs/wk	СР
Nobility Research and Transportation			Project-/problem-ba	ased Learning	3	3
lobility in Megacities and Developi	ng Countries (L1182)		Seminar		3	3
Module Responsible	Dr. Philine Gaffron					
Admission Requirements	None					
<b>Recommended Previous</b>	Module Transportation Planning and	Traffic Engineerin	g			
Knowledge						
Educational Objectives	After taking part successfully, stude	nts have reached I	he following learning results			
Professional Competence						
-	Students are able to:					
	<ul> <li>name the different urban tran</li> </ul>	nsport systems exi	sting around the world.			
	<ul> <li>explain the transport challenge</li> </ul>	ges in Asian and Af	rican mega cities.			
	<ul> <li>recognise and relate interact</li> </ul>	ions between tran	sport systems on the one ha	and and ecold	ogical, socio-cu	Itural and econor
	problem areas on the other.					
	<ul> <li>outline specific issues and pro</li> </ul>	oblems in urban de	velopment and transport (in	Germany and	developing co	ountries).
	<ul> <li>explain the effects of external</li> </ul>	l framework factor	s (like energy costs) on trans	port.		
Skills	Students are able to:					
	<ul> <li>analyse and evaluate given s</li> </ul>	aca studios				
	analyse and evaluate given c		iee			
	<ul> <li>transfer learning results to ot</li> </ul>	-				
	analyse specific issues and pr					
	critically assess actors, plann		inned measures and the imp	lementation	of transport pr	ojects in the light
	the UN Millennium Developm					and the set of a standard
	<ul> <li>develop and present sustain</li> </ul>		ai, poverty oriented, gender	balanced an	d economical)	solutions for urb
	personal and goods transport					
Personal Competence						
	Students are able to:					
<i>p</i>						
	<ul> <li>present and explain independ</li> </ul>	lently generated fi	ndings.			
	<ul> <li>constructively discuss potenti</li> </ul>	ally controversial	topics in a group context.			
Autonomy	Students are able to:					
	a second problem in the table of	ine reserved i	nalusia			
	carry out independent literatu		,			
	<ul> <li>independently author a writte</li> </ul>	en report on a give	n topic.			
Workload in Hours	Independent Study Time 96, Study T	Fime in Lecture 84				
Credit points	6					
Course achievement	Compulsory Bonus Form	Des	cription			
	Yes None Participation	in excursions Ex	kursion innerhalb Hamburgs a	abhängig von	aktuellen The	men im Modul
Examination	Written elaboration					
Examination duration and	All assignments in groups (2-4 stude	ents): written repo	t, 2000 words (incl. 2 short p	presentations	of 10 mins.); fi	inal presentation,
	mins plus discussion (incl. slides) a	nd 1000 word repo	rt incl. peer review (individua	al).		
scale	mino. pluo discussion (men. shacs) di					
scale Assignment for the	Civil- and Environmental Engineerin	g: Specialisation T	raffic and Mobility: Compulso	ry		
Assignment for the				-		
Assignment for the	Civil- and Environmental Engineerin	g: Specialisation C	ivil Engineering: Elective Con	npulsory	ry	
Assignment for the	Civil- and Environmental Engineering Civil- and Environmental Engineering	g: Specialisation C g: Specialisation W	ivil Engineering: Elective Con ater and Environment: Electi	npulsory	ry	

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:
	<ul> <li>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?</li> <li>Which external effects in turn are caused by mobility choices and traffic?</li> <li>How should these interactions be evaluated, how and by whom can they be influenced?</li> <li>Which measures at the municipal level can contribute to a more sustainable transport system?</li> </ul> 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: <ul> <li>Environmental Justice : which population groups are disproportionately affected by transport emissions and who causes them?</li> <li>Municipal cycle planning</li> <li>Transport and Climate Protection: can, want, act - everything could be, nothing must be?</li> </ul>
Literature	Die Literaturempfehlungen sind abhängig von den jeweiligen, wechselnden Themenschwerpunkten und werden rechtzeitig vor Beginn der Veranstaltung bekannt gegeben.

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	
Content	The course provides and overview over different transport projects in the metropolitan areas of developing countries. Considerin 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 the are a suitable example for sustainable urban development.
	The following examples could be suitable case studies: Singapore (Metro), Lagos (BRT Light), Guanghzou, Bogota, Jakarta (Fu 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 thi area (also: Skype online interviews with international experts in the transport sector). An English language presentation i also part of the course work.
Literature	Umweltbundesamt: Jahresbericht 2005
	GTZ: The Role of Transport in Urban Development Policy
	TRB/ STI: Sustainable Transportation Indicators - A Recommended Program To Define A Standard Set of Indicators For Sustainable Transportation Planning
	https://www.slocat.net
	https://www.sutp.org
	https://www.oecd.org
	https://www.itdp.org
	https://www.kfw-entwicklungsbank.de
	https://www.transportenvironment.org
	https://www.trl.co.uk
	https://www.embarq.org
	https://www.umweltbundesamt.de
	https://www.eurist.info

Module M1628: Susta	inable Building			
Courses				
Title		Тур	Hrs/wk	СР
Circular flow economy and structur	al recycling (L2464)	Integrated Lecture	2	2
Sustainable building materials and	buildings (L3179)	Integrated Lecture	2	2
Sustainable water management an	d hydraulic engineering (L3180)	Integrated Lecture	2	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
<b>Recommended Previous</b>	Basic knowledge of building materials, building cl	hemistry, building construction and building	g project managen	nent
Knowledge				
Educational Objectives	After taking part successfully, students have read	hed the following learning results		
Professional Competence				
Skills	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. Students can relate relevant legal requirements to practical problems of environmentally sound design and construction and thus justify the application of specific limit values for individual areas of application. Students are able to assess risks that may arise from hazardous construction waste in a concise manner. They are able to critically examine innovative areas of application of sustainable construction on the basis of central engineering, economic and legal criteria. They can thereafter evaluate and propose approaches for alternative solutions exemplarily, e.g. for the processing and recycling of construction waste.			
Personal Competence				
	The students are able to work out their own solul purpose, they can organise themselves in a divis are able to appoint group members to coordinat presentation of work results in the seminar. Students can coordinate their individual work per use of scientific media.	ion of labour and can give themselves a wo	ork and project pla ps of the module	and to moderate the
Workload in Hours	Independent Study Time 96, Study Time in Lectur	re 84		
Credit points	6			
Course achievement	Compulsory         Bonus         Form           Yes         20 %         Written elaboration	Description		
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the	Civil- and Environmental Engineering: Specialisat	ion Water and Environment: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisat	ion Traffic and Mobility: Elective Compulsor	У	
	Civil- and Environmental Engineering: Specialisat	ion Civil Engineering: Elective Compulsory		

Course L2464: Circular flow	economy and structural recycling
Тур	Integrated Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kerstin Kuchta
Language	DE
Cycle	SoSe
Content	<ul> <li>Types, origin, quantities of construction waste and building debris</li> <li>Risks and characterisation of construction waste</li> <li>Avoidance strategies and recycling options for construction waste and building debris</li> <li>Criteria of sampling, analysis and opportunities for the use of treated building materials</li> <li>political and legal requirements for the recycling of building materials</li> </ul>
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 L3179: Sustainable building materials and buildings		
Тур	Integrated Lecture	
Hrs/wk	2	
CP	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Sebastian Rybczynski	
Language	DE	
Cycle	SoSe	
Content		
Literature		

Course L3180: Sustainable w	vater management and hydraulic engineering		
Тур	Integrated 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	SoSe		
Content	Environmental water management and sustainable hydraulic engineering		
	Concepts of environmental responsibility and sustainability		
	<ul> <li>Nature-based concepts, green and hybrid solutions in hydraulic engineering</li> </ul>		
	Sustainable flood, low water and drought management		
	Resource-conserving construction materials and processes		
	<ul> <li>Analysis and evaluation of hydraulic engineering and water management projects</li> </ul>		
Literature	Vorlesungsfolien und ausgewählte Paper werden in der Veranstaltung zur Verfügung gestellt		

Module M1715: Rene	wable Energies				
-					
Courses					
Title		Тур	Hrs/wk	СР	
Fuels II (L3143)		Lecture	1	1	
Renewable Energies I (L2740)		Lecture	2	2	
Renewable Energies I (L2742)		Recitation Section (large)	1	1	
Renewable Energies II (L2741)		Lecture	2	2	
Module Responsible	Prof. Martin Kaltschmitt				
Admission Requirements					
Recommended Previous	none				
Knowledge					
	After taking part successfully, students have rea	ached the following learning results			
Professional Competence					
Knowledge	Upon completion of this module, students will be	e able to provide an overview of characterist	ics of renewable e	nergy systems. The	
	will be able to explain the issues that arise in t	hese systems. Furthermore, they are able t	o explain knowled	ge of energy suppl	
	energy distribution and energy trading in this c	ontext, taking into account contexts borderi	ng on specific disc	iplines. The studen	
	can explain this knowledge in detail for such e	energy systems and take a critical stand or	it. Furthermore, t	hey can explain th	
	environmental impact of using renewable ener	gy systems and have an overview of the ec	onomic classificat	ion of the respecti	
	options.				
Skills	Students are able to apply methodologies for de				
	systems. Furthermore, they can evaluate such	energy systems technically, ecologically an	d economically as	well as systemica	
	and also design them under certain given condi	tions. They are able to select the regulations	necessary for this	in a subject-spec	
	manner, especially by means of non-standard se	olutions 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 t	
	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.				
	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 sustainabilit	ty perspective.			
Autonomy	Students will be able to independently access so	purces about the field, acquire knowledge ar	d transform it to a	ddress new issues	
	· · · · · · · · · · · · · · · · · · ·				
Workload in Hours	Independent Study Time 96, Study Time in Lect	ure 84			
Credit points	6				
Course achievement	None				
Examination	Written exam				
Examination duration and	180 min				
scale					
Assignment for the	General Engineering Science (German program,	7 semester): Specialisation Green Technolo	gies: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisa	ation Civil Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specialisa	ation Traffic and Mobility: Elective Compulsor	У		
	Civil- and Environmental Engineering: Specialisa		-		
	Chemical and Bioprocess Engineering: Specialis		2		
	Engineering Science: Specialisation Chemical ar	5 5 1 5	ngineering: Comp	ulsory	
	Green Technologies: Energy, Water, Climate: Co		ingineering. comp	alsol y	
	Process Engineering: Core Qualification: Compu				
	Core Qualification: Compu	y 1001			

Course L3143: Fuels II		
Тур	Lecture	
Hrs/wk	1	
СР	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Dr. Karsten Wilbrand	
Language	DE	
Cycle	SoSe	
Content	<ul> <li>Regulatory requirements of "alternative" fuels (e.g. RED)</li> <li>Overview of today's alternative fuels</li> <li>o Biodiesel / HEFA</li> <li>o Bioethanol</li> </ul>	
	o Biomethane o Other fuels	
	Overview of future alternative fuels	
	o 2nd generation biofuels	
	Hydrogen and hydrogen derivatives	
	p Electricity-based fuels	
	o Other fuels	
	Electromobility	
	o with battery	
	o with hydrogen fuel cell	
	<ul> <li>Markets and market developments</li> <li>CO2 analyses of the various options per application area</li> <li>Global megatrends and future challenges</li> <li>Developments in vehicle and drive technologies</li> <li>Energy scenarios up to 2050 and significance for the mobility sector</li> </ul>	
Literature	Eigene Unterlagen, Veröffentlichungen, Fachliteratur Literature: Own documents, publications, technical literature	

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
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 Er	iergies I			
Тур	Recitation Section (large)			
Hrs/wk				
СР	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 En	ergies II
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 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

Module M0631: Reinf	orced Concrete	Structures	II			
Courses						
Title Project Concrete Structures II (L089 Concrete Structures II (L0348) Concrete Structures II (L0349)	34)			<b>Typ</b> Project Seminar Lecture Recitation Section (large)	<b>Hrs/wk</b> 1 2 2	<b>CP</b> 1 3 2
Module Responsible	Dr. Adrian Faron					
Admission Requirements	None					
Recommended Previous Knowledge	<ul><li>Basics of safety</li><li>Knowledge in c</li></ul>	y format are requi lesign of beams a	s and combination of actio red. nd columns for ultimate li ructures I, Structural Ana	mit state		
Educational Objectives	After taking part succ	essfully, students	have reached the following	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.					
<b>Personal Competence</b> <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	me 110, Study Tir	ne in Lecture 70			
Credit points						
Course achievement	Compulsory Bonus No None	Form Excercises	Description			
Examination		Exceleibeb				
Examination duration and	120 minutes					
scale						
Assignment for the Following Curricula	Civil- and Environmer	ntal Engineering: S	pecialisation Civil Engine	ecialisation Civil Engineering ering: Compulsory Mobility: Elective Compulsor		lsory
	Civil- and Environmer	ntal Engineering: S	pecialisation Water and E	Environment: Elective Compu	ulsory	

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	Dr. Adrian Faron	
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	Dr. Adrian Faron
Language	DE
Cycle	WiSe
Content	<ul> <li>Design of concrete members for shear, punching and torsion</li> <li>Design for serviceability limit state (durability): crack- and deflection control</li> <li>Detailing</li> <li>Design of discontinuity regions (e.g. corbels, frame corner)</li> <li>design of footings</li> <li>Introduction in the design of slabs</li> <li>Layout and content of a structural design</li> </ul>
Literature	<ul> <li>Vorlesungsumdrucke zum downloaden im STUDiP</li> <li>Zilch K., Zehetmaier G.: Bemessung im konstruktiven Betonbau. Springer Verlag, 2010</li> <li>König G., Tue N.: Grundlagen des Stahlbetonbaus. Teubner Verlag, Stuttgart 1998</li> <li>Deutscher Beton- und Bautechnikverein E.V.: Beispiele zur Bemessung von Betontragwerken nach Eurocode 2. Band 1: Hochbau, Bauverlag GmbH, Wiesbaden 2011</li> <li>Dahms KH.: Rohbauzeichnungen, Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997</li> <li>Grasser E. ,Thielen G.: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken. Deutscher Ausschuss für Stahlbeton, Heft 240, Verlag Ernst &amp; Sohn, Berlin 1978</li> <li>DIN EN 1992-1-1:2011: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 1: Allgemeine Bemessungsregeln für den Hochbau.</li> </ul>

Course 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	Dr. Adrian Faron
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Courses				
Title		Тур	Hrs/wk	CP
Introduction to Management (L088 Exercise Introduction to Manageme		Lecture Recitation Section (small)	3	3 3
Module Responsible				-
Admission Requirements				
Recommended Previous		S		
Knowledge				
Educational Objectives	After taking part successfully, students have r	eached the following learning results		
Professional Competence				
Knowledge		, and also to Investment and Controlling. In pa	rticular they are al	ble to
	<ul> <li>important definitions from the field of M</li> <li>explain the most important aspects of projects</li> <li>describe and explain basic business organization and human ressource mar</li> </ul>	and goals in Management and name the mo functions as production, procurement and nagement, information management, innovation and decision making in Business, esp. in situ ethods from mathematical Finance	st important aspe sourcing, supply in management ar	cts of entreprnet chain managem nd marketing
Skills	Students are able to analyse business units w out an Entrepreneurship project in a team. In		objectives, strateg	ies etc.) and to ca
	<ul> <li>analyse production and procurement sy analyse and apply basic methods of ma</li> <li>select and apply basic methods from m</li> </ul>	ares of companies ler multiple objectives, under uncertainty and o ystems and Business information systems		
Personal Competence Social Competence	Students are able to			
Autonomy	<ul> <li>work successfully in a team of students</li> <li>to apply their knowledge from the lectu</li> <li>to communicate appropriately and</li> <li>to cooperate respectfully with their fellow</li> <li>Students are able to</li> <li>work in a team and to organize the team</li> <li>to write a report on their project.</li> </ul>	ire to an entrepreneurship project and write a o	coherent report on	the project
10/	Independent Study Time 110, Study Time in L	ecture /U		
Credit points	Nono			
Credit points Course achievement				
Credit points Course achievement Examination	Subject theoretical and practical work	us final test (90 minutes)		
Credit points Course achievement Examination Examination duration and	Subject theoretical and practical work several written exams during the semester plu	us final test (90 minutes)		
Credit points Course achievement Examination Examination duration and scale	Subject theoretical and practical work several written exams during the semester plu		/	
Credit points Course achievement Examination Examination duration and scale	Subject theoretical and practical work several written exams during the semester plu General Engineering Science (German program	m, 7 semester): Core Qualification: Compulsory	/	
Credit points Course achievement Examination Examination duration and scale Assignment for the	Subject theoretical and practical work several written exams during the semester plu General Engineering Science (German progran Civil- and Environmental Engineering: Speciali	m, 7 semester): Core Qualification: Compulsory		
Credit points Course achievement Examination Examination duration and scale Assignment for the	Subject theoretical and practical work several written exams during the semester plu General Engineering Science (German progran Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali	m, 7 semester): Core Qualification: Compulsory isation Civil Engineering: Elective Compulsory	ulsory	
Credit points Course achievement Examination Examination duration and scale Assignment for the	Subject theoretical and practical work several written exams during the semester plu General Engineering Science (German program Civil- and Environmental Engineering: Special Civil- and Environmental Engineering: Special Civil- and Environmental Engineering: Special Bioprocess Engineering: Core Qualification: Co	m, 7 semester): Core Qualification: Compulsory isation Civil Engineering: Elective Compulsory isation Water and Environment: Elective Comp isation Traffic and Mobility: Elective Compulsor ompulsory	ulsory	
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Mechanical Engineering: Specialisation Materials in Engineering Sciences: Compulsory
Mechanical Engineering: Specialisation Product Development and Production: Compulsory
Mechanical Engineering: Specialisation Theoretical Mechanical Engineering: Compulsory
Mechanical Engineering: Specialisation Aircraft Systems Engineering: Compulsory
Mechanical Engineering: Specialisation Mechatronics: Compulsory
Mechatronics: Specialisation Electrical Systems: Compulsory
Mechatronics: Specialisation Medical Engineering: Compulsory
Mechatronics: Specialisation Robot- and Machine-Systems: Compulsory
Mechatronics: Specialisation Naval Engineering: Compulsory
Mechatronics: Specialisation Dynamic Systems and AI: 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 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. Matthias Meyer, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Christian Thies, Prof. Christoph Ihl, Prof. Kathrin Fischer,
	Prof. Moritz Göldner, Prof. Thomas Wrona, Prof. Thorsten Blecker, Prof. Tim Schweisfurth, Prof. Wolfgang Kersten
Language	DE
Cycle	WiSe/SoSe
Content	<ul> <li>Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management.</li> <li>Important definitions from Management,</li> <li>Developing Objectives for Business, and their relation to important Business functions</li> <li>Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management, Marketing and Sales</li> <li>Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management</li> <li>Definitions as information, information systems, aspects of data security and strategic information systems</li> <li>Definition and Relevance of innovations, e.g. innovation opporunities, risks etc.</li> <li>Relevance of marketing, B2B vs. B2C-Marketing</li> <li>different techniques from the field of marketing (e.g. scenario technique), pricing strategies</li> <li>important organizational structures</li> <li>basics of human ressource management</li> <li>Introduction to Business Planning and the steps of a planning process</li> <li>Decision Analysis: Elements of decision problems and methods for solving decision problems</li> <li>Selected Planning Tasks, e.g. Investment and Financial Decisions</li> <li>Introduction to Accounting: Accounting, Balance-Sheets, Costing</li> <li>Relevance of Controlling and selected Controlling methods</li> <li>Important aspects of Entrepreneurship projects</li> </ul>
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.

<ul> <li>business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentation and a corresponding pitch deck.</li> <li>Why this course is essential:</li> <li>Many students develop ideas for new products or services during their studies. This exercise provides them with the tools are basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams.</li> <li>Content:</li> <li>In ten weekly group exercises, students work out a business idea based on the following key questions: <ol> <li>How do you generate a relevant and viable business idea?</li> <li>How do you assess the market and potential customers for a specific product or service?</li> <li>How do you develop a sales and distribution strategy?</li> <li>How can you convince investors of a business idea and a business model to secure financing?</li> </ol> </li> <li>What you will learn and get:</li> <li>At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start-up and the necessary steps to do start a start a start-up and the necessary steps to do start a start as the sta</li></ul>	Course L0882: Exercise Intro	duction to Management (Exercise)
cp       3         Workload in Hours       Independent Study Time 62, Study Time in Lecture 28         Lecturer       Prof. Christian Lüthje         Language       DE         Cycle       WiSe/SoSe         Content       In this exercise, students develop the knowledge and skills to understand what it means to turn an idea for a new product service into a real business idea and to start a start-up. The students work together in weekly group exercises and develop business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentatic and a corresponding pitch deck.         Why this course is essential:       Many students develop ideas for new products or services during their studies. This exercise provides them with the tools ar basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams.         Content:       In ten weekly group exercises, students work out a business idea based on the following key questions:         1. How do you generate a relevant and viable business idea?       How do you develop a business model from a business idea?         3. How do you develop a sales and distribution strategy?       How do you develop a sales and distribution strategy?         5. How can you convince investors of a business idea and a business model to secure financing?         What you will learn and get:       At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do s Furthermore, you will have learned to transf	Тур	Recitation Section (small)
Workload in Hours         Independent Study Time 62, Study Time in Lecture 28           Lecturer         Prof. Christian Lüthje           Language         DE           Cycle         WiSe/SoSe           Content         In this exercise, students develop the knowledge and skills to understand what it means to turn an idea for a new product service into a real business idea and to start a start-up. The students work together in weekly group exercises and develop business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentatic and a corresponding pitch deck.           Why this course is essential:         Many students develop ideas for new products or services during their studies. This exercise provides them with the tools ar basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams.           Content:         In ten weekly group exercises, students work out a business idea?           1. How do you develop a basiness model from a business idea?         3. How do you develop a sales and distribution strategy?           5. How can you convince investors of a business idea and a business model to secure financing?         What you will learn and get:           At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do s Furthermore, you will have gained skills regarding teamwork.	Hrs/wk	2
Lecture       Prof. Christian Lüthje         Language       DE         Cycle       WiSe/SoSe         Content       In this exercise, students develop the knowledge and skills to understand what it means to turn an idea for a new product service into a real business idea and to start a start-up. The students work together in weekly group exercises and develop business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentatic and a corresponding pitch deck.         Why this course is essential:       Many students develop ideas for new products or services during their studies. This exercise provides them with the tools ar basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams.         Content:       In ten weekly group exercises, students work out a business idea         1. How do you generate a relevant and viable business idea?       3. How do you develop a business model from a business idea?         3. How do you develop a sales and distribution strategy?       5. How can you convince investors of a business idea and a business model to secure financing?         What you will learn and get:       At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do s Furthermore, you will have gained skills regarding teamwork.	CP	3
Language       DE         Cycle       WiSe/SoSe         Content       In this exercise, students develop the knowledge and skills to understand what it means to turn an idea for a new product service into a real business idea and to start a start-up. The students work together in weekly group exercises and develop business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentatic and a corresponding pitch deck.         Why this course is essential:       Many students develop ideas for new products or services during their studies. This exercise provides them with the tools ar basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams.         Content:       In ten weekly group exercises, students work out a business idea         1. How do you generate a relevant and viable business idea?       3. How do you develop a business model from a business idea?         3. How do you develop a sales and distribution strategy?       5. How can you convince investors of a business idea and a business model to secure financing?         What you will learn and get:       At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do s Furthermore, you will have gained skills regarding teamwork.	Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Cycle       WiSe/SoSe         Content       In this exercise, students develop the knowledge and skills to understand what it means to turn an idea for a new product service into a real business idea and to start a start-up. The students work together in weekly group exercises and develop business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentatic and a corresponding pitch deck.         Why this course is essential:       Many students develop ideas for new products or services during their studies. This exercise provides them with the tools ar basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams.         Content:       In ten weekly group exercises, students work out a business idea         1. How do you generate a relevant and viable business idea?       3. How do you develop a business model from a business idea?         3. How do you develop a sales and distribution strategy?       5. How can you convince investors of a business idea and a business model to secure financing?         What you will learn and get:       At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do s Furthermore, you will have gained skills regarding teamwork.	Lecturer	Prof. Christian Lüthje
<ul> <li>Content</li> <li>In this exercise, students develop the knowledge and skills to understand what it means to turn an idea for a new product service into a real business idea and to start a start-up. The students work together in weekly group exercises and develop business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentatic and a corresponding pitch deck.</li> <li>Why this course is essential:</li> <li>Many students develop ideas for new products or services during their studies. This exercise provides them with the tools ar basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams.</li> <li>Content:</li> <li>In ten weekly group exercises, students work out a business idea based on the following key questions:</li> <li>1. How do you generate a relevant and viable business idea?</li> <li>2. How do you develop a business model from a business idea?</li> <li>3. How do you assess the market and potential customers for a specific product or service?</li> <li>4. How do you develop a sales and distribution strategy?</li> <li>5. How can you convince investors of a business idea and a business model to secure financing?</li> <li>What you will learn and get:</li> <li>At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do s Furthermore, you will have gained skills regarding teamwork.</li> </ul>	Language	DE
<ul> <li>service into a real business idea and to start a start-up. The students work together in weekly group exercises and develop business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentation and a corresponding pitch deck.</li> <li>Why this course is essential:</li> <li>Many students develop ideas for new products or services during their studies. This exercise provides them with the tools are basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams.</li> <li>Content:</li> <li>In ten weekly group exercises, students work out a business idea based on the following key questions: <ol> <li>How do you generate a relevant and viable business idea?</li> <li>How do you develop a business model from a business idea?</li> <li>How do you assess the market and potential customers for a specific product or service?</li> <li>How do you convince investors of a business idea and a business model to secure financing?</li> </ol> </li> <li>What you will learn and get: <ul> <li>At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do s Furthermore, you will have learned to transform your theoretical knowledge into practical business ideas and business models. the process, you will have gained skills regarding teamwork.</li> </ul> </li> </ul>	Cycle	WiSe/SoSe
Many students develop ideas for new products or services during their studies. This exercise provides them with the tools ar basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams. Content: In ten weekly group exercises, students work out a business idea based on the following key questions: 1. How do you generate a relevant and viable business idea? 2. How do you develop a business model from a business idea? 3. How do you assess the market and potential customers for a specific product or service? 4. How do you develop a sales and distribution strategy? 5. How can you convince investors of a business idea and a business model to secure financing? What you will learn and get: At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do s Furthermore, you will have learned to transform your theoretical knowledge into practical business ideas and business models. the process, you will have gained skills regarding teamwork.	Content	service into a real business idea and to start a start-up. The students work together in weekly group exercises and develop a business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentation
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	Literature	Relevante Literatur aus der korrespondierenden Vorlesung.

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			
<b>Recommended Previous</b>	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	e following learning results		
Professional Competence				
Knowledge	Students are able to			
	- understand the factor contouts and chiestives of t			
	<ul> <li>understand the facts, contexts and objectives of t</li> <li>correctly apply definitions and concepts of transp.</li> </ul>			
	<ul> <li>reproduce basic concepts of transport modelling.</li> </ul>	ort planning.		
	<ul> <li>explain the fundamentals of traffic engineering ar</li> </ul>	d transport infrastructure construction		
	• explain the fundamentals of traine engineering a			
Skills	Students are able to			
	<ul> <li>analyse transport supply based on key metrics.</li> </ul>			
	<ul> <li>estimate transport demand using key metrics.</li> </ul>			
	<ul> <li>design transport networks, links and junctions.</li> </ul>			
	calculate traffic signal plans.			
	<ul> <li>assess transport concepts.</li> </ul>			
Personal Competence				
Social Competence	Students are able to			
	<ul> <li>get together in groups and constructively discuss</li> </ul>	and analyse set problems.		
	• in a group agree on solutions and document them			
Autonomy	Students are able to			
	<ul> <li>produce reports on group work.</li> </ul>			
	<ul> <li>structure the tasks and timing for working out a structure</li> </ul>	set problem.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
	6			
Credit points Course achievement	Compulsory Bonus Form Descr	iption		
course acmevement	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	,			
	Civil- and Environmental Engineering: Specialisation Tra	ffic and Mobility: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisation Wa			
-	Civil- and Environmental Engineering: Specialisation Civi			
	Engineering and Management - Major in Logistics and Ma			

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 sub- topic traffic engineering. The following subject areas are covered: <ul> <li>objectives of transport planning,</li> <li>key mobility metrics,</li> <li>measuring and predicting demand,</li> <li>designing and planning transport infrastructure,</li> <li>fundamentals of traffic engineering and</li> <li>an introduction to transport concepts and planning processes.</li> </ul>
Literature	<ul> <li>Bosserhoff, Dietmar (2000) Integration von Verkehrsplanung und räumlicher Planung. Schriftenreihe der Hessischen Straßen- und Verkehrsverwaltung, Heft 42. Hessisches Landesamt für Straßen- und Verkehrswesen. Wiesbaden.</li> <li>Lohse, Dieter; Schnabel, Werner (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung: Band 1; Straßenverkehrstechnik. Beuth Verlag. Berlin.</li> <li>Forschungsgesellschaft für Straßen- und Verkehrswesen (2006) Richtlinien für die Anlage von Stadtstraßen - RASt 06. FGSV-Verlag. Köln (FGSV, 200).</li> <li>Vallée, Dirk; Engel, Barbara; Vogt, Walter (2021) Stadtverkehrsplanung Band 3, Springer Verlag. Berlin.</li> </ul>

Lingineering				
Module M2023: Struc	tural Analysis III			
Courses				
Title		<b>Typ</b> Lecture	Hrs/wk 2	<b>CP</b> 2
Structural Analysis III (L3277) Structural Analysis III (L3278)		Recitation Section (large)	2	2
Module Responsible	Prof. Bastian Oesterle	Rectation Section (large)	1	1
Admission Requirements				
	Mechanics I/II, Mathematics I/II, Differential Equations	I, Structural Analysis I, Structural Analy	sis II	
Knowledge				
Educational Objectives	After taking part successfully, students have 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 stu		n-linear structura	I response of fram
	structures using the appropriate computational appro-	aches and methods.		
Personal Competence				
Social Competence	Students can participate in subject-specific and intere-	disciplinary discussions, defend their ov	vn work results i	n front of others an
	promote the scientific development of colleagues.	urthermore, they can give and accept p	rofessional const	ructive criticism.
Autonomy	Students are able to gain knowledge of the subject ar	-		oblems. Furthermore
	they are able to structure the solution process for prol	blems in the area of nonlinear structura	l analysis.	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42	2		
Credit points	3			
Course achievement	None			
Examination	Written exam	Written exam		
Examination duration and	60 min			
scale				
Assignment for the	General Engineering Science (German program, 7 sen	nester): Specialisation Civil Engineering	: Compulsory	
Following Curricula	Civil- and Environmental Engineering: Specialisation C	Civil Engineering: Compulsory		

Course L3277: Structural Ana	alysis III	
Тур	Lecture	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Bastian Oesterle	
Language	DE	
Cycle	NiSe	
Content	The module is structured into two main parts, namely 1. Geometrically nonlinear methods and 2. Materially nonlinear methods. In both parts, irst the phenomena are described, followed by the derivation of corresponding model and computational methods. The topics cover: Part 1: 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: non-linear material behaviour loading and unloading, self-stressed states, theory of plasticity, plastic hinge theory, ultimate limit states, aspects of implementation and application in computer programs.	
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 L3278: Structural Ana	ourse L3278: Structural Analysis III	
Тур	Recitation Section (large)	
Hrs/wk	1	
CP	1	
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14	
Lecturer	Prof. Bastian Oesterle	
Language	DE	
Cycle	WiSe	
Content	See interlocking course	
Literature	See interlocking course	

Module M0612: Steel	Structures II			
Courses		<b>-</b>	Have for the	<u></u>
Title Steel Structures II (L0301)		<b>Typ</b> Lecture	Hrs/wk 2	<b>СР</b> 3
Steel Structures II (L0301)		Recitation Section (large)	2	3
Module Responsible	Prof. Marcus Rutner		-	5
Admission Requirements				
Recommended Previous				
Knowledge				
-				
Educational Objectives	After taking part successfully, students have re-	ached the following learning results		
Professional Competence				
Knowledge	After successful completition students can			
	<ul> <li>describe and explain the behaviour of bo</li> </ul>	Ited and wolded connections		
	<ul> <li>design and check simple halls and building</li> </ul>			
	<ul> <li>calculate forces and stresses of simple st</li> </ul>	-		
		(framework, column base, load application p	oints)	
			,011(2)	
Skills	Students are able to design simple structures and connections, describe the load distribution and recognize the possible modes of			
	failure. They can apply structural imperfections	, calculate according to 2nd order theory an	d verify their result	S.
Personal Competence				
Social Competence	In this module, the student gains the ability to	professionally develop and responsibly shap	e his/her own life	This happens throug
	attending the lectures and exercise units as well as final exam preparation by assessing old exams. In the lecture and exercise			
	unit, the contents are not only introduced but also discussed and developed. In these discussions the students learn to critical			
	listen to opinions and interpretation of others a	nd to get involved in the discussion.		
Autonomy	At the beginning of every lecture, the content	s of the last lecture are repeated and discu	ussed with the stud	dents. Further, at th
	beginning of every exercise unit, examples ou			
	discussed. These discussions at the beginning			
	enforces independent follow-up and preparati	ion of the course material. Further, the pr	eparation for the	final exam demand
	strategic planning, persistence and independen	it learning		
Workload in Hours	Independent Study Time 124, Study Time in Le	cture 56		
Credit points				
Course achievement				
Examination	Written exam			
Examination duration and	120 minutes			
scale				
Assignment for the	General Engineering Science (German program	, 7 semester): Specialisation Civil Engineerir	ng: Elective Compu	lsory
Following Curricula	Civil- and Environmental Engineering: Specialisa	ation Civil Engineering: Compulsory		
	Civil- and Environmental Engineering: Specialise	ation Traffic and Mobility: Elective Compulso	ry	
	Civil- and Environmental Engineering: Specialise	ation 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	<ul> <li>Welded connections</li> <li>Simple constructions <ul> <li>Trusses</li> <li>Plate girders</li> <li>Frames</li> <li>Columns</li> </ul> </li> <li>Buildings with several storeys</li> <li>Halls</li> </ul>
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	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Marcus Rutner	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Module M1632: Appli	ed Water Management					
Courses						
Title		Тур	Hrs/wk	СР		
Modelling of soil water dynamics (L	2471)	Project-/problem-based Learning	2	2		
Modelling of soil water dynamics (L	2470)	Lecture	2	2		
Nature-oriented Hydraulic Engineer	ing (L2472)	Project-/problem-based Learning	2	2		
Module Responsible	Prof. Peter Fröhle					
Admission Requirements	None					
<b>Recommended Previous</b>						
Knowledge	Basic knowledge of analysis and differential equations					
	<ul> <li>hydromechanical and hydraulic engineering principles</li> </ul>					
Educational Objectives	After taking part successfully, students have reached the followi	ing learning results				
Professional Competence						
Knowledge	Students are able to define the basic tasks and terms of nature	e-oriented hydraulic engineering	und groundw	ater hydrology. Th		
	cam describe the basics concepts, the basic approaches and	methods of nature-oriented hy	draulic engin	eering, groundwa		
	hydrology and groundwater modelling and are able to apply the	se to practical problems.				
Skills	The students are able to apply the methods and approache	es of nature-oriented hydraulic	engineering	and of groundwa		
	hydrology to practical problems. They can demonstrate to tran	nsfer and apply these to simple	hydraulic eng	ineering systems		
	addition, they are able to apply the approaches commonly us	ddition, they are able to apply the approaches commonly used in groundwater hydrology. They can exemplarily explain and				
	reason how to apply them as a basis for geo-hydrological quest	tions. In addition, students can a	pply basic gro	oundwater model		
	methods to simple problems of groundwater movement and gro	undwater recharge.				
Personal Competence						
•	Students are able to help each other solving case studies. Th	e students are able to deploy t	heir gained k	nowledge in appl		
Social competence	problems of the practical nature-based hydraulic engineering. A					
	in teams consisting of engineers from different subject areas.	talifoldity, they will be able to a				
	in teams consisting of engineers norm different subject areas.					
Autonomy	The students will be able to independently extend their knowled	ge and apply it to new problems.				
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84					
Credit points						
•	None					
	Subject theoretical and practical work					
	Written-theoretical part and modeling					
scale	·······					
Assignment for the	General Engineering Science (German program, 7 semester): S	pecialisation Green Technologies	. Focus Water	r and Environmer		
-	Engineering: Elective Compulsory	,				
· ····································	Civil- and Environmental Engineering: Specialisation Civil Engine	ering: Elective Compulsory				
	Civil- and Environmental Engineering: Specialisation Civil Engine Civil- and Environmental Engineering: Specialisation Traffic and					
	Civil- and Environmental Engineering: Specialisation Tranc and Civil- and Environmental Engineering: Specialisation Water and I		24			
			-			
	Green Technologies: Energy, Water, Climate: Specialisation Wat	er Technologies: Elective Compu	ISOFY			

Course L2471: Modelling of s	Course L2471: 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	Sankeerth Govindaiah Narayanaswamy		
Language	EN		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Course L2470: Modelling of s	soil water dynamics
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Mohammad Aziz Zarif
Language	EN
Cycle	SoSe
Content	<ul> <li>Students will learn about soil physical characteristics, soil water potential, saturated and unsaturated flows in soil, basics of solute transport in soil, and numerical methods/tools to simulate water flow and solute transport in soil.</li> </ul>
Literature	

Course L2472: Nature-oriented Hydraulic Engineering		
Тур	Project-/problem-based Learning	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Peter Fröhle	
Language	DE	
Cycle	SoSe	
Content	<ul> <li>Nature oriented hydraulic engineering</li> <li>Regime-theory and application for the development of environmental guiding priciples of rivers</li> <li>Engineering-biological measures for the stabilization of rivers</li> <li>design techniques for water engineering</li> <li>hydraulic dimensioning of river bed and bank protection</li> <li>design principles and design techniques for fish passages (fish ladder, ramps etc.)</li> </ul>	
Literature	Patt, Heinz (2018): Naturnaher Wasserbau. Entwicklung und Gestaltung von Fließgewässern. With assistance of Peter Jürging, Werner Kraus. 5. Auflage. Wiesbaden: Springer Vieweg.	

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. Peter Fröhle			
Admission Requirements	None			
<b>Recommended Previous</b>				
Knowledge				
Educational Objectives	After taking part successfully, students ha	ave reached the following learning results		
Professional Competence				
Knowledge				
Skills				
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time	in Lecture 56		
Credit points	6			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and	Written-theoretical part and report			
scale				
Assignment for the	Civil- and Environmental Engineering: Spe	ecialisation Civil Engineering: Elective Compute	sory	
Following Curricula	Civil- and Environmental Engineering: Spe	ecialisation Water and Environment: Elective C	Compulsory	
	Civil- and Environmental Engineering: Spe	ecialisation Traffic and Mobility: Elective Comp	oulsory	
	Logistics and Mobility: Specialisation Traff	fic Planning and Systems: Elective Compulsory	/	
	Engineering and Management - Major in L	ogistics and Mobility: Specialisation II. Traffic	Planning and Systems:	Elective Compulso

Course L2474: Sustainable U	ourse 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	
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 M0985: Introd	luction to Railways				
Courses					
Title			Тур	Hrs/wk	СР
Introduction to Railways (L1184)		I	Lecture	2	4
Introduction to Railways (L1185)		I	Recitation Section (large)	1	2
Module Responsible	Prof. Carsten Gertz				
Admission Requirements	None				
<b>Recommended Previous</b>	none				
Knowledge					
Educational Objectives	After taking part successfully, students have r	reached the following	g learning results		
Professional Competence					
Knowledge	Students can				
	<ul> <li>give definitions for basic terms related</li> </ul>	to railways			
	-				
	<ul> <li>explain specifics concerning the nation</li> <li>explain the required infrastructure</li> </ul>	explain specifics concerning the handling of goods on railways     explain the required infractructure			
	<ul> <li>explain the required intrastructure</li> <li>describe the work at the track super structure</li> </ul>				
	· desenbe the work at the track super st				
Skills					
Personal Competence					
Social Competence	Students can				
	<ul> <li>work at tasks in groups and come to res</li> </ul>	sults together			
	<ul> <li>discuss contents in groups, summarize</li> </ul>	-	nem in front of others		
	<ul> <li>convey contents to other by processing</li> </ul>				
		-			
Autonomy	Students can work out and understand conten	nts themselves durin	g the lecture through literat	ure 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	isation Traffic and M	obility: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Speciali	isation Civil Enginee	ring: Elective Compulsory		
	Civil- and Environmental Engineering: Speciali	isation Water and En	vironment: Elective Compu	lsory	
	Logistics and Mobility: Specialisation Traffic Pl	lanning and Systems	: Elective Compulsory		
	Engineering and Management - Major in Logis	tics and Mobility: Sp	ecialisation II. Traffic Planni	ng and Systems:	Elective Compulsory

<b>Course L1184: Introduction t</b>	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:
literatura	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 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			
<b>Recommended Previous</b>	Basic knowledge in the field of drinking water s	supply and waste water disposal.		
Knowledge				
Educational Objectives	After taking part successfully, students have re	ached the following learning results		
Professional Competence				
<b>Personal Competence</b> Social Competence	The students are able to develop a specific topic in a team and to work out milestones according to a given plan.			
Workload in Hours	Independent Study Time 124, Study Time in Le	cture 56		
Credit points				
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 Techr	nologies, Focus Wate	r and Environmenta
Following Curricula	Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specialis	ation Water and Environment: Compulsory	,	
	Civil- and Environmental Engineering: Specialis			
	Civil- and Environmental Engineering: Specialis		-	
	Green Technologies: Energy, Water, Climate: S		-	

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	Dr. Dorothea Rechtenbach
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
	housing the end of the end of system is given, including where catchineric areas, where 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	ing Information Modeling			
Courses				
Title		Тур	Hrs/wk	СР
Building Information Modeling (L27		Integrated Lecture	2	2
Building Information Modeling (L27		Recitation Section (small)	2	4
Module Responsible				
Admission Requirements				
Recommended Previous	None			
Knowledge				
Professional Competence	After taking part successfully, students have reached the foll	lowing learning results		
Knowledge	The contents of this module follow the recommendatio (www.gacce.de) for the BIM courses taught at German unive to present methodological knowledge to enable students t companies and public institutions. An in-depth understand Emphasis is placed on generally valid principles and techni decades. The theoretical content taught in the lecture is co tools will be used. Topics include computer-aided design and BIM data exchange and cooperation (focusing on Industry applications, BIM tools, and advanced aspects. A central com The module focuses on enabling students to accomplish understanding the methods. The competencies includes c skills, in particular understanding of the requirements for me buildings. Specifically, implementing and editing 3D me	rsities in the subject area of engi o introduce, to design, to monit ding of the methods and techn iques independent of specific so mplemented by practical exercis d geometry modeling, digital mod y Foundation Classes), process aponent of this module will be a p o competencies required for pro onstruction-related skills, BIM-sp odeling buildings as well as for p	neering informat cor, and to impre- ologies relevant ftware products ses, in which sta deling of building modeling, job oroject work. ofessionally usin becific skills and lanning, implem	ics. The module ain ove BIM processes to BIM is essentia and valid for sever te-of-the-art softwar as and infrastructure descriptions and BI or BIM software ar additional speciali enting, and operatir
Demonstration of the second seco	implementing BIM in companies are among the competencie	es of this module.		
Personal Competence	Social skills are occoptial in the PIM context, as PIM mini-	etc are usually carried out his in	tordisciplinan: t	name With rogard
	<ul> <li>e Social skills are essential in the BIM context, as BIM projects are usually carried out by interdisciplinary teams. With regard social skills, this module aims to teaching students to convey information in a clear and comprehensible manner, to enabl students to work with others and achieve goals together, and to resolving conflicts constructively, which is essentially achieve through group work. In small student groups, the students train their communication and cooperation skills, receiving feedba from the instructors and fellow students.</li> <li>y The personal competencies pursued in this module in terms of independence are aiming towards completing tasks with f guidance or assistance, which is essential for BIM projects, as BIM projects often involve complex and urgent tasks. This mod helps students develop a degree of independence in working, particularly the skills to plan, prioritize, and complete tasks in</li> </ul>			
Workload in Hours	timely and efficient manner, primarilty supported through pr Independent Study Time 124, Study Time in Lecture 56			
Credit points				
Course achievement				
	Written elaboration			
	Description of a BIM model with 15-minute oral presentation			
Assignment for the	Civil- and Environmental Engineering: Specialisation Traffic a	and Mobility: Elective Compulsory	,	
Following Curricula	Civil- and Environmental Engineering: Specialisation Water a	nd Environment: Elective Compu	lsory	
	Civil- and Environmental Engineering: Specialisation Civil Eng	gineering: Elective Compulsory		

Hrs/wk 2 CP 2	egrated Lecture dependent Study Time 32, Study Time in Lecture 28
CP 2 Workload in Hours Inde	
Workload in Hours Inde	
Lecturer Prot	
	of. Kay Smarsly
Language DE	
Cycle SoS	Se
	<ul> <li>Historical development</li> <li>Introduction and motivation</li> <li>Basics of geometry</li> <li>2D geometry modeling</li> <li>2½D geometry modeling</li> <li>3D geometry modeling</li> <li>Digital modeling of buildings and infrastructure, object-oriented, semantic, and parametric modeling</li> <li>Data exchange, interoperability, and communication (with emphasis on Industry Foundation Classes)</li> <li>BIM data storage and data management</li> <li>Process modeling</li> <li>Job profiles and applications</li> <li>BIM tools</li> <li>Advanced aspects of BIM</li> <li>Seminar by external BIM experts and project presentations</li> </ul>
	rrmann, König, Koch, Beetz (Hrsg.), 2021. Building Information Modeling - Technologische Grundlagen und industrielle Praxis. 2., tualisierte Auflage. Springer.

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	

#### Specialization Traffic and Mobility

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			
Admission Requirements	None			
Recommended Previous	Module Transportation Planning and Traffic Engineering	3		
Knowledge				
	After taking part successfully, students have reached t	he following learning results		
Professional Competence				
Knowledge	Students are able to:			
	<ul> <li>name the different urban transport systems exis</li> </ul>	ting around the world.		
	• explain the transport challenges in Asian and Af	ican mega cities.		
	<ul> <li>recognise and relate interactions between trans</li> </ul>	port systems on the one hand and ecolo	gical, socio-cult	tural and economic
	problem areas on the other.			
	<ul> <li>outline specific issues and problems in urban de</li> </ul>	velopment and transport (in Germany and	developing cou	untries).
	<ul> <li>explain the effects of external framework factors</li> </ul>	s (like energy costs) on transport.		
Skills	Students are able to:			
	<ul> <li>analyse and evaluate given case studies.</li> </ul>			
	<ul> <li>transfer learning results to other regions and cit</li> </ul>	es.		
	<ul> <li>analyse specific issues and problems in urban de</li> </ul>	evelopment and transport (in developing o	ountries).	
	<ul> <li>critically assess actors, planning objectives, pla</li> </ul>	nned measures and the implementation of	of transport pro	jects in the light o
	the UN Millennium Development Goals			
	develop and present sustainable (i.e. ecologication)	I, poverty oriented, gender balanced an	d economical) :	solutions for urbar
	personal and goods transport			
Personal Competence				
Social Competence	Students are able to:			
	present and explain independently generated fir			
	<ul> <li>constructively discuss potentially controversial t</li> </ul>	opics in a group context.		
Autonomy	Students are able to:			
	<ul> <li>carry out independent literature research and an</li> </ul>	nalysis.		
	<ul> <li>independently author a written report on a giver</li> </ul>	topic.		
Workload in Hours	Independent Study Time 96, Study Time in Lecture 84			
Credit points				
Course achievement	Compulsory Bonus Form Des	ription		
	Yes None Participation in excursions Exk	ursion innerhalb Hamburgs abhängig von	aktuellen Them	nen im Modul
	Written elaboration			
	All assignments in groups (2-4 students): written repor		of 10 mins.); fir	nal presentation, 20
	mins. plus discussion (incl. slides) and 1000 word report			
5	Civil- and Environmental Engineering: Specialisation Tr	, , ,		
Following Curricula	Civil- and Environmental Engineering: Specialisation Ci			
	Civil- and Environmental Engineering: Specialisation W		У	
	Logistics and Mobility: Specialisation Traffic Planning and Engineering and Management - Major in Logistics and I		and Systems C	ompulsor
	Engineering and management - Major III Logistics dflu I	issuity. Specialisation II. Hallic Fidining	and Systems. U	опризоту

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:
	<ul> <li>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?</li> <li>Which external effects in turn are caused by mobility choices and traffic?</li> <li>How should these interactions be evaluated, how and by whom can they be influenced?</li> <li>Which measures at the municipal level can contribute to a more sustainable transport system?</li> </ul> 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: <ul> <li>Environmental Justice : which population groups are disproportionately affected by transport emissions and who causes them?</li> <li>Municipal cycle planning</li> <li>Transport and Climate Protection: can, want, act - everything could be, nothing must be?</li> </ul>
Literature	Die Literaturempfehlungen sind abhängig von den jeweiligen, wechselnden Themenschwerpunkten und werden rechtzeitig vor Beginn der Veranstaltung bekannt gegeben.

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	
Content	The course provides and overview over different transport projects in the metropolitan areas of developing countries. Considerin 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 the are a suitable example for sustainable urban development.
	The following examples could be suitable case studies: Singapore (Metro), Lagos (BRT Light), Guanghzou, Bogota, Jakarta (Fu 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 thi area (also: Skype online interviews with international experts in the transport sector). An English language presentation i also part of the course work.
Literature	Umweltbundesamt: Jahresbericht 2005
	GTZ: The Role of Transport in Urban Development Policy
	TRB/ STI: Sustainable Transportation Indicators - A Recommended Program To Define A Standard Set of Indicators For Sustainable Transportation Planning
	https://www.slocat.net
	https://www.sutp.org
	https://www.oecd.org
	https://www.itdp.org
	https://www.kfw-entwicklungsbank.de
	https://www.transportenvironment.org
	https://www.trl.co.uk
	https://www.embarq.org
	https://www.umweltbundesamt.de
	https://www.eurist.info

Engineering					
Module M0755: Geote	echnics II				
Courses					
Title			Тур	Hrs/wk	СР
Foundation Engineering (L0552)			Lecture	2	2
Foundation Engineering (L0553)			Recitation Section (la	arge) 2	2
Foundation Engineering (L1494)			Recitation Section (s	mall) 2	2
Module Responsible	Prof. Jürgen Grabe				
Admission Requirements	None				
<b>Recommended Previous</b>	Modules:				
Knowledge					
	Mechanics I-II				
	Geotechnics I				
Educational Objectives	After taking part successf	ully, students have rea	ched 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,				
	<ul> <li>know individual methods of ground improvement and apply them in their range of application,</li> </ul>				
		<ul> <li>know individual metrous of ground improvement and apply them in their range of application,</li> <li>design retaining walls.</li> </ul>			
		all5.			
Personal Competence					
Social Competence					
Autonomy					
Workload in Hours	Independent Study Time 9	96, Study Time in Lectu	ire 84		
Credit points	6				
Course achievement			Description		
	No 20 % Att	testation			
Examination	Written exam				
Examination duration and	90 minutes				
scale					
Assignment for the	General Engineering Scier	nce (German program,	7 semester): Specialisation Civil Eng	ineering: Elective Compu	lsory
Following Curricula	Civil- and Environmental E	Engineering: Specialisa	tion Civil Engineering: Compulsory		
	Civil- and Environmental E	Engineering: Specialisa	tion Traffic and Mobility: Elective Co	mpulsory	
		Engineering: Specialisa	tion Water and Environment: Electiv	e Compulsory	

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	SoSe
Content	<ul> <li>Shallow foundations</li> <li>Pile foundations</li> <li>Ground improvement</li> <li>Retaining walls</li> <li>Underpinning</li> <li>Groundwater Conservation</li> <li>Cut-off Walls</li> </ul>
Literature	<ul> <li>Vorlesung/Übung s. www.tu-harburg.de/gbt</li> <li>Grabe, J. (2004): Bodenmechanik und Grundbau</li> <li>Kolymbas, D. (1998): Geotechnik - Bodenmechanik und Grundbau</li> <li>Grundbau-Taschenbuch, neueste Auflage</li> </ul>

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	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	Prof. Jürgen Grabe
Language	DE
Cycle	SoSe
Content	See interlocking course
Literature	See interlocking course

Module M1628: Susta	inable Building			
Courses				
Title		Тур	Hrs/wk	СР
Circular flow economy and structur	al recycling (L2464)	Integrated Lecture	2	2
Sustainable building materials and	buildings (L3179)	Integrated Lecture	2	2
Sustainable water management an	d hydraulic engineering (L3180)	Integrated Lecture	2	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
<b>Recommended Previous</b>	Basic knowledge of building materials, building cl	hemistry, building construction and building	g project managen	nent
Knowledge				
Educational Objectives	After taking part successfully, students have read	hed the following learning results		
Professional Competence				
Skills	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. Students can relate relevant legal requirements to practical problems of environmentally sound design and construction and thus justify the application of specific limit values for individual areas of application. Students are able to assess risks that may arise from hazardous construction waste in a concise manner. They are able to critically examine innovative areas of application of sustainable construction on the basis of central engineering, economic and legal criteria. They can thereafter evaluate and propose approaches for alternative solutions exemplarily, e.g. for the processing and recycling of construction waste.			
Personal 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. 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 Lectur	re 84		
Credit points	6			
Course achievement	Compulsory         Bonus         Form           Yes         20 %         Written elaboration	Description		
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the	Civil- and Environmental Engineering: Specialisat	ion Water and Environment: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisat	ion Traffic and Mobility: Elective Compulsor	У	
	Civil- and Environmental Engineering: Specialisat	ion Civil Engineering: Elective Compulsory		

Course L2464: Circular flow	economy and structural recycling
	Integrated Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Prof. Kerstin Kuchta
Language	DE
Cycle	SoSe
Content	<ul> <li>Types, origin, quantities of construction waste and building debris</li> <li>Risks and characterisation of construction waste</li> <li>Avoidance strategies and recycling options for construction waste and building debris</li> <li>Criteria of sampling, analysis and opportunities for the use of treated building materials</li> <li>political and legal requirements for the recycling of building materials</li> </ul>
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 L3179: Sustainable building materials and buildings	
Тур	Integrated Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Sebastian Rybczynski
Language	DE
Cycle	SoSe
Content	
Literature	

Course L3180: Sustainable water management and hydraulic engineering			
Тур	Integrated 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	SoSe		
Content	Environmental water management and sustainable hydraulic engineering		
	Concepts of environmental responsibility and sustainability		
	Nature-based concepts, green and hybrid solutions in hydraulic engineering		
	Sustainable flood, low water and drought management		
	Resource-conserving construction materials and processes		
	<ul> <li>Analysis and evaluation of hydraulic engineering and water management projects</li> </ul>		
Literature	Vorlesungsfolien und ausgewählte Paper werden in der Veranstaltung zur Verfügung gestellt		

Module M1715: Rene	wable Energies				
Courses					
Title		Тур	Hrs/wk	СР	
Fuels II (L3143)	Lecture 1 1				
Renewable Energies I (L2740)		Lecture	2	2	
Renewable Energies I (L2742)		Recitation Section (large)	1	1	
Renewable Energies II (L2741)	Duraf Manthia Kalkasharikt	Lecture	2	2	
	Prof. Martin Kaltschmitt None				
Recommended Previous	none				
Keconniended Previous	none				
Educational Objectives	After taking part successfully, students have	reached the following learning results			
Professional Competence	Arter taking part successionly, students nave	reaction the following learning results			
-	Upon completion of this module, students w	ill be able to provide an even iow of characterist	icc of ronowable o	porqui systems. The	
Knowledge		ill be able to provide an overview of characterist in these systems. Furthermore, they are able t			
		is context, taking into account contexts borderi			
		ch energy systems and take a critical stand or			
		energy systems and have an overview of the ed			
	options.				
Skills		or determining energy demand or energy supply			
		uch energy systems technically, ecologically an			
	and also design them under certain given conditions. They are able to select the regulations necessary for this in a subject-specific				
	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					
	Students are able to investigate suitable technical alternatives and ultimately evaluate them based on technical, economic and				
Social Competence	ecological criteria - and thus from a sustaina		eni based on teci	inical, economic a	
		is a sective.			
Autonomy	Students will be able to independently access sources about the field, acquire knowledge and transform it to address new issues.				
hatohomy					
Workload in Hours	Independent Study Time 96, Study Time in I	_ecture 84			
Credit points					
Course achievement	None				
Examination	Written exam				
Examination duration and	180 min				
scale					
Assignment for the	General Engineering Science (German progr	ram, 7 semester): Specialisation Green Technolo	gies: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specia	alisation Civil Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specia	alisation Traffic and Mobility: Elective Compulsor	У		
	Civil- and Environmental Engineering: Specia	alisation Water and Environment: Elective Comp	ulsory		
	Chemical and Bioprocess Engineering: Speci	ialisation Chemical Engineering: Compulsory			
	Engineering Science: Specialisation Chemical and Bioprocess Engineering, Focus Chemical Engineering: Compulsory				
	Green Technologies: Energy, Water, Climate: Core Qualification: Compulsory				
	Process Engineering: Core Qualification: Cor	npulsory			

Course L3143: Fuels II			
Тур	Lecture		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	Dr. Karsten Wilbrand		
Language	DE		
Cycle	SoSe		
Content	<ul> <li>Regulatory requirements of "alternative" fuels (e.g. RED)</li> <li>Overview of today's alternative fuels</li> <li>o Biodiesel / HEFA</li> <li>o Bioethanol</li> </ul>		
	o Biomethane o Other fuels		
	Overview of future alternative fuels     o 2nd generation biofuels		
	o Hydrogen and hydrogen derivatives		
	o Electricity-based fuels o Other fuels		
	• Electromobility o with battery		
	o with hydrogen fuel cell		
	<ul> <li>Markets and market developments</li> <li>CO2 analyses of the various options per application area</li> <li>Global megatrends and future challenges</li> <li>Developments in vehicle and drive technologies</li> <li>Energy scenarios up to 2050 and significance for the mobility sector</li> </ul>		
Literature	Eigene Unterlagen, Veröffentlichungen, Fachliteratur Literature: Own documents, publications, technical literature		

Course L2740: Renewable En	ergies 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 Er	iergies 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
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			
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 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		

Module M0631: Reinforced Concrete Structures II					
Courses					
Title Project Concrete Structures II (L0894) Concrete Structures II (L0348) Concrete Structures II (L0349)		<b>Typ</b> Project Seminar Lecture Recitation Section (large)	<b>Hrs/wk</b> 1 2 2	<b>CP</b> 1 3 2	
Module Responsible	Dr. Adrian Faron				
Admission Requirements	None				
Recommended Previous Knowledge	Knowledge of loads on structures and combination of actions				
Educational Objectives	After taking part successfully, students have reached th	e following 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.				
<b>Personal Competence</b> Social Competence Autonomy	Cooperation in a project work, where they design in a team a real concrete building and present the results at the end.				
Workload in Hours	Independent Study Time 110, Study Time in Lecture 70				
Credit points	6				
Course achievement	Compulsory Bonus Form Descr No None Excercises	iption			
Examination					
Examination duration and	120 minutes				
scale					
Assignment for the Following Curricula	General Engineering Science (German program, 7 seme Civil- and Environmental Engineering: Specialisation Civ	il Engineering: Compulsory	Elective Compul	lsory	
	Civil- and Environmental Engineering: Specialisation Tra Civil- and Environmental Engineering: Specialisation Wa		sory		

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

Course L0348: Concrete Stru	stures II
	Lecture
Hrs/wk	
СР	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Adrian Faron
Language	DE
Cycle	WiSe
Content	<ul> <li>Design of concrete members for shear, punching and torsion</li> <li>Design for serviceability limit state (durability): crack- and deflection control</li> <li>Detailing</li> <li>Design of discontinuity regions (e.g. corbels, frame corner)</li> <li>design of footings</li> <li>Introduction in the design of slabs</li> <li>Layout and content of a structural design</li> <li>Vorlesungsumdrucke zum downloaden im STUDiP</li> <li>Zilch K., Zehetmaier G.: Bemessung im konstruktiven Betonbau. Springer Verlag, 2010</li> </ul>
	<ul> <li>Elter K., Zehennde G.: Demessung im Konstruktiven becknoud. Springer Verlag, 2010</li> <li>König G., Tue N.: Grundlagen des Stahlbetonbaus. Teubner Verlag, Stuttgart 1998</li> <li>Deutscher Beton- und Bautechnikverein E.V.: Beispiele zur Bemessung von Betontragwerken nach Eurocode 2. Band 1: Hochbau, Bauverlag GmbH, Wiesbaden 2011</li> <li>Dahms KH.: Rohbauzeichnungen, Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997</li> <li>Grasser E. ,Thielen G.: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken Deutscher Ausschuss für Stahlbeton, Heft 240, Verlag Ernst &amp; Sohn, Berlin 1978</li> <li>DIN EN 1992-1-1:2011: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 1: Allgemeine Bemessungsregeln für den Hochbau.</li> </ul>

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	Dr. Adrian Faron
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Courses				
Courses				
Title		Тур	Hrs/wk	CP
Introduction to Management (L088 Exercise Introduction to Manageme		Lecture Recitation Section (small)	3 2	3 3
Module Responsible			L	5
Admission Requirements				
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have reach	ed the following learning results		
Professional Competence				
Knowledge	After taking this module, students know the impor and Organisation to Marketing and Innovation, and	also to Investment and Controlling. In pa	rticular they are al	ble to
	<ul> <li>explain the differences between Economi important definitions from the field of Manage explain the most important aspects of and projects</li> <li>describe and explain basic business function organization and human ressource manager</li> <li>explain the relevance of planning and de uncertainty, and explain some basic method</li> <li>state basics from accounting and costing and</li> </ul>	gement goals in Management and name the mo tions as production, procurement and ment, information management, innovatio ecision making in Business, esp. in situ ds from mathematical Finance	ost important aspe sourcing, supply on management ar	cts of entreprnet chain managem nd marketing
Skills	Students are able to analyse business units with roout an Entrepreneurship project in a team. In parti		objectives, strateg	ies etc.) and to ca
	<ul> <li>analyse Management goals and structure th</li> <li>analyse organisational and staff structures of</li> <li>apply methods for decision making under m</li> <li>analyse production and procurement system</li> <li>analyse and apply basic methods of market</li> <li>select and apply basic methods from mathet</li> <li>apply basic methods from accounting, costing</li> </ul>	of companies iultiple objectives, under uncertainty and ins and Business information systems ing matical finance to predefined problems		
Personal Competence Social Competence	Students are able to			
Autonomy	<ul> <li>work successfully in a team of students</li> <li>to apply their knowledge from the lecture to</li> <li>to communicate appropriately and</li> <li>to cooperate respectfully with their fellow st</li> </ul> Students are able to <ul> <li>work in a team and to organize the team the</li> <li>to write a report on their project.</li> </ul>	udents.	coherent report on	the project
		70		
	Independent Study Time 110, Study Time in Lectur	re /u		
Credit points				
Course achievement				
	Subject theoretical and practical work several written exams during the semester plus fir	val toct (00 minutoc)		
	several whiten exams during the semester plus hi	lai test (90 minutes)		
	General Engineering Science (German program, 7	semester): Core Qualification: Compulson		
scale Assignment for the			2	
		on Water and Environment: Elective Comp	ulsory	
Assignment for the	Civil- and Environmental Engineering: Specialisatio			
Assignment for the	Civil- and Environmental Engineering: Specialisation Civil- and Environmental Engineering: Specialisation	on Traffic and Mobility: Elective Compulsor	ſУ	
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu	Ilsory	ту У	
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisati	ilsory on Bio Engineering: Elective Compulsory		
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisati Chemical and Bioprocess Engineering: Specialisati	ilsory on Bio Engineering: Elective Compulsory		
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisati Chemical and Bioprocess Engineering: Specialisati Data Science: Core Qualification: Compulsory	Ilsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu		
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisati Chemical and Bioprocess Engineering: Specialisati Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compuls	Ilsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu sory		
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisati Chemical and Bioprocess Engineering: Specialisati Data Science: Core Qualification: Compulsory	Ilsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu sory : Core Qualification: Compulsory	lsory	
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisati Chemical and Bioprocess Engineering: Specialisati Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compuls Electrical Engineering and Information Technology	Ilsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu sory : Core Qualification: Compulsory ialisation Biotechnologies: Elective Compu	lsory Ilsory	mpulsory
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisati Chemical and Bioprocess Engineering: Specialisati Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compuls Electrical Engineering and Information Technology Green Technologies: Energy, Water, Climate: Spec	Ilsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu sory : Core Qualification: Compulsory ialisation Biotechnologies: Elective Compu ialisation Energy Systems / Renewable En	lsory Jlsory ergies: Elective Co	mpulsory
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisati Chemical and Bioprocess Engineering: Specialisati Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compuls Electrical Engineering and Information Technology Green Technologies: Energy, Water, Climate: Spec Green Technologies: Energy, Water, Climate: Spec	Ilsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu sory : Core Qualification: Compulsory ialisation Biotechnologies: Elective Compu ialisation Energy Systems / Renewable En ialisation Energy Technology: Elective Com	lsory ulsory ergies: Elective Co mpulsory	mpulsory
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu- Chemical and Bioprocess Engineering: Specialisatic Chemical and Bioprocess Engineering: Specialisatic Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compuls Electrical Engineering and Information Technology Green Technologies: Energy, Water, Climate: Spec Green Technologies: Energy, Water, Climate: Spec Green Technologies: Energy, Water, Climate: Spec	Ilsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu sory : Core Qualification: Compulsory ialisation Biotechnologies: Elective Compu ialisation Energy Systems / Renewable En ialisation Energy Technology: Elective Com ialisation Maritime Technologies: Elective	lsory Ilsory ergies: Elective Co npulsory Compulsory	mpulsory
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu- Chemical and Bioprocess Engineering: Specialisatic Chemical and Bioprocess Engineering: Specialisatic Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compuls Electrical Engineering and Information Technology Green Technologies: Energy, Water, Climate: Spec Green Technologies: Energy, Water, Climate: Spec Green Technologies: Energy, Water, Climate: Spec Green Technologies: Energy, Water, Climate: Spec	Ilsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu- sory : Core Qualification: Compulsory ialisation Biotechnologies: Elective Compu- ialisation Energy Systems / Renewable En ialisation Energy Technology: Elective Com- ialisation Maritime Technologies: Elective ialisation Water Technologies: Elective Com-	lsory Ilsory ergies: Elective Co npulsory Compulsory	mpulsory
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisatic Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Electrical Engineering and Information Technology Green Technologies: Energy, Water, Climate: Spec Green Technologies: Energy, Water, Climate: Spec Computer Science in Engineering: Core Qualification Logistics and Mobility: Core Qualification: Compuls	alsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu- sory : Core Qualification: Compulsory ialisation Biotechnologies: Elective Compu- ialisation Energy Systems / Renewable En- ialisation Energy Technology: Elective Com- ialisation Maritime Technologies: Elective Com- ialisation Water Technologies: Elective Com- com Compulsory ory	lsory Ilsory ergies: Elective Co npulsory Compulsory	mpulsory
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisatic Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Green Technologies: Energy, Water, Climate: Spec Green Technologies: Energy, Water, Climate: Spec Computer Science in Engineering: Core Qualification: Compuls Mechanical Engineering: Core Qualification: Compuls	alsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu- sory : Core Qualification: Compulsory ialisation Biotechnologies: Elective Compu- ialisation Energy Systems / Renewable En- ialisation Energy Technology: Elective Com- ialisation Maritime Technologies: Elective Com- ialisation Water Technologies: Elective Com- com Compulsory ory ulsory	lsory Ilsory ergies: Elective Co npulsory Compulsory	mpulsory
Assignment for the	Civil- and Environmental Engineering: Specialisatic Bioprocess Engineering: Core Qualification: Compu Chemical and Bioprocess Engineering: Specialisatic Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Compulsory Electrical Engineering and Information Technology Green Technologies: Energy, Water, Climate: Spec Green Technologies: Energy, Water, Climate: Spec Computer Science in Engineering: Core Qualification Logistics and Mobility: Core Qualification: Compuls	Ilsory on Bio Engineering: Elective Compulsory on Chemical Engineering: Elective Compu- sory : Core Qualification: Compulsory ialisation Biotechnologies: Elective Compu- ialisation Energy Systems / Renewable En- ialisation Energy Technology: Elective Com- ialisation Maritime Technologies: Elective Com- ialisation Water Technologies: Elective Co- on: Compulsory ory ulsory ics: Compulsory	lsory Ilsory ergies: Elective Co npulsory Compulsory	mpulsory

Mechanical Engineering: Specialisation Materials in Engineering Sciences: Compulsory
Mechanical Engineering: Specialisation Product Development and Production: Compulsory
Mechanical Engineering: Specialisation Theoretical Mechanical Engineering: Compulsory
Mechanical Engineering: Specialisation Aircraft Systems Engineering: Compulsory
Mechanical Engineering: Specialisation Mechatronics: Compulsory
Mechatronics: Specialisation Electrical Systems: Compulsory
Mechatronics: Specialisation Medical Engineering: Compulsory
Mechatronics: Specialisation Robot- and Machine-Systems: Compulsory
Mechatronics: Specialisation Naval Engineering: Compulsory
Mechatronics: Specialisation Dynamic Systems and AI: 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 L0880: Introduction t	o Management	
Тур	Lecture	
Hrs/wk	3	
CP	3	
Workload in Hours	ndependent Study Time 48, Study Time in Lecture 42	
Lecturer	Prof. Matthias Meyer, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Christian Thies, Prof. Christoph Ihl, Prof. Kathrin Fischer,	
	rof. Moritz Göldner, Prof. Thomas Wrona, Prof. Thorsten Blecker, Prof. Tim Schweisfurth, Prof. Wolfgang Kersten	
Language	DE	
Cycle	WiSe/SoSe	
Content	<ul> <li>Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management</li> <li>Important definitions from Management,</li> <li>Developing Objectives for Business, and their relation to important Business functions</li> <li>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</li> <li>Definitions as information, information systems, aspects of data security and strategic information systems</li> <li>Definition and Relevance of innovations, e.g. innovation opporunities, risks etc.</li> <li>Relevance of marketing, B2B vs. B2C-Marketing</li> <li>different techniques from the field of marketing (e.g. scenario technique), pricing strategies</li> <li>important organizational structures</li> <li>basics of human ressource management</li> <li>Introduction to Business Planning and the steps of a planning process</li> <li>Decision Analysis: Elements of decision problems and methods for solving decision problems</li> <li>Selected Planning Tasks, e.g. Investment and Financial Decisions</li> <li>Introduction to Accounting: Accounting, Balance-Sheets, Costing</li> <li>Relevance of Controlling and selected Controlling methods</li> <li>Important aspects of Entrepreneurship projects</li> </ul>	
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.	

Course L0882: Exercise Intro	duction to Management (Exercise)
Тур	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christian Lüthje
Language	DE
Cycle	WiSe/SoSe
	In this exercise, students develop the knowledge and skills to understand what it means to turn an idea for a new product or service into a real business idea and to start a start-up. The students work together in weekly group exercises and develop a business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentation and a corresponding pitch deck.
	Why this course is essential: Many students develop ideas for new products or services during their studies. This exercise provides them with the tools and basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams. Content:
	In ten weekly group exercises, students work out a business idea based on the following key questions:  1. How do you generate a relevant and viable business idea?  2. How do you develop a business model from a business idea?  3. How do you assess the market and potential customers for a specific product or service?  4. How do you develop a sales and distribution strategy?  5. How can you convince investors of a business idea and a business model to secure financing?  What you will learn and get:  At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do so. Furthermore, you will have learned to transform your theoretical knowledge into practical business ideas and business models. In the process, you will have gained skills regarding teamwork.
Literature	Relevante Literatur aus der korrespondierenden Vorlesung.

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			
<b>Recommended Previous</b>	None			
Knowledge				
Educational Objectives	After taking part successfully, students have reached the	following learning results		
<b>Professional Competence</b>				
Knowledge	Students are able to			
	<ul> <li>understand the facts, contexts and objectives of tr</li> </ul>	ansport planning		
	<ul> <li>correctly apply definitions and concepts of transpo</li> </ul>			
	<ul> <li>reproduce basic concepts of transport modelling.</li> </ul>	re planning.		
	<ul> <li>explain the fundamentals of traffic engineering and</li> </ul>	d transport infrastructure construction.		
Skills	Students are able to			
	<ul> <li>analyse transport supply based on key metrics.</li> </ul>			
	<ul> <li>estimate transport demand using key metrics.</li> </ul>			
	<ul> <li>design transport networks, links and junctions.</li> </ul>			
	calculate traffic signal plans.			
	assess transport concepts.			
Personal Competence	Churchenster and a blacks			
Social Competence	Students are able to			
	get together in groups and constructively discuss a	and analyse set problems.		
	<ul> <li>in a group agree on solutions and document them.</li> </ul>			
Automore	Chudente ere eble te			
Autonomy	Students are able to			
	<ul> <li>produce reports on group work.</li> </ul>			
	• structure the tasks and timing for working out a set	et problem.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Course achievement	Compulsory Bonus Form Descrij	otion		
course acmevement	No 5 % Excercises			
Examination	Subject theoretical and practical work			
Examination duration and	Project report in four work packages, in small groups, dur	ing the semester		
scale		-		
Assignment for the	Civil- and Environmental Engineering: Specialisation Trafi	fic and Mobility: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisation Wate	er and Environment: Compulsory		
	Civil- and Environmental Engineering: Specialisation Civil	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	<ul> <li>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: <ul> <li>objectives of transport planning,</li> <li>key mobility metrics,</li> <li>measuring and predicting demand,</li> <li>designing and planning transport infrastructure,</li> <li>fundamentals of traffic engineering and</li> <li>an introduction to transport concepts and planning processes.</li> </ul> </li> </ul>
Literature	<ul> <li>Bosserhoff, Dietmar (2000) Integration von Verkehrsplanung und räumlicher Planung. Schriftenreihe der Hessischen Straßen- und Verkehrsverwaltung, Heft 42. Hessisches Landesamt für Straßen- und Verkehrswesen. Wiesbaden.</li> <li>Lohse, Dieter; Schnabel, Werner (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung: Band 1; Straßenverkehrstechnik. Beuth Verlag. Berlin.</li> <li>Forschungsgesellschaft für Straßen- und Verkehrswesen (2006) Richtlinien für die Anlage von Stadtstraßen - RASt 06. FGSV-Verlag. Köln (FGSV, 200).</li> <li>Vallée, Dirk; Engel, Barbara; Vogt, Walter (2021) Stadtverkehrsplanung Band 3, Springer Verlag. Berlin.</li> </ul>

Medule MOORE, Intra-	Justice to Deilwove			
Module M0985: Introd	auction to Rallways			
Courses				
Title		Тур	Hrs/wk	СР
ntroduction to Railways (L1184)		Lecture	2	4
Introduction to Railways (L1185)		Recitation Section (large)	1	2
Module Responsible	Prof. Carsten Gertz			
Admission Requirements	None			
<b>Recommended Previous</b>	none			
Knowledge				
Educational Objectives	After taking part successfully, students have reac	hed the following learning results		
<b>Professional Competence</b>				
Knowledge	Students can			
	<ul> <li>give definitions for basic terms related to related.</li> </ul>	always		
	<ul> <li>explain specifics concerning the handling of</li> </ul>			
	<ul> <li>explain specifics concerning the nanding to</li> <li>explain the required infrastructure</li> </ul>	goods on ranways		
	<ul> <li>describe the work at the track super struct</li> </ul>			
	• describe the work at the track super struct			
Skills				
Personal Competence				
Social Competence	Students can			
	<ul> <li>work at tasks in groups and come to result</li> </ul>	s together		
	<ul> <li>discuss contents in groups, summarize the</li> </ul>	-		
	<ul> <li>convey contents to other by processing the</li> </ul>			
Autonomy	Students can work out and understand contents t	homsolves during the lesture through literat	uro rosoarch	
Workload in Hours	Independent Study Time 138, Study Time in Lecto	· ·	are research	
Credit points				
Course achievement				
Examination				
Examination duration and	90 min			
scale				
Assignment for the	Civil- and Environmental Engineering: Specialisati	on Traffic and Mobility: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisati	on Civil Engineering: Elective Compulsory		
	Civil- and Environmental Engineering: Specialisati		lsory	
	Logistics and Mobility: Specialisation Traffic Plann			
	Engineering and Management - Major in Logistics	and Mobility: Specialisation II. Traffic Planni	ng and Systems:	Elective Compulsor

<b>Course L1184: Introduction t</b>	o Railways	
Тур	Lecture	
Hrs/wk		
CP	4	
Workload in Hours	s 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				
<b>Fitle</b>		Тур	Hrs/w	k CP
ntroduction to Geoinformation Sci	ence (L2465)	Project-/problem-ba	ased Learning 3	3
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
<b>Recommended Previous</b>	Principles of analysis and linear alge	bra		
Knowledge				
Educational Objectives	After taking part successfully, studer	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 o	of geo information sys	tems. They can report f
	basics, the basic approaches and me	ethods of geo information systems and are able	to transfer these to p	practical questions.
Skills	s Students are able to apply the basic methods used in geo-information systems to practical problems. They are able to apply the			vey are able to apply th
to simple applications of geographic information systems and to transfer them to other problems. The s				
	simple GIS project and present their results.			
Personal Competence				
•	The students can work together grou	ups cooperatively and productively.		
Autonomy	Students are able to organize thei	r work flow to prepare themselves before pr	resentations and disc	cussion. They can acqu
	appropriate knowledge by making er	nquiries independently.		
Workload in Hours	Independent Study Time 48, Study T	ime in Lecture 42		
Credit points	3			
Course achievement	None			
Examination	Subject theoretical and practical wor	rk		
Examination duration and	Computer aided GIS-Application and	written-theoretical part		
scale				
Assignment for the	General Engineering Science (Germa	an program, 7 semester): Specialisation Civil Er	igineering: Compulsor	ý
Following Curricula	Civil- and Environmental Engineering	g: Specialisation Traffic and Mobility: Compulso	ry	
	Civil- and Environmental Engineering	g: Specialisation Water and Environment: Comp	oulsorv	

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	<ul> <li>Theoretical basics of Geo-Information-Systems</li> <li>Data models, geographical coordinates, geo-referencing, map-views</li> <li>Data mining and -analyses of geo-data</li> <li>Analysis techniques</li> </ul>
Literature	

Module M0612: Steel	Structures II			
Courses		<b>T</b>	Have for the	<u></u>
Title Steel Structures II (L0301)		<b>Typ</b> Lecture	Hrs/wk 2	<b>СР</b> 3
Steel Structures II (L0302)		Recitation Section (large)	2	3
Module Responsible	Prof. Marcus Rutner			-
Admission Requirements				
<b>Recommended Previous</b>	Steel Structures I			
Knowledge				
Educational Objectives	After taking part successfully, students have rea	ched the following learning results		
Professional Competence				
Knowledge	After successful completition students can			
	<ul> <li>describe and explain the behaviour of bol</li> </ul>	ted and welded connections		
	<ul> <li>describe and explain the behaviour of boll</li> <li>design and check simple halls and buildin</li> </ul>			
	<ul> <li>calculate forces and stresses of simple str</li> </ul>	-		
	<ul> <li>illustrate and dimension he main details (</li> </ul>		points)	
Skills	Students are able to design simple structures a		-	
	failure. They can apply structural imperfections,	calculate according to 2nd order theory an	d verify their result	IS.
Personal Competence				
Social Competence	In this module, the student gains the ability to p	rofessionally develop and responsibly shap	e his/her own life. <sup>-</sup>	This happens throug
	attending the lectures and exercise units as well as final exam preparation by assessing old exams. In the lecture and exercise			
	unit, the contents are not only introduced but a	also discussed and developed. In these dis	cussions the stude	ents learn to critical
	listen to opinions and interpretation of others an	d to get involved in the discussion.		
Autonomy	At the beginning of every lecture, the contents	of the last lecture are repeated and discu	ussed with the stud	dents. Further. at th
	beginning of every exercise unit, examples out			
	discussed. These discussions at the beginning o	f every lecture and exercise unit enable th	e student to test h	is/her knowledge an
	enforces independent follow-up and preparation	on of the course material. Further, the pr	eparation for the	final exam demand
	strategic planning, persistence and independent	learning		
Workload in Hours	Independent Study Time 124, Study Time in Lec	ture 56		
Credit points				
Course achievement	None			
Examination	Written exam			
Examination duration and	120 minutes			
scale				
Assignment for the	General Engineering Science (German program,	7 semester): Specialisation Civil Engineerin	ng: Elective Compu	lsory
Following Curricula	Civil- and Environmental Engineering: Specialisa	tion Civil Engineering: Compulsory		
	Civil- and Environmental Engineering: Specialisa	tion Traffic and Mobility: Elective Compulso	ory	
	Civil- and Environmental Engineering: Specialisa	tion 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	<ul> <li>Welded connections</li> <li>Simple constructions <ul> <li>Trusses</li> <li>Plate girders</li> <li>Frames</li> <li>Columns</li> </ul> </li> <li>Buildings with several storeys</li> <li>Halls</li> </ul>
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	
CP	3	
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28	
Lecturer	Prof. Marcus Rutner	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Module 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			
<b>Recommended Previous</b>	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 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 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	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Dr. Dorothea Rechtenbach
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

Engineering				
Module M1632: Applie	ed Water Management			
Courses				
Title		Тур	Hrs/wk	СР
Aodelling of soil water dynamics (L	2471)	Project-/problem-based Learning	2	2
Iodelling of soil water dynamics (L	2470)	Lecture	2	2
lature-oriented Hydraulic Engineer	ring (L2472)	Project-/problem-based Learning	2	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
<b>Recommended Previous</b>	De sie het state of en sharis and differentie	La sua biana		
Knowledge	Basic knowledge of analysis and differentia			
	<ul> <li>hydromechanical and hydraulic engineering</li> </ul>	g principles		
Educational Objectives	After taking part successfully, students have reach	hed the following learning results		
Professional Competence				
Knowledge	Students are able to define the basic tasks and to	erms of nature-oriented hydraulic engineering	und groundw	ater hydrology. Th
	cam describe the basics concepts, the basic ap	proaches and methods of nature-oriented hy	draulic engin	eering, groundwa
	hydrology and groundwater modelling and are abl	le to apply these to practical problems.		
Skills	The students are able to apply the methods a			-
	hydrology to practical problems. They can demon			
	addition, they are able to apply the approaches		-	
	reason how to apply them as a basis for geo-hydrological questions. In addition, students can apply basic groundwate			oundwater modell
	methods to simple problems of groundwater move	ement and groundwater recharge.		
Personal Competence				
Social Competence	Students are able to help each other solving ca	se studies. The students are able to deploy t	heir gained k	nowledge in appl
	problems of the practical nature-based hydraulic	engineering. Additionaly, they will be able to o	lemonstrate t	o work cooperativ
	in teams consisting of engineers from different su	bject areas.		
Autonomy	The students will be able to independently extend	I their knowledge and apply it to new problems		
Workload in Hours	Independent Study Time 96, Study Time in Lecture	e 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	7 semester): Specialisation Green Technologies	, Focus Wate	and Environmen
Following Curricula	Engineering: Elective Compulsory			
. enering earneana	Civil and Environmental Engineering, Cresialisati			
	Civil- and Environmental Engineering: Specialisation	on Civil Engineering: Elective Compulsory		
	Civil- and Environmental Engineering: Specialisation			
		on Traffic and Mobility: Elective Compulsory	ТУ.	

Course L2471: 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	Sankeerth Govindaiah Narayanaswamy	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L2470: Modelling of s	soil water dynamics
Тур	Lecture
Hrs/wk	2
СР	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Mohammad Aziz Zarif
Language	EN
Cycle	SoSe
Content	<ul> <li>Students will learn about soil physical characteristics, soil water potential, saturated and unsaturated flows in soil, basics of solute transport in soil, and numerical methods/tools to simulate water flow and solute transport in soil.</li> </ul>
Literature	

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	<ul> <li>Nature oriented hydraulic engineering</li> <li>Regime-theory and application for the development of environmental guiding priciples of rivers</li> <li>Engineering-biological measures for the stabilization of rivers</li> <li>design techniques for water engineering</li> <li>hydraulic dimensioning of river bed and bank protection</li> <li>design principles and design techniques for fish passages (fish ladder, ramps etc.)</li> </ul>
Literature	Patt, Heinz (2018): Naturnaher Wasserbau. Entwicklung und Gestaltung von Fließgewässern. With assistance of Peter Jürging, Werner Kraus. 5. Auflage. Wiesbaden: Springer Vieweg.

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. Peter Fröhle			
Admission Requirements	None			
<b>Recommended Previous</b>				
Knowledge				
Educational Objectives	After taking part successfully, students ha	ave reached the following learning results		
Professional Competence				
Knowledge				
Skills				
Personal Competence				
Social Competence				
Autonomy				
Workload in Hours	Independent Study Time 124, Study Time	in Lecture 56		
Credit points	6			
Course achievement	None			
Examination	Subject theoretical and practical work			
Examination duration and	Written-theoretical part and report			
scale				
Assignment for the	Civil- and Environmental Engineering: Spe	ecialisation Civil Engineering: Elective Compute	sory	
Following Curricula	Civil- and Environmental Engineering: Spe	ecialisation Water and Environment: Elective C	Compulsory	
	Civil- and Environmental Engineering: Spe	ecialisation Traffic and Mobility: Elective Comp	oulsory	
	Logistics and Mobility: Specialisation Traff	fic Planning and Systems: Elective Compulsory	/	
	Engineering and Management - Major in L	ogistics and Mobility: Specialisation II. Traffic	Planning and Systems:	Elective Compulso

Course L2474: Sustainable U	ourse 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 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		Turn	Hrs/wk	СР
Building Information Modeling (L27	60)	Typ Integrated Lecture	2	2
Building Information Modeling (L27		Recitation Section (small)	2	4
Module Responsible				
Admission Requirements				
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have reached the fo	blowing learning results		
Professional Competence				
Knowledge	The contents of this module follow the recommendati (www.gacce.de) for the BIM courses taught at German univ to present methodological knowledge to enable students companies and public institutions. An in-depth understa Emphasis is placed on generally valid principles and tech decades. The theoretical content taught in the lecture is of tools will be used. Topics include computer-aided design an BIM data exchange and cooperation (focusing on Indust applications, BIM tools, and advanced aspects. A central co	ersities in the subject area of enginersities in the subject area of enginers of the methods and techning of the methods and techning independent of specific soles of the method by practical exercises and geometry modeling, digital moder the provide of the second seco	neering informati or, and to impro- ologies relevant ftware products ses, in which sta deling of building modeling, job	ics. The module aim ove BIM processes in to BIM is essentia and valid for sever- te-of-the-art softwar is and infrastructure
	The module focuses on enabling students to accomplis understanding the methods. The competencies includes skills, in particular understanding of the requirements for r buildings. Specifically, implementing and editing 3D r implementing BIM in companies are among the competence	construction-related skills, BIM-sp nodeling buildings as well as for p nodels, coordinating and manag	ecific skills and lanning, implem	additional specialis enting, and operatin
Personal Competence				
	Social skills are essential in the BIM context, as BIM proj social skills, this module aims to teaching students to co students to work with others and achieve goals together, through group work. In small student groups, the student from the instructors and fellow students. The personal competencies pursued in this module in te guidance or assistance, which is essential for BIM projects helps students develop a degree of independence in wor timely and efficient manner, primarilty supported through p	onvey information in a clear and and to resolving conflicts constru- is train their communication and o erms of independence are aiming 5, as BIM projects often involve co- king, particularly the skills to plan	comprehensible ctively, which is cooperation skill towards compl mplex and urge	manner, to enablin essentially achieve s, receiving feedbac eting tasks with fen ht tasks. This modul
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points				
Course achievement				
	Written elaboration			
	Description of a BIM model with 15-minute oral presentatio	n		
Assignment for the	Civil- and Environmental Engineering: Specialisation Traffic	and Mobility: Elective Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisation Water	and Environment: Elective Compu	lsory	
	Civil- and Environmental Engineering: Specialisation Civil E	ngineering: Elective Compulsory		

Course L2760: Building Information 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	<ul> <li>Historical development</li> <li>Introduction and motivation</li> <li>Basics of geometry</li> <li>2D geometry modeling</li> <li>2½D geometry modeling</li> <li>3D geometry modeling</li> <li>Digital modeling of buildings and infrastructure, object-oriented, semantic, and parametric modeling</li> <li>Data exchange, interoperability, and communication (with emphasis on Industry Foundation Classes)</li> <li>BIM data storage and data management</li> <li>Process modeling</li> <li>Job profiles and applications</li> <li>BIM tools</li> <li>Advanced aspects of BIM</li> <li>Seminar by external BIM experts and project presentations</li> </ul>	
Literature	Borrmann, König, Koch, Beetz (Hrsg.), 2021. Building Information Modeling - Technologische Grundlagen und industrielle Praxis. 2., aktualisierte Auflage. Springer.	

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	

#### **Specialization Water and Environment**

Module M1628: Susta	inable Building			
Courses				
Title		Тур	Hrs/wk	СР
Circular flow economy and structur Sustainable building materials and		Integrated Lecture Integrated Lecture	2	2
Sustainable water management an	-	Integrated Lecture	2	2
Module Responsible			_	_
Admission Requirements				
Recommended Previous	Basic knowledge of building materials, building chemist	y, building construction and buildi	ng project manager	nent
Knowledge				
Educational Objectives	After taking part successfully, students have reached th	e following learning results		
Professional Competence				
Skills	constructional and environmental properties of recyclate overview of the history, definition and to provide strate environmental perspective. Furthermore, they can expl field of sustainable construction (e.g. environmental imp energy and climate-optimised planning and constructio discuss the fundamental relationship between the origi- characterising them. Students can relate relevant legal requirements to prac- justify the application of specific limit values for individ from hazardous construction waste in a concise mann sustainable construction on the basis of central enginee	egic approaches to the sustainabil ain relevant objectives, strategies bacts of the production and use of i n, material principles of renewable in and type of construction waste tical problems of environmentally lual areas of application. Students er. They are able to critically exa	ity discussion from and exemplary fiel building materials, l e raw materials). St e, quantities produ sound design and o are able to assess mine innovative ar	a constructional and ds of research in the ife cycle assessment udents will be able to ced and methods for construction and thus risks that may arise eas of application of
Personal Competence Social Competence	approaches for alternative solutions exemplarily, e.g. fo The students are able to work out their own solutions for purpose, they can organise themselves in a division of I are able to appoint group members to coordinate the o presentation of work results in the seminar.	r specific problems of recycling bu	uilding materials in work and project pla	an. Furthermore, the
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	Compulsory         Bonus         Form         Description           Yes         20 %         Written elaboration	iption		
Examination	Written exam			
Examination duration and scale	90 min			
Assignment for the Following Curricula	5 5 1	ffic and Mobility: Elective Compuls	-	

Course L2464: Circular flow	ourse L2464: Circular flow economy and structural recycling		
Тур	Integrated Lecture		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Kerstin Kuchta		
Language	DE		
Cycle	SoSe		
Content	<ul> <li>Types, origin, quantities of construction waste and building debris</li> <li>Risks and characterisation of construction waste</li> <li>Avoidance strategies and recycling options for construction waste and building debris</li> <li>Criteria of sampling, analysis and opportunities for the use of treated building materials</li> <li>political and legal requirements for the recycling of building materials</li> </ul>		
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 L3179: Sustainable b	ourse L3179: Sustainable building materials and buildings		
Тур	Integrated Lecture		
Hrs/wk	2		
CP	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Sebastian Rybczynski		
Language	DE		
Cycle	SoSe		
Content			
Literature			

Course L3180: Sustainable w	Course L3180: Sustainable water management and hydraulic engineering		
Тур	Integrated Lecture		
Hrs/wk	2		
СР	2		
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28		
Lecturer	Prof. Peter Fröhle		
Language	DE		
Cycle	SoSe		
Content	Environmental water management and sustainable hydraulic engineering		
	<ul> <li>Concepts of environmental responsibility and sustainability</li> <li>Nature-based concepts, green and hybrid solutions in hydraulic engineering</li> <li>Sustainable flood, low water and drought management</li> <li>Resource-conserving construction materials and processes</li> <li>Analysis and evaluation of hydraulic engineering and water management projects</li> </ul>		
Literature	Vorlesungsfolien und ausgewählte Paper werden in der Veranstaltung zur Verfügung gestellt		

Engineering					
Module M0755: Geote	chnics II				
Courses					
Title			Тур	Hrs/wk	СР
Foundation Engineering (L0552)			Lecture	2	2
Foundation Engineering (L0553)			Recitation Section (I	arge) 2	2
Foundation Engineering (L1494)			Recitation Section (s	small) 2	2
Module Responsible	Prof. Jürgen Grabe				
Admission Requirements	None				
<b>Recommended Previous</b>	Modules:				
Knowledge					
	Mechanics I-II				
	<ul> <li>Geotechnics I</li> </ul>				
Educational Objectives	After taking part successfull	y, students have reac	hed 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:				
	<ul> <li>verificate the stability and usability of foundations,</li> <li>know individual methods of ground improvement and apply them in their range of application,</li> </ul>				
		5 1	ement and apply them in their ran	ge of application,	
	<ul> <li>design retaining walls</li> </ul>	5.			
Personal Competence					
Social Competence					
Autonomy					
Workload in Hours	Independent Study Time 96,	Study Time in Lectur	e 84		
Credit points	6				
Course achievement	Compulsory Bonus Form		Description		
	No 20 % Attes	station			
Examination	Written exam				
Examination duration and	90 minutes				
scale					
Assignment for the	General Engineering Science	e (German program, 7	semester): Specialisation Civil En	gineering: Elective Compu	Ilsory
Following Curricula	Civil- and Environmental Eng	gineering: Specialisati	on Civil Engineering: Compulsory		
	Civil- and Environmental Eng	gineering: Specialisati	on Traffic and Mobility: Elective Co	ompulsory	
	Civil- and Environmental End	gineering: Specialisati	on Water and Environment: Electiv	ve Compulsory	

Course L0552: Foundation E	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	SoSe		
Content	<ul> <li>Shallow foundations</li> <li>Pile foundations</li> <li>Ground improvement</li> <li>Retaining walls</li> <li>Underpinning</li> <li>Groundwater Conservation</li> <li>Cut-off Walls</li> </ul>		
Literature	<ul> <li>Vorlesung/Übung s. www.tu-harburg.de/gbt</li> <li>Grabe, J. (2004): Bodenmechanik und Grundbau</li> <li>Kolymbas, D. (1998): Geotechnik - Bodenmechanik und Grundbau</li> <li>Grundbau-Taschenbuch, neueste Auflage</li> </ul>		

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	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Course L1494: Foundation E	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	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Engineering" Module M0983: Mobil	ity Concepts							
Courses								
		<b>T</b>	Have family	<u></u>				
<b>Title</b> Mobility Research and Transportati	on Projects (11191)	Typ Project (problem based Learning	Hrs/wk 3	<b>СР</b> 3				
Mobility in Megacities and Develop	-	Project-/problem-based Learning Seminar	3	3				
Module Responsible								
Admission Requirements	None							
Recommended Previous		ering						
Knowledge	inoutie transportation framming and frame Engine	Iodule Transportation Planning and Traffic Engineering						
Educational Objectives	After taking part successfully, students have reach	ned the following learning results						
Professional Competence		····· ································						
	Students are able to:							
	<ul> <li>name the different urban transport systems</li> </ul>							
	explain the transport challenges in Asian an							
	<ul> <li>recognise and relate interactions between a second s</li></ul>	transport systems on the one hand and ecolo	gical, socio-cul	tural and econon				
	problem areas on the other.	n development and transport (in Company and		(untring)				
	<ul> <li>outline specific issues and problems in urba</li> <li>oxplain the offects of external framework fa</li> </ul>		r developing co	untries).				
	<ul> <li>explain the effects of external framework fa</li> </ul>	ctors (like energy costs) on transport.						
Skills	Students are able to:							
	analyse and evaluate given case studies.							
	<ul> <li>transfer learning results to other regions an</li> <li>analyze analyze and problems in urban</li> </ul>		acustrias)					
	<ul> <li>analyse specific issues and problems in urba</li> <li>critically assess actors, planning objectives</li> </ul>			viacte in the light				
	the UN Millennium Development Goals			jects in the light				
	develop and present sustainable (i.e. ecolo	ogical, poverty oriented, gender balanced an	d economical)	solutions for urb				
	personal and goods transport							
Borconal Compotonco								
Personal Competence	Students are able to:							
Social Competence								
	<ul> <li>present and explain independently generate</li> </ul>	ed findings.						
	<ul> <li>constructively discuss potentially controvers</li> </ul>	sial topics in a group context.						
Autonomy	Students are able to:							
	<ul> <li>carry out independent literature research and</li> </ul>	nd analysis.						
	<ul> <li>independently author a written report on a generative structure of the second se</li></ul>	•						
Workload in Hours	Independent Study Time 96, Study Time in Lecture	e 84						
Credit points	6							
Course achievement	Compulsory Bonus Form	Description						
course acmevement		Exkursion innerhalb Hamburgs abhängig von	aktuellen Ther	nen im Modul				
Examination	Written elaboration							
Examination duration and	All assignments in groups (2-4 students): written r	eport, 2000 words (incl. 2 short presentations	of 10 mins.); fir	nal presentation,				
scale								
Assignment for the	Civil- and Environmental Engineering: Specialisation	on Traffic and Mobility: Compulsory						
Following Curricula								
	Civil- and Environmental Engineering: Specialisation	on Water and Environment: Elective Compulso	ry					
	Logistics and Mobility: Specialisation Traffic Planni	ng and Systems: Compulsory						
	Engineering and Management - Major in Logistics a	and Mobility: Specialisation II. Traffic Planning	and Systems: C	Compulsory				

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:			
	<ul> <li>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?</li> <li>Which external effects in turn are caused by mobility choices and traffic?</li> <li>How should these interactions be evaluated, how and by whom can they be influenced?</li> <li>Which measures at the municipal level can contribute to a more sustainable transport system?</li> </ul> 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: <ul> <li>Environmental Justice : which population groups are disproportionately affected by transport emissions and who causes them?</li> <li>Municipal cycle planning</li> <li>Transport and Climate Protection: can, want, act - everything could be, nothing must be?</li> </ul>			
Literature	Die Literaturempfehlungen sind abhängig von den jeweiligen, wechselnden Themenschwerpunkten und werden rechtzeitig vor Beginn der Veranstaltung bekannt gegeben.			

Тур	Seminar
Hrs/wk	
CP	
Workload in Hours	Independent Study Time 48, Study Time in Lecture 42
Lecturer	Dr. Jürgen Perschon, Christof Hertel
Language	DE
Cycle	
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). An English language presentation is also part of the course work.
Literature	Umweltbundesamt: Jahresbericht 2005
	GTZ: The Role of Transport in Urban Development Policy
	TRB/ STI: Sustainable Transportation Indicators - A Recommended Program To Define A Standard Set of Indicators For Sustainable Transportation Planning
	https://www.slocat.net
	https://www.sutp.org
	https://www.oecd.org
	https://www.itdp.org
	https://www.kfw-entwicklungsbank.de
	https://www.transportenvironment.org
	https://www.trl.co.uk
	https://www.embarq.org
	https://www.umweltbundesamt.de
	https://www.eurist.info

Engineering					
Module M1715: Rene	wable Energies				
Courses					
Title		Тур	Hrs/wk	СР	
Fuels II (L3143)		Lecture	1	1	
Renewable Energies I (L2740)		Lecture	2	2	
Renewable Energies I (L2742)		Recitation Section (large)	1	1	
Renewable Energies II (L2741)		Lecture	2	2	
Module Responsible	Prof. Martin Kaltschmitt				
Admission Requirements	None				
<b>Recommended Previous</b>	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 an overview of characteris	tics of renewable e	energy systems. The	
	will be able to explain the issues that arise	in these systems. Furthermore, they are able t	to explain knowled	ge of energy supply	
		is context, taking into account contexts border			
		ch energy systems and take a critical stand o			
		nergy systems and have an overview of the e			
	options.				
	optionsi				
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 technically, ecologically ar	nd economically as	well as systemical	
	and also design them under certain given co	nditions. They are able to select the regulation	s necessary for this	s in a subject-speci	
	manner, especially by means of non-standar	d solutions to a problem.			
	Churcharaka anna a bha ba annalla annala in iarana fu			: <b>6</b> - +   +  -	
	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.				
	Tespective 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 sustaina	bility perspective.			
Autonomy	Students will be able to independently acces	s sources about the field, acquire knowledge a	nd transform it to a	ddress new issues.	
	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	6				
Course achievement	None				
Examination					
Examination duration and	180 min				
scale					
Assignment for the	General Engineering Science (German progr	am, 7 semester): Specialisation Green Technolo	ogies: Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specia	lisation Civil Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specia	alisation Traffic and Mobility: Elective Compulso	ry		
	Civil- and Environmental Engineering: Specia	alisation Water and Environment: Elective Comp	oulsory		
	Chemical and Bioprocess Engineering: Speci	alisation Chemical Engineering: Compulsory	-		
		l and Bioprocess Engineering, Focus Chemical	Engineering: Comp	ulsory	
	Green Technologies: Energy, Water, Climate		5 <u>5</u>	- 2	
	Process Engineering: Core Qualification: Con				
		·,			

Course L3143: Fuels II			
Тур	Lecture		
Hrs/wk	1		
CP	1		
Workload in Hours	Independent Study Time 16, Study Time in Lecture 14		
Lecturer	r. Karsten Wilbrand		
Language	DE		
Cycle	SoSe		
Content	<ul> <li>Regulatory requirements of "alternative" fuels (e.g. RED)</li> <li>Overview of today's alternative fuels</li> <li>o Biodiesel / HEFA</li> </ul>		
	o Bioethanol o Biomethane o Other fuels		
	Overview of future alternative fuels     o 2nd generation biofuels     o Hydrogen and hydrogen derivatives		
	o Electricity-based fuels o Other fuels		
	Electromobility     o with battery     o with hydrogen fuel cell		
	<ul> <li>Markets and market developments</li> <li>CO2 analyses of the various options per application area</li> <li>Global megatrends and future challenges</li> <li>Developments in vehicle and drive technologies</li> <li>Energy scenarios up to 2050 and significance for the mobility sector</li> </ul>		
Literature	Eigene Unterlagen, Veröffentlichungen, Fachliteratur Literature: Own documents, publications, technical literature		

Course L2740: Renewable En	ergies 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

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			
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			

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Course L2741: Renewable En	ergies II
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
Content	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

Module M0631: Reinf	orced Concrete	Structures	Ш			
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	<b>CP</b> 1 3 2
Module Responsible	Dr. Adrian Faron					
Admission Requirements	None					
Recommended Previous Knowledge	<ul><li>Basics of safet</li><li>Knowledge in c</li></ul>	y format are requi lesign of beams a	s and combination of acti ired. Ind columns for ultimate li tructures 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 c	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,	
<b>Personal Competence</b> <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	me 110, Study Tir	me in Lecture 70			
Credit points						
Course achievement	Compulsory Bonus No None	Form Excercises	Description			
Examination						
Examination duration and	120 minutes					
scale						
Assignment for the Following Curricula	Civil- and Environmer Civil- and Environmer	ntal Engineering: S ntal Engineering: S	Specialisation Civil Engine Specialisation Traffic and	Mobility: Elective Compulsory	4	lsory
	Civil- and Environmer	ntal Engineering: S	Specialisation Water and I	Environment: Elective Compu	lsory	

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	Dr. Adrian Faron	
Language	DE	
Cycle	WiSe	
Content	Design of a truss structure	
Literature	Skript zur Lehrveranstaltung "Stahlbetonbau II"	

Course L0348: Concrete Structures II		
	Lecture	
Hrs/wk		
CP		
	ndependent Study Time 62, Study Time in Lecture 28	
	Dr. Adrian Faron	
Language	DE	
Cycle	WiSe	
Content	<ul> <li>Design of concrete members for shear, punching and torsion</li> <li>Design for serviceability limit state (durability): crack- and deflection control</li> <li>Detailing</li> <li>Design of discontinuity regions (e.g. corbels, frame corner)</li> <li>design of footings</li> <li>Introduction in the design of slabs</li> <li>Layout and content of a structural design</li> <li>Vorlesungsumdrucke zum downloaden im STUDiP</li> <li>Zilch K., Zehetmaier G.: Bemessung im konstruktiven Betonbau. Springer Verlag, 2010</li> <li>König G., Tue N.: Grundlagen des Stahlbetonbaus. Teubner Verlag, Stuttgart 1998</li> <li>Deutscher Beton- und Bautechnikverein E.V.: Beispiele zur Bemessung von Betontragwerken nach Eurocode 2. Band 1: Hochbau, Bauverlag GmbH, Wiesbaden 2011</li> <li>Dahms KH.: Rohbauzeichnungen, Bewehrungszeichnungen. Bauverlag, Wiesbaden 1997</li> <li>Grasser E., Thielen G.: Hilfsmittel zur Berechnung der Schnittgrößen und Formänderungen von Stahlbetontragwerken. Deutscher Ausschuss für Stahlbeton, Heft 240, Verlag Ernst &amp; Sohn, Berlin 1978</li> <li>DIN EN 1992-1-1:2011: Bemessung und Konstruktion von Stahlbeton- und Spannbetontragwerken - Teil 1: Allgemeine Bemessungsregeln für den Hochbau.</li> </ul>	

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	Dr. Adrian Faron
Language	DE
Cycle	WiSe
Content	See interlocking course
Literature	See interlocking course

Courses				
Fitle		Тур	Hrs/wk	СР
Introduction to Management (L088) Exercise Introduction to Manageme		Lecture Recitation Section (small)	3 2	3 3
Module Responsible			2	5
	None			
Recommended Previous		5		
Knowledge				
Educational Objectives	After taking part successfully, students have r	eached the following learning results		
Professional Competence				
Knowledge		, and also to Investment and Controlling. In par	ticular they are al	ble to
	<ul> <li>important definitions from the field of M</li> <li>explain the most important aspects of projects</li> <li>describe and explain basic business organization and human ressource man</li> </ul>	and goals in Management and name the mo- functions as production, procurement and s hagement, information management, innovatio d decision making in Business, esp. in situ- ethods from mathematical Finance	st important aspe sourcing, supply n management ar	ects of entreprneu chain management nd marketing
Skills	Students are able to analyse business units w out an Entrepreneurship project in a team. In p		bjectives, strateg	ies etc.) and to ca
	<ul> <li>analyse production and procurement sy</li> <li>analyse and apply basic methods of ma</li> <li>select and apply basic methods from m</li> </ul>	res of companies er multiple objectives, under uncertainty and u stems and Business information systems	inder risk	
Personal Competence	Students are able to			
Autonomy	<ul> <li>work successfully in a team of students</li> <li>to apply their knowledge from the lecture</li> <li>to communicate appropriately and</li> <li>to cooperate respectfully with their fellor</li> <li>Students are able to</li> <li>work in a team and to organize the team</li> <li>to write a report on their project.</li> </ul>	re to an entrepreneurship project and write a o	oherent report on	the project
Workload in Hours	Independent Study Time 110, Study Time in L	ecture /U		
Credit points				
Course achievement	Subject theoretical and practical work			
Course achievement Examination				
Course achievement Examination Examination duration and	several written exams during the semester plu	us final test (90 minutes)		
Course achievement Examination Examination duration and scale	several written exams during the semester plu			
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German program	n, 7 semester): Core Qualification: Compulsory		
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German program Civil- and Environmental Engineering: Speciali	n, 7 semester): Core Qualification: Compulsory		
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German progran Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory	ilsory	
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German progran 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 Compu sation Traffic and Mobility: Elective Compulsor	ilsory	
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German prograr 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 Compulsory sation Traffic and Mobility: Elective Compulsory	ilsory	
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German prograr 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 Compulsory sation Traffic and Mobility: Elective Compulsory	ulsory y	
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Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German prograr 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 Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Com Electrical Engineering and Information Techno Green Technologies: Energy, Water, Climate: S	n, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compulsory sation Traffic and Mobility: Elective Compulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compul npulsory logy: Core Qualification: Compulsory Specialisation Biotechnologies: Elective Compu	ulsory y sory Isory ergies: Elective Co	ompulsory
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German prograr 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 Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Cor Electrical Engineering and Information Techno Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S	m, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compulsory sation Traffic and Mobility: Elective Compulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulsory logy: Core Qualification: Compulsory Specialisation Biotechnologies: Elective Compu Specialisation Energy Systems / Renewable End	ulsory y sory Isory ergies: Elective Co apulsory	ompulsory
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German prograr 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 Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Cor Electrical Engineering and Information Techno Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S	m, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compulsory sation Traffic and Mobility: Elective Compulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulsory logy: Core Qualification: Compulsory Specialisation Biotechnologies: Elective Compu Specialisation Energy Systems / Renewable Energy Specialisation Energy Technology: Elective Compu	ulsory y sory lsory ergies: Elective Co upulsory Compulsory	ompulsory
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German prograr 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 Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Cor Electrical Engineering and Information Techno Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S	m, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compulsory sation Traffic and Mobility: Elective Compulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulsory logy: Core Qualification: Compulsory Specialisation Biotechnologies: Elective Compu Specialisation Energy Systems / Renewable Energy Specialisation Maritime Technologies: Elective Compulsory Specialisation Water Technologies: Elective Compu	ulsory y sory lsory ergies: Elective Co upulsory Compulsory	ompulsory
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German prograr 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 Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Com Electrical Engineering and Information Techno Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S	m, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compulsory sation Traffic and Mobility: Elective Compulsory ompulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulsory logy: Core Qualification: Compulsory Specialisation Biotechnologies: Elective Compu Specialisation Energy Systems / Renewable Energy Specialisation Energy Technology: Elective Compu Specialisation Maritime Technologies: Elective Compu Specialisation Water Technologies: Elective Compu Compulsory	ulsory y sory lsory ergies: Elective Co upulsory Compulsory	ompulsory
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German prograr Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Divil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Cor Chemical and Bioprocess Engineering: Special Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Cor Electrical Engineering and Information Techno Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S Computer Science in Engineering: Core Qualification: S Computer Science in Engineering: Core Qualification: S Bater Science in Engineering: Cor	m, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compulsory sation Traffic and Mobility: Elective Compulsory ompulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulsory logy: Core Qualification: Compulsory Specialisation Biotechnologies: Elective Compu Specialisation Energy Systems / Renewable Energy Specialisation Energy Technology: Elective Com Specialisation Maritime Technologies: Elective Com cation: Compulsory ipulsory	ulsory y sory lsory ergies: Elective Co upulsory Compulsory	ompulsory
Course achievement Examination Examination duration and scale Assignment for the	several written exams during the semester plu General Engineering Science (German prograr Civil- and Environmental Engineering: Speciali Civil- and Environmental Engineering: Speciali Divil- and Environmental Engineering: Speciali Bioprocess Engineering: Core Qualification: Cor Chemical and Bioprocess Engineering: Special Data Science: Core Qualification: Compulsory Electrical Engineering: Core Qualification: Cor Electrical Engineering and Information Techno Green Technologies: Energy, Water, Climate: S Green Technologies: Energy, Water, Climate: S Computer Science in Engineering: Core Qualification: Corr Logistics and Mobility: Core Qualification: Corr	m, 7 semester): Core Qualification: Compulsory sation Civil Engineering: Elective Compulsory sation Water and Environment: Elective Compulsory sation Traffic and Mobility: Elective Compulsory isation Bio Engineering: Elective Compulsory isation Chemical Engineering: Elective Compulsory logy: Core Qualification: Compulsory Specialisation Biotechnologies: Elective Compu Specialisation Energy Systems / Renewable Energy Specialisation Energy Technology: Elective Compu Specialisation Maritime Technologies: Elective Con cation: Compulsory upulsory pulsory pulsory chanics: Compulsory	ulsory y sory lsory ergies: Elective Co upulsory Compulsory	ompulsory

Mechanical Engineering: Specialisation Materials in Engineering Sciences: Compulsory
Mechanical Engineering: Specialisation Product Development and Production: Compulsory
Mechanical Engineering: Specialisation Theoretical Mechanical Engineering: Compulsory
Mechanical Engineering: Specialisation Aircraft Systems Engineering: Compulsory
Mechanical Engineering: Specialisation Mechatronics: Compulsory
Mechatronics: Specialisation Electrical Systems: Compulsory
Mechatronics: Specialisation Medical Engineering: Compulsory
Mechatronics: Specialisation Robot- and Machine-Systems: Compulsory
Mechatronics: Specialisation Naval Engineering: Compulsory
Mechatronics: Specialisation Dynamic Systems and AI: 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 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. Matthias Meyer, Prof. Christian Lüthje, Prof. Christian Ringle, Prof. Christian Thies, Prof. Christoph Ihl, Prof. Kathrin Fischer,		
	Prof. Moritz Göldner, Prof. Thomas Wrona, Prof. Thorsten Blecker, Prof. Tim Schweisfurth, Prof. Wolfgang Kersten		
Language	)E		
Cycle	WiSe/SoSe		
Content	<ul> <li>Introduction to Business and Management, Business versus Economics, relevant areas in Business and Management.</li> <li>Important definitions from Management,</li> <li>Developing Objectives for Business, and their relation to important Business functions</li> <li>Business Functions: Functions of the Value Chain, e.g. Production and Procurement, Supply Chain Management, Innovation Management, Marketing and Sales</li> <li>Cross-sectional Functions, e.g. Organisation, Human Ressource Management, Supply Chain Management, Information Management</li> <li>Definitions as information, information systems, aspects of data security and strategic information systems</li> <li>Definition and Relevance of innovations, e.g. innovation opporunities, risks etc.</li> <li>Relevance of marketing, B2B vs. B2C-Marketing</li> <li>different techniques from the field of marketing (e.g. scenario technique), pricing strategies</li> <li>important organizational structures</li> <li>basics of human ressource management</li> <li>Introduction to Business Planning and the steps of a planning process</li> <li>Decision Analysis: Elements of decision problems and methods for solving decision problems</li> <li>Selected Planning Tasks, e.g. Investment and Financial Decisions</li> <li>Introduction to Accounting: Accounting, Balance-Sheets, Costing</li> <li>Relevance of Controlling and selected Controlling methods</li> <li>Important aspects of Entrepreneurship projects</li> </ul>		
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.		
<u> </u>			

Course L0882: Exercise Intro	duction to Management (Exercise)
Тур	Recitation Section (small)
Hrs/wk	2
CP	3
Workload in Hours	Independent Study Time 62, Study Time in Lecture 28
Lecturer	Prof. Christian Lüthje
Language	DE
Cycle	WiSe/SoSe
Content	In this exercise, students develop the knowledge and skills to understand what it means to turn an idea for a new product or service into a real business idea and to start a start-up. The students work together in weekly group exercises and develop a business idea in teams of up to five people. Finally, they present their developed business ideas in the form of a final presentation and a corresponding pitch deck.
	Why this course is essential: Many students develop ideas for new products or services during their studies. This exercise provides them with the tools and basic knowledge to turn these ideas into reality. In the process, students learn to work creatively, structured, and in teams. Content:
	In ten weekly group exercises, students work out a business idea based on the following key questions:  1. How do you generate a relevant and viable business idea?  2. How do you develop a business model from a business idea?  3. How do you assess the market and potential customers for a specific product or service?  4. How do you develop a sales and distribution strategy?  5. How can you convince investors of a business idea and a business model to secure financing?  What you will learn and get:  At the end of this exercise, you will have gained an overview of what it means to start a start-up and the necessary steps to do so. Furthermore, you will have learned to transform your theoretical knowledge into practical business ideas and business models. In the process, you will have gained skills regarding teamwork.
Literatura	Relevante Literatur aus der korrespondierenden Vorlesung.
Literature	nelevanite Literatur aus der Konespondierenden vonesung.

Courses				
<b>Title</b> Introduction to Microplastics in Env Research Methods (L2756) Research Trends (L2757)	ironment (L2755)	<b>Typ</b> Integrated Lecture Lecture Seminar	<b>Hrs/wk</b> 2 1 2	<b>CP</b> 2 2 2
Module Responsible	Prof. Nima Shokri			
Admission Requirements	None			
Recommended Previous Knowledge	Basic knowledge in water and environmental-related research			
Educational Objectives	After taking part successfully, students have reached	the following learning results		
-	The students will be introduced to current research topics relevant to water and environment with a particular focus on the effer of microplastics in environment (introductory level). Data analysis, curation and presentation will be other skills discussed in t module.			
	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 thro	ugh Research-Based Teaching appro	aches will be at the c	ore of this module
Autonomy	The students will be involved in writing individual project reports and giving research presentation. This will contribute to the students' ability and willingness to work independently and responsibly.			
	Independent Study Time 110, Study Time in Lecture	70		
Workload in Hours	6			
Workload in Hours Credit points	0			
Credit points Course achievement				
Credit points Course achievement	None Subject theoretical and practical work			
Credit points Course achievement Examination Examination duration and scale	None Subject theoretical and practical work	mester): Specialisation Green Techr	iologies, Focus Water	and Environment
Credit points Course achievement Examination Examination duration and scale Assignment for the	None Subject theoretical and practical work Report and Presentation	·	-	and Environment

Course L2755: Introduction t	Course L2755: Introduction to 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 Methods	
	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 Trends	
Тур	Seminar
Hrs/wk	2
CP	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			
<b>Recommended Previous</b>	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 contracts and chiestings of t	wananash ala aning		
	<ul> <li>understand the facts, contexts and objectives of f</li> <li>correctly apply definitions and concepts of transp</li> </ul>			
	<ul> <li>reproduce basic concepts of transport modelling.</li> </ul>	ort planning.		
	<ul> <li>explain the fundamentals of traffic engineering at</li> </ul>	ad transport infrastructure construction		
	• explain the fundamentals of traine engineering a			
Skills	Students are able to			
	<ul> <li>analyse transport supply based on key metrics.</li> </ul>			
	<ul> <li>estimate transport demand using key metrics.</li> </ul>			
	<ul> <li>design transport networks, links and junctions.</li> </ul>			
	calculate traffic signal plans.			
	assess transport concepts.			
Personal Competence				
Social Competence	Students are able to			
	<ul> <li>get together in groups and constructively discuss</li> </ul>	and analyse set problems.		
	<ul> <li>in a group agree on solutions and document then</li> </ul>	۱.		
Autonomy	Students are able to			
	<ul> <li>produce reports on group work.</li> </ul>			
	<ul> <li>structure the tasks and timing for working out a structure</li> </ul>	set problem.		
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points	6			
Course achievement		iption		
course acmevement	No 5 % Excercises			
Examination	Subject theoretical and practical work			
Examination duration and	Project report in four work packages, in small groups, du	Iring the semester		
scale		-		
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	il Engineering: Elective Compulsory		
	Engineering and Management - Major in Logistics and M	obility: 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 sub- topic traffic engineering. The following subject areas are covered: <ul> <li>objectives of transport planning,</li> <li>key mobility metrics,</li> <li>measuring and predicting demand,</li> <li>designing and planning transport infrastructure,</li> <li>fundamentals of traffic engineering and</li> <li>an introduction to transport concepts and planning processes.</li> </ul>
Literature	<ul> <li>Bosserhoff, Dietmar (2000) Integration von Verkehrsplanung und räumlicher Planung. Schriftenreihe der Hessischen Straßen- und Verkehrsverwaltung, Heft 42. Hessisches Landesamt für Straßen- und Verkehrswesen. Wiesbaden.</li> <li>Lohse, Dieter; Schnabel, Werner (2011) Grundlagen der Straßenverkehrstechnik und der Verkehrsplanung: Band 1; Straßenverkehrstechnik. Beuth Verlag. Berlin.</li> <li>Forschungsgesellschaft für Straßen- und Verkehrswesen (2006) Richtlinien für die Anlage von Stadtstraßen - RASt 06. FGSV-Verlag. Köln (FGSV, 200).</li> <li>Vallée, Dirk; Engel, Barbara; Vogt, Walter (2021) Stadtverkehrsplanung Band 3, Springer Verlag. Berlin.</li> </ul>

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			
<b>Recommended Previous</b>	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				
<b>Personal Competence</b> 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	Dr. Dorothea Rechtenbach			
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		

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			
<b>Recommended Previous</b>	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	ods used in geo-information systems to practical prol	Nome Thoy ar	a able to apply the
SKIIIS		rmation systems and to transfer them to other prot	-	
	simple GIS project and present their result		nems. The stu	dents can process
	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	Course L2465: Introduction to 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	<ul> <li>Theoretical basics of Geo-Information-Systems</li> <li>Data models, geographical coordinates, geo-referencing, map-views</li> <li>Data mining and -analyses of geo-data</li> <li>Analysis techniques</li> </ul>		
Literature			

Module M0612: Steel	Structures II			
Courses		<b>T</b>	Hara facilia	<u></u>
Title Steel Structures II (L0301)		<b>Typ</b> Lecture	Hrs/wk	<b>СР</b> 3
Steel Structures II (L0302)		Recitation Section (large)	2	3
Module Responsible	Prof. Marcus Rutner		_	-
Admission Requirements				
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have re	ached the following learning results		
Professional Competence				
Knowledge	After successful completition students can			
	<ul> <li>describe and explain the behaviour of bo</li> </ul>	lted and welded connections		
	<ul> <li>design and check simple halls and buildi</li> </ul>			
	<ul> <li>calculate forces and stresses of simple s</li> </ul>	-		
		(framework, column base, load application p	oints)	
Skills	Students are able to design simple structures a		-	
	failure. They can apply structural imperfections	, calculate according to 2nd order theory an	d verify their result	S.
Personal Competence				
Social Competence	In this module, the student gains the ability to	professionally develop and responsibly shap	e his/her own life.	This happens throug
	attending the lectures and exercise units as v	vell as final exam preparation by assessing	old exams. In the	lecture and exercise
	unit, the contents are not only introduced but	also discussed and developed. In these dis	cussions the stude	ents learn to critical
	listen to opinions and interpretation of others a	nd to get involved in the discussion.		
Autonomy	At the beginning of every lecture, the content	s of the last lecture are repeated and discu	issed with the stud	lents. Further. at th
	beginning of every exercise unit, examples ou			
	discussed. These discussions at the beginning			
	enforces independent follow-up and preparat	ion of the course material. Further, the pr	eparation for the	final exam demand
	strategic planning, persistence and independer	it learning		
Workload in Hours	Independent Study Time 124, Study Time in Le	cture 56		
Credit points				
Course achievement				
Examination	Written exam			
Examination duration and	120 minutes			
scale				
Assignment for the	General Engineering Science (German program	, 7 semester): Specialisation Civil Engineerir	ig: Elective Compu	lsory
Following Curricula	Civil- and Environmental Engineering: Specialis	ation Civil Engineering: Compulsory		
	Civil- and Environmental Engineering: Specialis	ation Traffic and Mobility: Elective Compulso	ry	
	Civil- and Environmental Engineering: Specialis	ation Water and Environment: Elective Comp	oulsory	

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	<ul> <li>Welded connections</li> <li>Simple constructions <ul> <li>Trusses</li> <li>Plate girders</li> <li>Frames</li> <li>Columns</li> </ul> </li> <li>Buildings with several storeys</li> <li>Halls</li> </ul>		
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	
CP	3	
Workload in Hours	pendent Study Time 62, Study Time in Lecture 28	
Lecturer	f. Marcus Rutner	
Language	DE	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Medule MOORE, Intra-	Justice to Deilusus				
Module M0985: Introd	Suction to Railways				
Courses					
Title		Тур	Hrs/wk	СР	
ntroduction to Railways (L1184)		Lecture	2	4	
Introduction to Railways (L1185)		Recitation Section (large)	1	2	
Module Responsible	Prof. Carsten Gertz				
Admission Requirements	None				
<b>Recommended Previous</b>	none				
Knowledge					
Educational Objectives	After taking part successfully, students have rea	ched the following learning results			
Professional Competence					
Knowledge	Students can				
	<ul> <li>give definitions for basic terms related to</li> </ul>	railways			
	<ul> <li>explain specifics concerning the handling</li> </ul>				
	<ul> <li>explain the required infrastructure</li> </ul>				
	describe the work at the track super structure				
Skills					
Personal Competence					
Social Competence	Students can				
	<ul> <li>work at tasks in groups and come to resu</li> </ul>	lts together			
	<ul> <li>discuss contents in groups, summarize th</li> </ul>	em and present them in front of others			
	convey contents to other by processing the second sec	nem in writing			
Autonomy	Students can work out and understand contents	themselves during the lecture through literat	ure research		
Workload in Hours	Independent Study Time 138, Study Time in Lec				
Credit points					
Course achievement					
Examination	Written exam				
Examination duration and	90 min				
scale					
Assignment for the	Civil- and Environmental Engineering: Specialisa	tion Traffic and Mobility: Compulsory			
Following Curricula	Civil- and Environmental Engineering: Specialisa	tion Civil Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specialisa	tion Water and Environment: Elective Compu	lsory		
	Logistics and Mobility: Specialisation Traffic Plan	ning and Systems: Elective Compulsory			
	Engineering and Management - Major in Logistic	s and Mobility: Specialisation II. Traffic Planni	ng and Systems:	Elective Compulsory	

<b>Course L1184: Introduction t</b>	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	ependent Study Time 46, Study Time in Lecture 14		
Lecturer	ré Schoppe		
Language	DE		
Cycle	SoSe		
Content	See interlocking course		
Literature	See interlocking course		

Module M1633: Plann	ing Law and Environmental	Law/ Sustainable Urban Develo	opment	
Courses				
Title		Тур	Hrs/wk	СР
Sustainable Urban Development (L	2474)	Lecture	2	3
Planning law and Environmental la	N (L2473)	Lecture	2	3
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
<b>Recommended Previous</b>				
Knowledge				
Educational Objectives	After taking part successfully, students I	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 Compu	lsory	
Following Curricula	Civil- and Environmental Engineering: S	pecialisation Water and Environment: Elective	Compulsory	
	Civil- and Environmental Engineering: S	pecialisation Traffic and Mobility: Elective Com	pulsory	
	Logistics and Mobility: Specialisation Tra	affic Planning and Systems: Elective Compulsor	ſy	
	Engineering and Management - Major in	Logistics and Mobility: Specialisation II. Traffic	Planning and Systems:	Elective Compulso

ourse 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		

Module M1723: Buildi	ng Information Modeling			
Courses				
Title		Түр	Hrs/wk	СР
Building Information Modeling (L27	50)	Integrated Lecture	2	2
Building Information Modeling (L27		Recitation Section (small)	2	4
Module Responsible				
Admission Requirements				
Recommended Previous				
Knowledge				
Educational Objectives	After taking part successfully, students have reached the for	blowing learning results		
Professional Competence				
Knowledge	The contents of this module follow the recommendati (www.gacce.de) for the BIM courses taught at German univ to present methodological knowledge to enable students companies and public institutions. An in-depth understan Emphasis is placed on generally valid principles and techn decades. The theoretical content taught in the lecture is of tools will be used. Topics include computer-aided design ar BIM data exchange and cooperation (focusing on Indust applications, BIM tools, and advanced aspects. A central co	ersities in the subject area of engi to introduce, to design, to monit nding of the methods and techn niques independent of specific so omplemented by practical exercis nd geometry modeling, digital mod rry Foundation Classes), process	neering informati or, and to impro- ologies relevant ftware products ses, in which sta deling of building modeling, job	ics. The module aim ove BIM processes to BIM is essentia and valid for sever te-of-the-art softwar is and infrastructure
	The module focuses on enabling students to accomplis understanding the methods. The competencies includes skills, in particular understanding of the requirements for m buildings. Specifically, implementing and editing 3D m implementing BIM in companies are among the competence	construction-related skills, BIM-sp nodeling buildings as well as for p nodels, coordinating and manag	ecific skills and lanning, implem	additional specialis enting, and operatin
Personal Competence				
	Social skills are essential in the BIM context, as BIM proje social skills, this module aims to teaching students to co students to work with others and achieve goals together, through group work. In small student groups, the student from the instructors and fellow students. The personal competencies pursued in this module in te guidance or assistance, which is essential for BIM projects helps students develop a degree of independence in wor timely and efficient manner, primarilty supported through p	nvey information in a clear and and to resolving conflicts constru- s train their communication and o erms of independence are aiming , as BIM projects often involve co- king, particularly the skills to plan	comprehensible ctively, which is cooperation skill towards compl mplex and urge	manner, to enablin essentially achieve s, receiving feedbac eting tasks with fe nt tasks. This modul
Workload in Hours	Independent Study Time 124, Study Time in Lecture 56			
Credit points				
Course achievement				
	Written elaboration			
	Description of a BIM model with 15-minute oral presentation	n		
Assignment for the	Civil- and Environmental Engineering: Specialisation Traffic	and Mobility: Elective Compulsory		
Following Curricula	Civil- and Environmental Engineering: Specialisation Water	and Environment: Elective Compu	lsory	
	Civil- and Environmental Engineering: Specialisation Civil En	ngineering: Elective Compulsory		

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	<ul> <li>Historical development</li> <li>Introduction and motivation</li> <li>Basics of geometry</li> <li>2D geometry modeling</li> <li>2½D geometry modeling</li> <li>3D geometry modeling</li> <li>Digital modeling of buildings and infrastructure, object-oriented, semantic, and parametric modeling</li> <li>Data exchange, interoperability, and communication (with emphasis on Industry Foundation Classes)</li> <li>BIM data storage and data management</li> <li>Process modeling</li> <li>Job profiles and applications</li> <li>BIM tools</li> <li>Advanced aspects of BIM</li> <li>Seminar by external BIM experts and project presentations</li> </ul>
	Borrmann, König, Koch, Beetz (Hrsg.), 2021. Building Information Modeling - Technologische Grundlagen und industrielle Praxis. 2., aktualisierte Auflage. Springer.

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

Module M1622, Appli	ed Water Management			
Module M1052: Appli	ed water Management			
Courses				
Title		Turn	Hrs/wk	СР
Modelling of soil water dynamics (L	2471)	<b>Typ</b> Project-/problem-based Learning	2	2
Modelling of soil water dynamics (L		Lecture	2	2
Nature-oriented Hydraulic Engineer		Project-/problem-based Learning	2	2
Module Responsible	Prof. Peter Fröhle			
Admission Requirements	None			
<b>Recommended Previous</b>				
Knowledge	<ul> <li>Basic knowledge of analysis and differential equ</li> </ul>	uations		
	<ul> <li>hydromechanical and hydraulic engineering print</li> </ul>	nciples		
Educational Objectives	After taking part successfully, students have reached	the following learning results		
<b>Professional Competence</b>				
Knowledge	Students are able to define the basic tasks and terms	s of nature-oriented hydraulic engineering	und groundw	ater hydrology. Th
	cam describe the basics concepts, the basic approa	aches and methods of nature-oriented hy	/draulic engin	eering, groundwa
	hydrology and groundwater modelling and are able to	apply these to practical problems.		
Skills	The students are able to apply the methods and	approaches of nature-oriented hydraulic	engineering	and of groundwa
	hydrology to practical problems. They can demonstra	ate to transfer and apply these to simple	hydraulic eng	ineering systems
	addition, they are able to apply the approaches cor	nmonly used in groundwater hydrology. T	They can exer	nplarily explain a
	reason how to apply them as a basis for geo-hydrolog	gical questions. In addition, students can a	apply basic gro	oundwater modell
	methods to simple problems of groundwater moveme	nt and groundwater recharge.		
Personal Competence				
Social Competence	Students are able to help each other solving case s	tudies. The students are able to deploy t	heir gained k	nowledge in appl
	problems of the practical nature-based hydraulic engi	ineering. Additionaly, they will be able to d	demonstrate t	o work cooperativ
	in teams consisting of engineers from different subjec	t areas.		
Autonomy	The students will be able to independently extend the	ir 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	Written-theoretical part and modeling			
scale				
Assignment for the	General Engineering Science (German program, 7 ser	mester): Specialisation Green Technologies	s, Focus Water	r and Environmen
Following Curricula	Engineering: Elective Compulsory			
	Civil- and Environmental Engineering: Specialisation C	ivil Engineering: Elective Compulsory		
	Civil- and Environmental Engineering: Specialisation T	raffic and Mobility: Elective Compulsory		
	Civil- and Environmental Engineering: Specialisation W	ater and Environment: Elective Compulsor	ry	

Course L2471: Modelling of s	ourse L2471: 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	Sankeerth Govindaiah Narayanaswamy	
Language	EN	
Cycle	SoSe	
Content	See interlocking course	
Literature	See interlocking course	

Course L2470: Modelling of s	oil water dynamics
Тур	Lecture
Hrs/wk	2
CP	2
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28
Lecturer	Mohammad Aziz Zarif
Language	EN
Cycle	SoSe
Content	<ul> <li>Students will learn about soil physical characteristics, soil water potential, saturated and unsaturated flows in soil, basics of solute transport in soil, and numerical methods/tools to simulate water flow and solute transport in soil.</li> </ul>
Literature	

Course L2472: Nature-oriented Hydraulic Engineering		
Тур	Project-/problem-based Learning	
Hrs/wk	2	
СР	2	
Workload in Hours	Independent Study Time 32, Study Time in Lecture 28	
Lecturer	Prof. Peter Fröhle	
Language	DE	
Cycle	SoSe	
Content	<ul> <li>Nature oriented hydraulic engineering</li> <li>Regime-theory and application for the development of environmental guiding priciples of rivers</li> <li>Engineering-biological measures for the stabilization of rivers</li> <li>design techniques for water engineering</li> <li>hydraulic dimensioning of river bed and bank protection</li> <li>design principles and design techniques for fish passages (fish ladder, ramps etc.)</li> </ul>	
Literature	Patt, Heinz (2018): Naturnaher Wasserbau. Entwicklung und Gestaltung von Fließgewässern. With assistance of Peter Jürging, Werner Kraus. 5. Auflage. Wiesbaden: Springer Vieweg.	

	Thesis
	· _· ·
Module M-001: Bache	lor Thesis
Courses	
Title	Typ Hrs/wk CP
Module Responsible	Professoren der TUHH
Admission Requirements	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.
Recommended Previous	
Knowledge	
Educational Objectives	After taking part successfully, students have reached the following learning results
Professional Competence Knowledge Skills	<ul> <li>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).</li> <li>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.</li> <li>The students are able to outline the state of research on a selected issue in their subject area.</li> <li>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.</li> </ul>
	<ul> <li>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.</li> <li>The students can take up a critical position on the findings of their own research work from a specialized perspective.</li> </ul>
<b>Personal Competence</b> Social Competence	<ul> <li>Both in writing and orally the students can outline a scientific issue for an expert audience accurately, understandably and in a structured way.</li> <li>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.</li> </ul>
Autonomy	<ul> <li>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.</li> <li>The students are able to identify, open up, and connect knowledge and material necessary for working on a scientific problem.</li> <li>The students can apply the essential techniques of scientific work to research of their own.</li> </ul>
Workload in Hours	Independent Study Time 360, Study Time in Lecture 0
Credit points	12
Course achievement	
Examination	Thesis According to General Regulations
scale	
-	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 Electrical Engineering: Thesis: Compulsory
	Electrical Engineering and Information Technology: Thesis: Compulsory Engineering Science: Thesis: Compulsory General Engineering Science (English program): Thesis: Compulsory General Engineering Science (English program): Thesis: Compulsory Green Technologies: Energy, Water, Climate: Thesis: Compulsory Computer Science in Engineering: Thesis: Compulsory Logistics and Mobility: Thesis: Compulsory Mechanical Engineering: Thesis: Compulsory Mechatronics: Thesis: Compulsory Naval Architecture: Thesis: Compulsory Technomathematics: Thesis: Compulsory Teilstudiengang Lehramt Metalltechnik: Thesis: Compulsory Process Engineering: Thesis: Compulsory